LONGHORN ARMY AMMUNITION PLANT KARNACK, TEXAS

ADMINISTRATIVE RECORD

Volume 6 of 8

2013

Bate Stamp Numbers
00187953 - 00188531

Prepared for
Department of the Army
Longhorn Army Ammunition Plant

1976 – 2013

LONGHORN ARMY AMMUNITION PLANT
KARNACK, TEXAS
ADMINISTRATIVE RECORD – CHRONOLOGICAL INDEX

VOLUME 6 of 8

2013

A. Title: Report – Draft Final Baseline Ecological Risk Assessment Addendum Work Plan, Longhorn Army Ammunition Plant, Karnack, Texas – August 2013

Author(s): AGEISS Inc.

Recipient: U.S. Army Corps of Engineers

Date: September 3, 2013

Bate Stamp: 00187953 - 00188531

00187953

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

September 3, 2013

DAIM-ODB-LO

Mr. Rich Mayer
US Environmental Protection Agency
Federal Facilities Section R6
1445 Ross Avenue
Dallas, TX 75202-2733

Re: Draft Final Baseline Ecological Risk Assessment Addendum Work Plan, Longhorn Army Ammunition Plant, Karnack, Texas, August 2013

Dear Mr. Mayer,

The above-referenced document is being transmitted to you for your records. In accordance with the FFA, the Draft Final will be considered Final after 30 days without further comment.

The document was prepared by AGEISS on behalf of the Army as part of AGEISS's A-E contract for the facility. I ask that Jim Denier, AGEISS's Project Manager, be copied on any communications related to the project.

The point of contact for this action is the undersigned. 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:
A. Palmie, TCEQ, Austin, TX
D. Vodak, TCEQ, Tyler, TX
P. Bruckwicki, Caddo Lake NWR, TX
R. Smith, USACE, Tulsa District, OK
A. Williams, USACE, Tulsa District, OK
M. Plitnik, USAEC, San Antonio, TX
J. Denier, AGEISS – Evergreen, CO (for project files)

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

September 3, 2013

DAIM-ODB-LO

Ms. April Palmie
Texas Commission on Environmental Quality Superfund Section, MC-136
12100 Park 35 Circle, Bldg D
Austin, TX 78753

Re: Draft Final Baseline Ecological Risk Assessment Addendum Work Plan,
Longhorn Army Ammunition Plant, Karnack, Texas, August 2013

Dear Ms. Palmie,

The above-referenced document is being transmitted to you for your records. In accordance with the FFA, the Draft Final will be considered Final after 30 days without further comment.

The document was prepared by AGEISS on behalf of the Army as part of AGEISS's A-E contract for the facility. I ask that Jim Denier, AGEISS's Project Manager, be copied on any communications related to the project.

The point of contact for this action is the undersigned. 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:
R. Mayer, USEPA Region 6, Dallas, TX
D. Vodak, TCEQ, Tyler, TX
P. Bruckwicki, Caddo Lake NWR, TX
R. Smith, USACE, Tulsa District, OK
A. Williams, USACE, Tulsa District, OK
M. Plitnik, USAEC, San Antonio, TX
J. Denier, AGEISS, Evergreen, CO (for project files)

Responses to Comments on
Baseline Ecological Risk Assessment Addendum Work Plan
Longhorn Army Ammunition Plant

Date: 2 August 2013

Reviewer: Rich Mayer (EPA)
Respondent: AGEISS Team

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

Comment No.	**Reference**	**Comments**	**C, D, E or X[1]**	**Response**
1	General	For the waste sub area, please clarify which sample at Site 12 will have a subsurface sample taken.	C	Sample 12SB01 in the Waste Sub-Area is the location where a subsurface soil sample will be collected. This sample will replace a 1 to 2 feet below ground surface sample with rejected ITS explosives data. This subsurface soil sample is indicated in Table 2-1 of the Work Plan with a "DS" following the sample location in the Planned Replacement Sample Locations column. "DS" and "SS" will be defined as subsurface soil and surface soil samples, respectively, in footnotes for this table.
2	General	In the other two sub areas, all soil sample locations will have a subsurface sample taken, where the waste sub area will have only one subsurface sample taken. What is the logic for the limited subsurface sampling in the waste sub area vs. the subsurface sampling in the other two areas.	C	As stated in Section 4.3 of the *Data Gap Memorandum for Explosives in Soil at the Longhorn Army Ammunition Plant* (which is also included in Appendix A of the Work Plan), the approach that was agreed upon by the LHAAP team was to replace all rejected samples at all sites within the Waste Sub-Area, except for LHAAP-17. Based on this approach, the only rejected subsurface sample requiring replacing is the 12SB01 sample discussed in

Responses to Comments on
Baseline Ecological Risk Assessment Addendum Work Plan
Longhorn Army Ammunition Plant

Date: 2 August 2013

Reviewer: Rich Mayer (EPA)
Respondent: AGEISS Team

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

Comment No.	Reference	Comments	C, D, E or X[1]	Response
				Comment 1 (see Table 4-1 in the Data Gap Memorandum). Justification for replacement samples in the Low Impact Sub-Area and the Industrial Sub-Area are presented in Sections 2.2 and 3.2 of the Data Gap Memorandum, respectively. Briefly, these two sub-areas had many more sample locations with rejected ITS-ENV data below the 0 to 0.5 foot surface soil sample depth than the Waste Sub-Area, thus resulting in more subsurface soil replacement samples.
3	General	For Site 32, EPA only saw 7 sites identified on Figure 2-2, instead of the 8 locations listed in Table 4 of Appendix B.	C	Although 8 locations are planned to be sampled at Site 32 as presented in Table 2-1 of the Work Plan, it is agreed that it appears only 7 locations are depicted in Figure 2-2. This is because replacement sample locations 32SB14 and 32SS03 are in a densely sampled area and are very close to each other, and appear as a single sample location when plotted on a small-scale map. Figure 4 in Appendix E provides a large-scale map of the portion of the Industrial Sub-Area that contains Site 32, and shows a little more clearly the nearly overlapping locations

Responses to Comments on
Baseline Ecological Risk Assessment Addendum Work Plan
Longhorn Army Ammunition Plant

Date: 2 August 2013

Reviewer: Rich Mayer (EPA)
Respondent: AGEISS Team

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

Comment No.	Reference	Comments	C, D, E or X[1]	Response
				for these two samples.
4	General	EPA recommends that surface water locations should be sampled when there is flow or recent runoff. Sampling still standing water or water pooled in small areas of the drainage do not provide pertinent data.	C	Agreed. The following text will be added to the end of the second paragraph of Section 3.2 of the Work Plan: "*Surface water samples will be collected from areas with flow or recent runoff. Sampling from still or standing water, or water pooled in small areas of the drainage, will be avoided when possible.*"
5	General	Are the SOP's identified in the worksheets of the S & A Plan (Appendix B) using the most updated SOPs found in the IWWP of 2011?	A/E	The SOP's included in Appendix C of the QAPP are the SOPs specific to the work to be performed for the BERA Addendum however the project specific SOPs have been compared to the IWWP SOPs and are deemed to be consistent with the IWWP SOPs.
6	General	In Worksheet 15 of the S & A Plan, Tables 1, 2 and 3, were the PALs developed using the most recent regulatory guidance and	C	The PALs were developed using the same regulatory guidance source documents as were used in the original BERA. As stated in the last paragraph of Chapter 4.0 of the Work Plan, the

Responses to Comments on
Baseline Ecological Risk Assessment Addendum Work Plan
Longhorn Army Ammunition Plant

Date: 2 August 2013

Reviewer: Rich Mayer (EPA)
Respondent: AGEISS Team

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

Comment No.	Reference	Comments	C, D, E or X[1]	Response
		procedures? EPA noticed that some of the references used appear to be outdated.		intent is to update the ecological screening values (ESV) in the BERA Addendum, if necessary and/or appropriate. However, a review performed within the past few weeks indicated that the PALs listed in Worksheet 15 are still current and applicable for use.
7	General	A point of clarification, from the large figures depicting the sampling locations, the sampling locations with the pink color in the center are still being analyzed for the full suite of explosives listed in Method 8330A?	C	Yes, sample locations indicated by a black circle around a pink center are locations where limited (i.e., 2,4 and 2,6-DNT) explosives data were available from historical data, but are also planned replacement sample locations that will be analyzed for the full explosives suite.

Responses to Comments on
Baseline Ecological Risk Assessment Addendum Work Plan
Longhorn Army Ammunition Plant

Date: 31 July 2013

Reviewer: April Palmie (TCEQ)
Respondent: AGEISS Team

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

Comment No.	Reference	Comments	C, D, E or X[1]	Response
1	General	The discussion indicates (page 12) that all ecological screening values (ESVs), measurement and assessment endpoints, food chain model receptors and parameters, toxicity values, and other variables and inputs used in the evaluation steps described previously will be identical to those that were used in the BERA. The discussion does add that "... if updated information is available that would improve the confidence in the analysis (e.g., updated ESVs, use of a more current statistical software package to calculate 95% UCLs), it will be noted and used in the BERA Addendum Report, as appropriate." TCEQ agrees with this statement.	C	Comment noted.

Responses to Comments on
Baseline Ecological Risk Assessment Addendum Work Plan
Longhorn Army Ammunition Plant

Date: 31 July 2013

Reviewer: April Palmie (TCEQ)
Respondent: AGEISS Team

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

Comment No.	**Reference**	**Comments**	**C, D, E or X[1]**	**Response**
		As it has been at least five years since the final BERA was submitted, we assume that LHAAP representatives will re-evaluate the literature (e.g., journal articles and government documents) to determine if the screening values and toxicity reference values used in the previous BERA (for explosives) should be updated. This evaluation should be summarized in the BERA addendum report. No response is necessary in the Work Plan.		
2	General	Revise references to Appendix B (acronym list, Table of Contents, page 3, and cover page) to include the Sampling and Analysis Plan.	A	References will be revised to incorporate the Sampling and Analysis Plan.

DRAFT FINAL

Baseline Ecological Risk Assessment Addendum
Work Plan
Longhorn Army Ammunition Plant, Karnack, Texas

Contract No. W912BV-10-D-2010
Task Order 0004

PREPARED FOR:

U.S. Army Corps of Engineers, Tulsa District
1645 South 101 East Avenue
Tulsa, Oklahoma 74128

PREPARED BY:

AGEISS Inc.
1202 Bergen Parkway, Suite 310
Evergreen, Colorado 80439

CB&I
1401 Enclave Parkway, Suite 250
Houston, TX 77077

September 2013

This page is intentionally left blank.

TABLE OF CONTENTS

Section **Page**

LIST OF TABLES

Table

LIST OF FIGURES

Figure

LIST OF APPENDICES

ABBREVIATION/ACRONYM LIST

95% UCL	95 percent upper confidence levels on the mean
AGEISS	AGEISS Inc.
BERA	baseline ecological risk assessment
CB&I	Chicago Bridge and Iron, Inc.
COC	chemical of concern
COPEC	chemical of potential ecological concern
DNT	dinitrotoluene
EPC	exposure point concentration
ESV	ecological screening value
FOD	frequency of detection
ISA	Industrial Sub-Area
ITS-ENV	Intertek Testing Services Environmental Laboratories, Inc.
Jacobs	Jacobs Engineering
LHAAP	Longhorn Army Ammunition Plant
LISA	Low Impact Sub-Area
MEC	munitions and explosives of concern
NT	nitrotoluene
SAP	Sampling and Analysis Plan
Shaw	Shaw Environmental & Infrastructure, Inc.
SVOC	semivolatile organic compound
TCEQ	Texas Commission on Environmental Quality
TNT	2,4,6-trinitrotoluene
UFP-QAPP	*Baseline Ecological Risk Assessment Addendum, Longhorn Army Ammunition Plant, Karnack, Texas, Uniform Federal Policy for Quality Assurance Project Plan*
USACE	U.S. Army Corps of Engineers
USEPA	U.S. Environmental Protection Agency
WSA	Waste Sub-Area

1.0 INTRODUCTION

This Work Plan for the Baseline Ecological Risk Assessment (BERA) Addendum Report at Longhorn Army Ammunition Plant (LHAAP), Karnack, Texas, has been prepared by AGEISS Inc. (AGEISS) for the U.S. Army Corps of Engineers (USACE), Tulsa District, under Task Order 0004 of Contract Number W912BV-10-D-2010. This Work Plan describes the collection, analysis, and interpretation of explosives data to be collected from the LHAAP that will address data gaps associated with the BERA previously performed at the installation (Shaw Environmental & Infrastructure, Inc. [Shaw], 2007).

1.1 Background

In 2003, Shaw (now CB&I) was tasked by the USACE, Tulsa District, to perform an installation-wide BERA at LHAAP, located in Karnack, Texas. This BERA included Steps 3 through 8 of the 8-step ecological risk assessment process; Steps 1 and 2 had been previously performed by Jacobs Engineering (Jacobs, 2001a, 2002, 2003). The BERA was finalized in November 2007 (Shaw, 2007). The BERA included a synthesis of many environmental investigations that had previously been performed by other subcontractors at the facility in prior years.

The primary dataset used to calculate potential risks to various representative ecological receptors in the BERA was comprised of data from 1993 through late 2003 or early 2004 (depending on the medium). These data are referred to herein as “the BERA dataset.” Additional data from samples collected after that timeframe and before the time when the BERA was finalized in 2007 were also discussed separately in the BERA to ensure that more recent sampling information did not affect overall site conclusions. These data were referred to in the BERA and herein as the “post-BERA dataset.” The data were grouped by terrestrial and aquatic exposure units. The three terrestrial exposure units at LHAAP are “sub-areas” that had been previously delineated based on their common historical uses and similar ecological habitat (Shaw, 2007). These sub-areas include the Low Impact Sub-Area (LISA), the Industrial Sub-Area (ISA), and the Waste Sub-Area (WSA). The WSA was the only sub-area where explosives compounds were identified as chemicals of concern (COC) in the BERA. The four aquatic exposure units at LHAAP are watersheds, including Central Creek, Goose Prairie Creek, Harrison Bayou, and Saunders Branch. Explosives were not selected as COCs in any of the four watersheds.

Explosives data are of primary concern at LHAAP due to its history as an ammunition plant whose primary mission was to produce 2,4,6-trinitrotoluene (TNT) flake. Explosives data collected for the LHAAP investigation in the 1993 to 1995 timeframe analyzed by Intertek Testing Services Environmental Laboratories, Inc. (ITS-ENV) in Richardson, Texas, were deemed unusable by the U.S. Environmental Protection Agency (USEPA) for environmental decision making (Jacobs, 2001b).

Although the determination that the ITS-ENV data were unusable was made prior to Shaw’s involvement on the project, the quality problems with the ITS-ENV explosives data were known when the BERA was initiated, and all known data associated with ITS-ENV (as determined by a code in the Laboratory Identification field of the electronic database) were removed from Shaw’s BERA dataset prior to hazard calculations.

After the BERA was approved and finalized, a data review performed as part of the remediation design for one of the sites at LHAAP (LHAAP-17) revealed that some of the explosives data used in the BERA were likely ITS-ENV data. Although these data that were provided to Shaw by the Army were not labeled with the expected identifier flags or unusable data qualifiers used to identify the ITS-ENV data, the time period (i.e., 1993 through 1995) and other evidence suggested that this may have been the case. A review of the hard copy Phase I and II reports confirmed that many of these suspected data points did indeed originate with the ITS-ENV laboratory. Therefore, ITS-ENV data that were incorrectly or cryptically coded for their laboratory source had been inadvertently retained in the dataset and used to quantify ecological risk in the BERA.

Once it was discovered that the BERA had inadvertently used ITS-ENV data, Shaw performed an analysis to determine how the removal of these data affected the BERA conclusions and provided initial recommendations to address any remaining data gaps. CB&I and AGEISS communicated the results of this analysis via two Data Gap Memorandum reports, which are included in Appendix A. After review by the USEPA Region 6 and the Texas Commission on Environmental Quality (TCEQ), these reports were approved as the basis for a more detailed work plan, as presented herein.

1.2 Goals of this Baseline Ecological Risk Assessment Addendum Investigation

The two primary goals of this BERA Addendum at LHAAP are as follows:

- Address explosives contaminants data gaps by collecting sufficient additional explosives data in all media to have confidence that the terrestrial and aquatic exposure units are sufficiently characterized for these chemicals

- Evaluate the new data combined with the previously collected (valid) BERA data to determine whether the BERA conclusions regarding explosives contaminants are valid, or if they need to be adjusted based on new findings

This Work Plan describes the additional sampling required to address the first goal and also describes how the data from these samples will be evaluated to meet the second goal, i.e., to either confirm or adjust the conclusions that were previously presented in the BERA (Shaw, 2007).

Two major considerations were taken to account when developing the recommendations for additional sampling to reduce data gaps in the explosives database for LHAAP. The first consideration was the coverage that was obtained (and found to be acceptable by all stakeholders) in the original BERA. The second consideration was professional judgment, given knowledge of historical processes, fate and transport of the specific explosives contaminants, evaluation of available data (collected both during the BERA and during subsequent investigations), and ecological conceptual models. Therefore, the coverage provided in the original BERA was considered the ideal maximum for replacement samples, but it was also believed that this number could be reduced in some cases by careful consideration of all available information, resulting in a less than one-to-one sample replacement strategy in areas where a release was unlikely, exposure was expected to be low, or supplemental information suggested that any remnant contamination was no longer present (if it was ever present).

It should be recognized that the intent of the explosives dataset for the original BERA was to characterize potential ecological risks associated with exposure to an entire sub-area and/or watershed, and this is also true for this BERA Addendum. Therefore, the emphasis on the data gaps sample replacement exercise was not full delineation or characterization of individual sites within a sub-area or watershed, but to ensure that the exposure unit was sufficiently characterized for ecological exposure to a similar degree as it was in the BERA, with current information also taken into account that was not available when the BERA was performed. It is not expected that elevated concentrations of explosives compounds will be identified in the planned data gaps replacement samples. However, if unusually elevated concentrations are detected such that a realistic potential for ecological risk may exist, it is acknowledged that additional samples may be required in localized areas for characterization purposes.

1.3 Work Plan Organization

This Work Plan is organized as follows:

- ***Section 2.0, Data Gaps in Soil.*** Summarizes the data gaps in terrestrial exposure units that resulted from the elimination of the ITS-ENV explosives data and describes additional surface and subsurface soil samples required to address these data gaps.

- ***Section 3.0, Data Gaps in Sediment and Surface Water.*** Summarizes the data gaps in aquatic exposure units that resulted from the elimination of the ITS-ENV explosives data and describes additional samples required to address these data gaps.

- ***Section 4.0, Data Evaluation, Reporting, and Interpretation.*** Describes how the data will be validated, what criteria will be used to accept or reject the data, and how the data will be reported. The data interpretation describes the methodology that will be used to interpret the data gap sample results, including how the data will be evaluated in conjunction with previously collected data, and previous decision rules for how the conclusions of the BERA (Shaw, 2007) will be either confirmed or adjusted based on the new data.

- ***Section 5.0, References.*** Provides the references for this Work Plan.

Additional components of this Work Plan are presented in the following appendices:

- ***Appendix A, Data Gap Memoranda for Explosives in Soil, and for Explosives in Sediment and Surface Water.*** Presents the two data gap memoranda previously submitted to project stakeholders describing the rationale for additional sampling at the terrestrial sub-areas and the aquatic watersheds at LHAAP.

- ***Appendix B, Sampling and Analysis Plan (SAP).*** Presents specific worksheets from the *Baseline Ecological Risk Assessment Addendum, Longhorn Army Ammunition Plant, Karnack, Texas, Uniform Federal Policy for Quality Assurance Project Plan* (UFP-QAPP) (AGEISS, 2013) describing the standard operating procedures and methodologies for soil, surface water, and sediment sample collection at LHAAP.

- ***Appendix C, Accident Prevention Plan.*** Presents a Safety and Health Plan, Activity Hazard Analysis, Hazardous Materials, and Hazard Communication Plan for the BERA Addendum field work.

- ***Appendix D, Large Scale Maps of Low Impact Sub-Area Sample Locations.*** Presents larger scale “zoom in” maps of the LISA for improved clarity and readability.

- ***Appendix E, Large Scale Maps of Industrial Sub-Area Sample Locations.*** Presents larger scale “zoom in” maps of the ISA for improved clarity and readability.

- ***Appendix F, Large Scale Maps of Waste Sub-Area Sample Locations.*** Presents larger scale “zoom in” maps of the WSA for improved clarity and readability.

- ***Appendix G, Uniform Federal Policy for Quality Assurance Project Plan (UFP-QAPP).*** Presents the *Baseline Ecological Risk Assessment Addendum, Longhorn Army Ammunition Plant*, *Karnack*, *Texas*, *Uniform Federal Policy for Quality Assurance Project Plan* (UFP-QAPP) (AGEISS, 2013) on compact disc, which describes the standard operating procedures and methodologies for soil, surface water, and sediment sample collection at LHAAP.

2.0 DATA GAPS IN SOIL

This section summarizes information that was presented in detail in the *Data Gap Memorandum for Explosives in Soil at the Longhorn Army Ammunition Plan, Karnack, Texas,* which is presented in full in **Appendix A**. It presents the findings and defines the required samples to complete the BERA Addendum. Preparing the *Data Gap Memorandum for Explosives in Soil at the Longhorn Army Ammunition Plan, Karnack, Texas*, was an iterative process with involvement from the Army and regulatory agencies (i.e., TCEQ and USEPA Region 6). As such, the Army and regulatory agencies have concurred with the number of soil samples and locations presented in this work plan to address data gaps in soil at the installation.

As described previously, the soil exposure units, as evaluated in the BERA (Shaw, 2007), consist of three large sub-areas, the LISA, WSA, and ISA. Data gaps and recommendations for additional sampling are described for each of these sub-areas individually.

2.1 Low Impact Sub-Area

The LISA is an approximately 3,000+ acre sub-area that includes the following sites:

- LHAAP-11 – Suspected TNT Burial Site
- LHAAP-13 – TNT Burial Site/Acid Dump
- LHAAP-14 – Area 54 Burial Ground
- LHAAP-27 – South Test Area
- LHAAP-45 – Container Storage Area
- LHAAP-52 – Magazine Washout Area
- LHAAP-63 – Former Burial Pits
- LHAAP-XX, also known as LHAAP-54 – Ground Signal Test Area

The LISA sites had been investigated prior to the BERA, with the conclusion of minimal impact.

An evaluation of the explosives data set for the LISA revealed that 17 ITS-ENV samples were inadvertently used in the BERA, and were subsequently removed. Six additional soil samples (three surface soil and three subsurface soil samples) are planned from locations where ITS-ENV data were eliminated at LHAAP-11 and LHAAP-54. For the third site with rejected data, LHAAP-27, only two sample locations were previously sampled, so only four samples (one surface and subsurface sample from each of the two sample locations) are planned for this site.

During review of the Draft Data Gap Memorandum, the TCEQ expressed concern that explosives were not adequately addressed in the LISA, particularly for LHAAP-27. Conclusions from the munitions and explosives of concern (MEC) summary report (Shaw, 2011) that explosives were of low concern at specific sites in the LISA provided supplemental information in defense of the planned sampling strategy. The MEC report relied on the following data collected between 1982 and 2006 to make its recommendations for LHAAP-27, including a few studies that were performed during the time when ITS-ENV was conducting the explosives analyses at LHAAP:

- 3 shallow soil samples collected by Environmental Protection Systems (1982)
- 10 soil borings sampled and 4 surface soil samples collected by Ebasco during the Phase I remedial investigation (1993) *

- 4 soil borings sampled by Ebasco during the Phase II remedial investigation (1994) *
- 9 surface soil samples collected by the USACE during a baseline risk assessment (1997) *
- 2 surface soil samples collected by CAPE during an engineering evaluation/cost evaluation (2006)

* Some or all of these samples may contain ITS-ENV data.

It is noted that the original BERA data set for LHAAP-27 consisted of only two samples, both of which were collected in the open burn/open detonation area. Excluding the samples in the above bulleted list that may have included ITS-ENV data, the conclusions of the MEC summary report were based on five soil samples, which is approximately two times more samples than were analyzed in the BERA dataset for this site. Although the 1982 Environmental Protection Systems samples would not be used due to their age, the other two samples in the above list that were collected outside of the window when ITS-ENV was used for the explosives analyses could be incorporated into the revised BERA dataset. These two samples plus the four planned replacement samples from the two original BERA locations that were rejected would result in a maximum of six valid data points for explosives in LHAAP-27.

Thus, a total of 16 additional soil samples will be collected at the LISA as identified in the Data Gap Memorandum (**Appendix A**). These additional data, in combination with valid explosives data at the LISA, are expected to be sufficient for confirming that explosives are not COCs at this sub-area.

The final recommended number and location codes for new LISA soil samples to replace the ITS-ENV data are presented in **Table 2-1**. Replacement sample locations were selected from the pool of locations where ITS-ENV data were removed. Preference was given to those samples that lost full suites of explosives data and that lacked any supplemental explosives data (i.e., 2,4-dinitrotoluene [DNT] and 2,6-DNT) that was available as part of the semivolatile organic compound (SVOC) analytical suite. Preference was also given to replacing samples that either previously had detectable levels of explosives in the rejected ITS-ENV data set or were near to other locations that had previously detected explosives. The replacement sample locations for the LISA are presented in **Figure 2-1**.

2.2 Industrial Sub-Area

The ISA is an approximately 2,330-acre sub-area that includes the following sites:

- LHAAP-01 – Inert Burning Grounds – 1.5 acres
- LHAAP-04 – Pilot Wastewater Treatment Plant – 1.4 acres
- LHAAP-08 – Sewage Treatment Plant – 2 acres
- LHAAP-29 – Former TNT Production Area – 85 acres
- LHAAP-32 – Former TNT Waste Disposal Plant – 9 acres
- LHAAP-35A (58) – Shop Area – 15 acres
- LHAAP-35B (37) – Chemical Laboratory – 8 acres
- LHAAP-35C (53) – Static Test Area – 26 acres
- LHAAP-46 – Plant 2 Area – 190 acres
- LHAAP-47 – Plant 3 Area – 275 acres
- LHAAP-48 – Y Area – 16 acres
- LHAAP-49 – Acid Storage Area – 19.5 acres
- LHAAP-50 – Former Sump Water Tank – 1 acres
- LHAAP-60 – Pesticide Storage Buildings – less than 1 acre

- LHAAP-67 – Above-Ground Storage Tank Farm – 12 acres

Historical activities in the ISA include TNT production, wastewater and sewage treatment, chemical laboratory, shop, test areas, pyrotechnic/rocket motor production, and pesticide storage.

An evaluation of the explosives data set for the ISA revealed that out of 476 explosives samples included in the BERA dataset, 367 ITS-ENV samples were inadvertently used in the BERA and were subsequently removed (however, some limited usable explosives data from another laboratory were available for 166 of these samples). After considering other data that were available, reviewing the histories of individual sites within the ISA, and evaluating results from the valid data, the Army recommended collecting 170 additional surface and subsurface soil samples from locations where ITS-ENV data were eliminated (please see the Data Gap Memo in **Appendix A**). The recommended replacement sample locations were variously allocated among the ISA sites to more intensively sample larger sites that experienced greater data loss. These additional data, in combination with valid explosives data at the ISA, are expected to be sufficient for characterizing explosives at this sub-area.

The final recommended number and location codes for new ISA soil samples to replace the ITS-ENV data are presented in **Table 2-1**. Replacement sample locations were selected from the pool of locations where ITS-ENV data were removed. Preference was given to those samples that lost full suites of explosives data and that lacked limited SVOC explosives data. Preference was also given to replacing samples that either previously had detectable levels of explosives in the rejected ITS-ENV data set or were near to other locations that had previously detected explosives. The replacement sample locations for the ISA are presented in **Figure 2-2**.

2.3 Waste Sub-Area

The WSA is approximately 486 acres in size and is defined by the areas where waste disposal activities occurred at LHAAP. The WSA consists of the following sites:

- LHAAP-12 – Landfill – 7 acres
- LHAAP-16 – Old Landfill – 20 acres
- LHAAP-17 – Burning Ground No. 2 (Flashing Area) – 2.6 acres
- LHAAP-18/24 – Burning Ground No. 3/Unlined Evaporation Pond – 34.5 acres

This sub-area was the only area in which ecological COCs were identified in the BERA. Three nitrotoluene (NT) compounds (2,4-DNT, 2,6-DNT, and TNT) were selected as COCs in the WSA (Shaw, 2007).

An evaluation of the explosives data set for the WSA revealed that out of 72 explosives samples, 23 were ITS-ENV samples that were inadvertently used in the BERA and were subsequently removed. However, 2,4-DNT, 2,6-DNT, and NT data analyzed as part of the SVOC suite from another laboratory were available for all of these samples. Based on a review of the valid data and site histories within the WSA, replacement samples for all of the rejected samples within the WSA are currently planned for all sites except LHAAP-17, which now has more explosives data than it did when it was evaluated in the BERA due to additional samples collected in the intervening time period (please see the Data Gap Memo in **Appendix A**). Thus, a total of 12 new explosives samples in the WSA are planned.

The final recommended number and location codes for new WSA soil samples to replace the ITS-ENV data are presented in **Table 2-1**. Replacement sample locations were selected from the pool of locations where ITS-ENV data were removed. The replacement sample locations for the WSA are presented in **Figure 2-3**.

3.0 DATA GAPS IN SEDIMENT AND SURFACE WATER

This section summarizes information that was presented in the *Data Gap Memorandum for Explosives in Sediment and Surface Water at the Longhorn Army Ammunition Plan, Karnack, Texas*, which is presented in full in **Appendix A**. It presents the findings and defines the required samples to complete the BERA Addendum. Preparing the *Data Gap Memorandum for Explosives in Sediment and Surface Water at the Longhorn Army Ammunition Plan, Karnack, Texas,* was an iterative process with involvement from the Army and regulatory agencies (i.e., TCEQ and USEPA Region 6). As such, the Army and the regulatory agencies have concurred with the number of sediment and surface water samples and locations presented in this work plan to address data gaps in sediment and surface water at the installation.

The four watersheds at LHAAP comprise the aquatic ecological exposure units of concern that were evaluated in the BERA (Shaw, 2007) and include Saunders Branch, Harrison Bayou, Central Creek, and Goose Prairie Creek. Data gaps and recommendations for additional sampling are described for each of these watersheds individually. These four watersheds are shown in **Figure 3-1**.

3.1 Saunders Branch Watershed

Ten sediment samples in Saunders Branch were used for the BERA. Six ITS-ENV samples were removed, but three post-BERA sediment samples were identified. All explosives were nondetect in BERA and post-BERA sediment samples at Saunders Branch. Four surface water samples in Saunders Branch were used for the BERA. All four ITS-ENV samples were removed, but three post-BERA surface water samples were identified. All explosives were nondetect in BERA and post-BERA surface water samples at Saunders Branch.

The revised dataset, with the ITS-ENV data removed, was determined to have adequate sediment and surface water spatial coverage, given that all available explosives data were nondetect. In addition, this watershed is on the easternmost portion of the Facility and drains many nonimpacted terrestrial areas, so explosives contamination is not believed to be a major concern for Saunders Branch. Therefore, no additional sediment and surface water sampling is planned for Saunders Branch (please see the Data Gap Memo in **Appendix A**).

3.2 Harrison Bayou Watershed

Thirty-two sediment samples in Harrison Bayou were used for the BERA. Twenty-six ITS-ENV samples were removed, and one post-BERA sediment sample was identified. All explosives were nondetect in BERA and post-BERA sediment samples at Harrison Bayou. Thirty-six surface water samples in Harrison Bayou were used for the BERA. Twenty-seven ITS-ENV samples were removed, and one post-BERA surface water sample was identified. All explosives were nondetect in BERA and post-BERA surface water samples at Harrison Bayou.

Although a large number of samples were removed, sediment and surface water spatial coverage is generally still adequate in the Harrison Bayou watershed. However, even though all explosives data were nondetect in both the BERA and the revised dataset, there is some uncertainty related to this finding, due to the loss of a considerable amount of explosives data. In addition, eight to ten samples are generally recommended for estimation of EPCs for use in risk assessments, and only seven sediment samples remain with full explosives results (**Table 2-1** in the Sediment and Surface Water Data Gap

Memorandum in **Appendix A**). Therefore, eight additional sediment samples and five additional surface water samples are planned to be collected for Harrison Bayou to increase the number of sediment samples to 15 and to provide enhanced spatial coverage (please see the Data Gap Memo in **Appendix A**). Surface water samples will be collected from areas with flow or recent runoff. Sampling from still or standing water, or water pooled in small areas of the drainage, will be avoided when possible.

The final recommended number and location codes for new Harrison Bayou sediment and surface water samples to replace the ITS-ENV data are presented in **Table 3-1**. Replacement sample locations were selected from the pool of locations where ITS-ENV data were removed. The replacement sample locations for the Harrison Bayou watershed are presented in **Figure 3-2**.

3.3 Central Creek Watershed

Forty-nine sediment samples in Central Creek were used for the BERA. Twenty-eight ITS-ENV samples were removed, but ten post-BERA sediment samples were identified. All explosives were nondetect in BERA and post-BERA sediment samples at Central Creek. Thirty-seven surface water samples in Central Creek were used for the BERA. Twenty-eight ITS-ENV samples were removed, but five post-BERA surface water samples were identified. The explosive 2-NT in surface water was detected in the BERA (frequency of detection [FOD] = 1/37), but not detected in the revised dataset (i.e., ITS-ENV data removed). The explosives 3-NT (FOD = 1/14), octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine (FOD = 2/14), and hexahydro-1,3,5-trinitro-1,3,5-triazine (FOD = 1/14) were detected in the Central Creek revised surface water dataset (with post-BERA samples), but not in the BERA itself.

Although explosives data for 28 sediment and 28 surface water samples were eliminated from the Central Creek watershed, the available data were determined to provide adequate sediment and surface water spatial coverage, particularly since explosives were infrequently detected in both media. Therefore, no additional sediment or surface water sampling is planned for Central Creek (please see the Data Gap Memo in **Appendix A**).

3.4 Goose Prairie Creek Watershed

Seventy-one sediment samples in Goose Prairie Creek were used for the BERA. Twenty-two ITS-ENV samples were removed, but six post-BERA sediment samples were identified. The explosives 2,4,6-TNT, 2-A-4,6-DNT, and 4-A-2,6-DNT were infrequently detected in the BERA, but only 2,4,6-TNT was detected in the revised dataset. Two hundred-two surface water samples in Goose Prairie Creek were used for the BERA. Fifteen ITS-ENV samples were removed, but two post-BERA surface water samples were identified. Eleven explosives were detected in the BERA surface water samples. Eleven explosives were also detected in the revised dataset.

Goose Prairie Creek had the lowest percentage of sediment and surface water samples eliminated, and it had the most samples available in both the BERA and the revised dataset. The revised dataset includes adequate sediment and surface water spatial coverage. In addition, some explosives were nondetect or were generally infrequently detected in both media, and the FODs were very similar between the BERA and the revised datasets. Therefore, no additional sediment or surface water sampling is planned for Goose Prairie Creek (please see the Data Gap Memo in **Appendix A**).

4.0 DATA EVALUATION, REPORTING, AND INTERPRETATION

Soil (surface and subsurface), surface water, and sediment samples will be collected as described in the worksheets presented in the UFP-QAPP (AGEISS, 2013). Coordinates for the replacement samples are provided in **Table 4-1**. Worksheets that describe the sample collection and data analysis for this BERA Addendum field effort are presented in the Sampling and Analysis Plan (SAP), located in **Appendix B** of this Work Plan. The UFP-QAPP is presented in its entirety on compact disc in **Appendix G** of this Work Plan.

Upon receipt of the analytical results, the data will be used to determine current explosives concentrations in soil, surface water, and sediment. All data will be subjected to a "Level III" data validation effort, which includes a check on all laboratory quality control and calibration information. Ten percent of the data will be subjected to a "Level IV" validation, which includes Level III validation and also recalculates all results from the raw data for one analyte per method for initial calibration, continuing calibration, laboratory control sample, matrix spike/matrix spike duplicates, and sample results. Summary tables presenting the data will be presented in the BERA Addendum Report.

The BERA Addendum dataset for each sub-area and watershed will include the combined data from the current as well as previous environmental investigations at LHAAP, including the BERA and post-BERA data sets (as defined in the BERA; Shaw, 2007), replacement sample data as listed in the Data Gap Memoranda (**Appendix A**), and any additional data that can be readily identified and included. The evaluation of the data will closely follow the process used in the BERA to ensure that consistency is maintained in the interpretation of the results, and additional details regarding these approaches can be found therein. Once the revised data set is established, the evaluation and interpretation of the data will include the following components:

- ***Identification of Preliminary Chemicals of Potential Ecological Concern.*** New EPCs, calculated as the 95 percent upper confidence levels on the mean (95% UCL), will be generated for each explosives chemical and compared to conservative ecological screening values (ESV). Chemicals with EPCs that exceed their ESVs are considered preliminary chemicals of potential ecological concern (COPEC) and retained for further analysis. Chemicals with EPCs that are below their ESVs are not considered further. Also, chemicals with EPCs that are lower than those calculated in the BERA will not be evaluated further, as previous BERA "no further action" conclusions for these chemicals would not change. However, if one or more of these COPECs was identified as a COC in the BERA and its EPC (using replacement sample results and previous valid sample results) is determined to be lower than previously estimated, then BERA conclusions for this COPEC will be revised, as needed.

- ***Direct Toxicity Evaluation.*** A direct toxicity evaluation will be performed to determine whether potentially significant impacts may be occurring to lower-trophic level organisms, such as soil invertebrates, terrestrial plants, sediment benthic invertebrates, and aquatic biota (including fish). Preliminary COPEC concentrations will be compared to benchmark concentrations protective of these receptors using the 95% UCLs (Tier 1) as well as the mean concentrations (Tier 2). These comparisons will help determine if direct contact toxicity is a concern for any of the sub-areas and watersheds.

- ***Food Chain Model.*** A food chain model will be performed for any preliminary COPECs carried forward to determine whether significant impacts may be occurring to higher-trophic level organisms due to food chain effects. Both Tier 1 (calculated using 95% UCLs as the EPCs, more conservative uptake factors, minimum home ranges, etc.) and Tier 2 (calculated using the mean concentrations as EPCs, more realistic uptake factors, average home ranges, etc.) food chain models will be performed. Wildlife hazard quotient values, calculated by dividing the total daily chemical dose by either no-effect or lowest-observed effect toxicity reference values will provide a quantitative indication of potential impacts associated with COPEC exposure for higher-trophic level organisms.

- ***Evaluation of Potential Risk to Small-Range Receptors.*** To ensure that the EPCs (e.g., the 95% UCLs) for the large sub-areas are appropriately protective of small-range receptors that could be exposed to local concentrations of explosives that are much higher than the EPCs (i.e., hot spots), a three-step process will be used, as described in the BERA (Shaw, 2007). First, for each COPEC in each sub-area, its maximum detected concentration will be divided by the 95% UCL. For any chemical with a maximum detected concentration that is more than 50 times larger than its 95% UCL, the average distance between all samples with concentrations above the 95% UCL will be determined. If this average distance is less than 100 feet (which approximates the diameter of the home range for a small-range receptor), it will be noted that there is potential evidence of a situation where elevated sample results might adversely impact a receptor more than what is estimated using the 95% UCL as the EPC.

As previously stated, the new explosives data set will be evaluated following the approach that was used in the original BERA. All ESVs, measurement and assessment endpoints, food chain model receptors and parameters, toxicity values, and other variables and inputs used in the evaluation steps described above will be identical to those that were used in the BERA (Shaw, 2007). However, if updated information is available that would improve the confidence in the analysis (e.g., updated ESVs, use of a more current statistical software package to calculate 95% UCLs), it will be noted and used in the BERA Addendum Report, as appropriate. All lines of evidence will be considered in the BERA Addendum Report, and the conclusions regarding the potential risk to ecological receptors associated with explosives contamination will be presented.

5.0 REFERENCES

AGEISS Inc., 2013, *Baseline Ecological Risk Assessment Addendum, Longhorn Army Ammunition Plant, Karnack, Texas, Uniform Federal Policy for Quality Assurance Project Plan*, March.

Jacobs Engineering (Jacobs), 2001a, *Final Ecological Risk Assessment, A Supplement to the Remedial Investigation Report Site 16 Landfill, Longhorn Army Ammunition Plant, Karnack, Texas*, Oak Ridge, Tennessee.

Jacobs, 2001b, *Final Remedial Investigation Report for the Group 2 Sites, Longhorn Army Ammunition Plant, Karnack, Texas*, Oak Ridge, Tennessee, April.

Jacobs, 2002, *Final Baseline Human Health and Ecological Risk Assessment Report for the Group 2 Sites, Longhorn Army Ammunition Plant, Karnack, Texas*, Oak Ridge, Tennessee.

Jacobs, 2003, *Final Baseline Human Health and Ecological Risk Assessment Report for the Group 4 Sites, Longhorn Army Ammunition Plant, Karnack, Texas*, Oak Ridge, Tennessee.

Shaw Environmental & Infrastructure, Inc. (Shaw), 2011, *Final Munitions Constituents Data Summary Report, South Test Area/Bomb Test Area, LHAAP-001-R and Ground Signal Test Area, LHAAP-003-R, Longhorn Army Ammunition Plant, Karnack, Texas*, Houston, Texas, June.

Shaw, 2007, *Final Installation-Wide Baseline Ecological Risk Assessment, Longhorn Army Ammunition Plant, Karnack, Texas*, Houston, Texas, November.

This page is intentionally left blank.

TABLES

This page is intentionally left blank.

Table 2-1
Replacement Samples to Address Data Gaps in Soil Baseline Ecological Risk Assessment Addendum
Longhorn Army Ammunition Plant, Karnack, Texas

Site	Number of Surface Soil (0-0.5 feet) Samples	Number of Subsurface Soil (0.5-3 feet) Samples	Total Number of Samples	Replacement Sample Locations (a)
Low Impact Sub-Area (LISA)				
LHAAP-11	3	3	6	11SB03, 11SB05, 11SD13
LHAAP-27	2	2	4	27SB34, 27SB38
LHAAP-54	3	3	6	XXSB15, XXSB17, XXSB20
		LISA Total:	**16**	
Industrial Sub-Area (ISA)				
LHAAP-01	5	5	10	01A-SB02, 01A-SB04, 01-SD09, 01SB23, 01SB28
LHAAP-04	2	2	4	LHSMW01, LHSMW02
LHAAP-08	0	0	0	NA
LHAAP-29	12	12	24	29SD01, 29SB05, 29SB07, 29SB08, 29SB09, 29SB11, 29SD10, 29WL02, 29SB14, 29SB15, 29SB12, 29SB13
LHAAP-32	8	8	16	32SB13, 32SB03, 32SB06, 32SB14, 32SS03, 32SS04, 32WL01, 32SD06
LHAAP-35A (58)	5	5	10	LH-S723-01, LH-S111-01, LH-S112-01, LH-S113-01, LH-S117-01
LHAAP-35B (37)	0	0	0	NA
LHAAP-35C (53)	5	5	10	LHSMW67, LHSMW68, LHSMW69, LHSMW70, LHSMW71
LHAAP-46	20	20	40	LH-S30-01, LH-S32-01, LH-S14-02, LH-S16-01, LH-S22-01, LH-S27-01, LH-S05-01, LH-S29-01, LH-S026-01, LH-S025-01, LH-S19-01, LH-S021-01, LH-S43-01, LH-S41-01, LH-S08-01, LH-S06-01, LH-S12-01, LH-S10-01, LH-S11-01, 46SD02
LHAAP-47	23	23	46	LH-S93-01, LH-S92-01, LH-S88-01, LH-S89-02, LH-S86-01, LH-S83-01, LH-S82-01, LH-S73-01, LH-DL74-01, LH-DL75-01, LH-S77-01, LH-S71-01, LH-S61-01, LH-S59-01, LH-S58-01, LH-S55-01, LH-S121-01, LH-S44-01, H-DL45-01, LH-S47-01, LH-S49-01, LH-S48-01, LH-S50-01
LHAAP-48	5	5	10	LH-S94-01, LH-S95-01, LH-S97-01, LH-S98-01, LH-S100-01
LHAAP-49	0	0	0	NA
LHAAP-50	0	0	0	NA
LHAAP-60	0	0	0	NA
LHAAP-67	0	0	0	NA
		ISA Total:	**170**	
Waste Sub-Area (WSA)				
LHAAP-12	4	1	5	12SB01 (DS), 12WW05 (SS), 12WW01 (SS), 12WW02 (SS), 12WW07 (SS)
LHAAP-16	1	0	1	16SD02 (SS)
LHAAP-18	6	0	6	18SD03, 18SD04, 18SD05, 18SD06, 18SD07, 18SD08 (all SS)
		WSA Total:	**12**	
Total Replacement Samples for All Sub-areas:			**198**	

(a) DS and SS refer to subsurface and surface replacement soil samples, respectively.

Table 3-1
Replacement Samples to Address Data Gaps in Sediment and Surface Water
Longhorn Army Ammunition Plant, Karnack, Texas

Site	Number of Sediment Samples	Number of Surface Water Samples	Planned Replacement Sample Locations (locations marked with an asterisk [*] will have surface water collected, in addition to sediment)
Saunders Branch Watershed	0	0	NA
Harrison Bayou Watershed	8	5	LHAAP-HB-ABERA-01 *, LHAAP-HB-ABERA-02, LHAAP-HB-ABERA-03 *, LHAAP-HB-ABERA-04 *, LHAAP-HB-ABERA-05, LHAAP-HB-ABERA-06, LHAAP-HB-ABERA-07 *, LHAAP-HB-ABERA-08 *
Central Creek Watershed	0	0	NA
Goose Prairie Creek Watershed	0	0	NA

Note: Planned surface water samples will be collected from areas with flow or recent runoff when possible.

Table 4-1
Planned Replacement Sample Coordinates
Longhorn Army Ammunition Plant, Karnack, Texas

Location Code	Northing	Easting	Coordinate System	Datum	Sub-Area
Planned Soil Replacement Samples					
01A-SB02	6961922.24657	3303029.27422	Texas State Plane North Central	NAD 1983	Industrial Sub-Area
01A-SB04	6961367.71467	3303080.54789	Texas State Plane North Central	NAD 1983	Industrial Sub-Area
01SB23	6961449.38057	3303139.85367	Texas State Plane North Central	NAD 1983	Industrial Sub-Area
01SB28	6961440.04518	3303276.15039	Texas State Plane North Central	NAD 1983	Industrial Sub-Area
01SD09	6961722.72123	3303435.75813	Texas State Plane North Central	NAD 1983	Industrial Sub-Area
29SB05	6954689.08500	3304720.11500	Texas State Plane North Central	NAD 1983	Industrial Sub-Area
29SB07	6954572.53900	3304768.22500	Texas State Plane North Central	NAD 1983	Industrial Sub-Area
29SB08	6954495.62900	3304882.96200	Texas State Plane North Central	NAD 1983	Industrial Sub-Area
29SB09	6954385.90200	3305017.01200	Texas State Plane North Central	NAD 1983	Industrial Sub-Area
29SB11	6954168.94200	3305547.10200	Texas State Plane North Central	NAD 1983	Industrial Sub-Area
29SB12	6957032.86400	3306892.94700	Texas State Plane North Central	NAD 1983	Industrial Sub-Area
29SB13	6957211.56900	3307071.25700	Texas State Plane North Central	NAD 1983	Industrial Sub-Area
29SB14	6956861.53000	3307068.58500	Texas State Plane North Central	NAD 1983	Industrial Sub-Area
29SB15	6956509.66400	3307293.94100	Texas State Plane North Central	NAD 1983	Industrial Sub-Area
29SD01	6954573.87200	3304488.19800	Texas State Plane North Central	NAD 1983	Industrial Sub-Area
29SD10	6955588.72300	3307513.70600	Texas State Plane North Central	NAD 1983	Industrial Sub-Area
29WL02	6955299.58600	3305925.37400	Texas State Plane North Central	NAD 1983	Industrial Sub-Area
32SB03	6958192.90600	3305947.87200	Texas State Plane North Central	NAD 1983	Industrial Sub-Area
32SB06	6957956.06200	3306280.14000	Texas State Plane North Central	NAD 1983	Industrial Sub-Area
32SB13	6957862.70500	3305717.99900	Texas State Plane North Central	NAD 1983	Industrial Sub-Area
32SB14	6957675.06000	3306156.26000	Texas State Plane North Central	NAD 1983	Industrial Sub-Area
32SD06	6957618.27000	3306093.34200	Texas State Plane North Central	NAD 1983	Industrial Sub-Area
32SS03	6957684.50000	3306144.80000	Texas State Plane North Central	NAD 1983	Industrial Sub-Area
32SS04	6957644.60000	3306185.70000	Texas State Plane North Central	NAD 1983	Industrial Sub-Area
32WL01	6957530.96100	3306271.18000	Texas State Plane North Central	NAD 1983	Industrial Sub-Area
46SD02	6961569.00000	3305857.00000	Texas State Plane North Central	NAD 1983	Industrial Sub-Area
LH-DL44-01	6957842.40800	3308970.79800	Texas State Plane North Central	NAD 1983	Industrial Sub-Area
LH-DL47-01	6957971.54200	3309322.04200	Texas State Plane North Central	NAD 1983	Industrial Sub-Area
LH-DL73-01	6960493.27900	3309440.41600	Texas State Plane North Central	NAD 1983	Industrial Sub-Area
LH-DL74-01	6960550.61400	3309533.84300	Texas State Plane North Central	NAD 1983	Industrial Sub-Area
LH-DL75-01	6960456.89100	3309552.90600	Texas State Plane North Central	NAD 1983	Industrial Sub-Area
LH-S021-01	6962674.70500	3306316.64500	Texas State Plane North Central	NAD 1983	Industrial Sub-Area
LH-S025-01	6962932.56700	3306298.08900	Texas State Plane North Central	NAD 1983	Industrial Sub-Area
LH-S026-01	6962984.92700	3306293.88700	Texas State Plane North Central	NAD 1983	Industrial Sub-Area
LH-S05-01	6963337.90100	3305996.68300	Texas State Plane North Central	NAD 1983	Industrial Sub-Area
LH-S06-01	6963182.48900	3307020.17600	Texas State Plane North Central	NAD 1983	Industrial Sub-Area
LH-S08-01	6963364.80400	3307012.91500	Texas State Plane North Central	NAD 1983	Industrial Sub-Area
LH-S10-01	6962434.10900	3307053.65100	Texas State Plane North Central	NAD 1983	Industrial Sub-Area

Table 4-1
Planned Replacement Sample Coordinates
Longhorn Army Ammunition Plant, Karnack, Texas

Location Code	Northing	Easting	Coordinate System	Datum	Sub-Area
LH-S100-01	6959421.92100	3314695.42300	Texas State Plane North Central	NAD 1983	Industrial Sub-Area
LH-S11-01	6962360.34500	3307063.27400	Texas State Plane North Central	NAD 1983	Industrial Sub-Area
LH-S111-01	6960220.57600	3305226.30100	Texas State Plane North Central	NAD 1983	Industrial Sub-Area
LH-S112-01	6960153.19300	3305236.26400	Texas State Plane North Central	NAD 1983	Industrial Sub-Area
LH-S113-01	6960044.01700	3304481.82100	Texas State Plane North Central	NAD 1983	Industrial Sub-Area
LH-S117-01	6959897.84100	3304294.38400	Texas State Plane North Central	NAD 1983	Industrial Sub-Area
LH-S12-01	6962443.04400	3307297.05800	Texas State Plane North Central	NAD 1983	Industrial Sub-Area
LH-S121-01	6959041.16500	3310354.51100	Texas State Plane North Central	NAD 1983	Industrial Sub-Area
LH-S14-02	6962278.50500	3305671.65400	Texas State Plane North Central	NAD 1983	Industrial Sub-Area
LH-S16-01	6962432.00300	3305644.30300	Texas State Plane North Central	NAD 1983	Industrial Sub-Area
LH-S19-01	6962555.70300	3306318.67900	Texas State Plane North Central	NAD 1983	Industrial Sub-Area
LH-S22-01	6962779.26900	3305645.60700	Texas State Plane North Central	NAD 1983	Industrial Sub-Area
LH-S27-01	6963127.38700	3305631.33000	Texas State Plane North Central	NAD 1983	Industrial Sub-Area
LH-S29-01	6963470.42300	3306767.95400	Texas State Plane North Central	NAD 1983	Industrial Sub-Area
LH-S30-01	6961267.61700	3305727.52900	Texas State Plane North Central	NAD 1983	Industrial Sub-Area
LH-S32-01	6961382.84000	3305725.52400	Texas State Plane North Central	NAD 1983	Industrial Sub-Area
LH-S41-01	6961535.34200	3306366.86200	Texas State Plane North Central	NAD 1983	Industrial Sub-Area
LH-S43-01	6961657.57200	3306198.89900	Texas State Plane North Central	NAD 1983	Industrial Sub-Area
LH-S45-01	6957763.70500	3308997.35100	Texas State Plane North Central	NAD 1983	Industrial Sub-Area
LH-S48-01	6958148.95200	3309705.16300	Texas State Plane North Central	NAD 1983	Industrial Sub-Area
LH-S49-01	6958236.12500	3309737.83800	Texas State Plane North Central	NAD 1983	Industrial Sub-Area
LH-S50-01	6958384.80500	3309609.02700	Texas State Plane North Central	NAD 1983	Industrial Sub-Area
LH-S55-01	6958778.18900	3309931.97100	Texas State Plane North Central	NAD 1983	Industrial Sub-Area
LH-S58-01	6958552.44200	3308440.09400	Texas State Plane North Central	NAD 1983	Industrial Sub-Area
LH-S59-01	6959229.66400	3308958.06600	Texas State Plane North Central	NAD 1983	Industrial Sub-Area
LH-S61-01	6959663.90100	3310250.59200	Texas State Plane North Central	NAD 1983	Industrial Sub-Area
LH-S71-01	6960416.51200	3309132.87900	Texas State Plane North Central	NAD 1983	Industrial Sub-Area
LH-S723-01	6960246.58600	3304996.05900	Texas State Plane North Central	NAD 1983	Industrial Sub-Area
LH-S77-01	6960615.56700	3309866.42100	Texas State Plane North Central	NAD 1983	Industrial Sub-Area
LH-S82-01	6961235.67200	3308895.24200	Texas State Plane North Central	NAD 1983	Industrial Sub-Area
LH-S83-01	6961480.96200	3308810.48200	Texas State Plane North Central	NAD 1983	Industrial Sub-Area
LH-S86-01	6961424.28200	3309129.97500	Texas State Plane North Central	NAD 1983	Industrial Sub-Area
LH-S88-01	6961681.44500	3309250.55800	Texas State Plane North Central	NAD 1983	Industrial Sub-Area
LH-S89-02	6961632.81000	3309269.67200	Texas State Plane North Central	NAD 1983	Industrial Sub-Area
LH-S92-01	6961958.43400	3309443.50900	Texas State Plane North Central	NAD 1983	Industrial Sub-Area
LH-S93-01	6962077.31900	3309562.53000	Texas State Plane North Central	NAD 1983	Industrial Sub-Area
LH-S94-01	6959066.35500	3314202.94100	Texas State Plane North Central	NAD 1983	Industrial Sub-Area
LH-S95-01	6959051.66700	3314777.94000	Texas State Plane North Central	NAD 1983	Industrial Sub-Area
LH-S97-01	6959200.90000	3314740.99000	Texas State Plane North Central	NAD 1983	Industrial Sub-Area

Table 4-1
Planned Replacement Sample Coordinates
Longhorn Army Ammunition Plant, Karnack, Texas

Location Code	Northing	Easting	Coordinate System	Datum	Sub-Area
LH-S98-01	6959214.86100	3314668.23000	Texas State Plane North Central	NAD 1983	Industrial Sub-Area
LHSMW01	6959159.79000	3306087.69000	Texas State Plane North Central	NAD 1983	Industrial Sub-Area
LHSMW02	6959133.73000	3305705.23000	Texas State Plane North Central	NAD 1983	Industrial Sub-Area
LHSMW67	6957361.09000	3315706.92000	Texas State Plane North Central	NAD 1983	Industrial Sub-Area
LHSMW68	6957111.64000	3315493.34000	Texas State Plane North Central	NAD 1983	Industrial Sub-Area
LHSMW69	6957346.18000	3315271.77000	Texas State Plane North Central	NAD 1983	Industrial Sub-Area
LHSMW70	6958033.52000	3316533.17000	Texas State Plane North Central	NAD 1983	Industrial Sub-Area
LHSMW71	6958207.89000	3316839.63000	Texas State Plane North Central	NAD 1983	Industrial Sub-Area
11SB03	6953273.25869	3310209.54583	Texas State Plane North Central	NAD 1983	Low Impact Sub-Area
11SB05	6953704.05451	3310281.56562	Texas State Plane North Central	NAD 1983	Low Impact Sub-Area
11SD13	6953438.62327	3310069.35486	Texas State Plane North Central	NAD 1983	Low Impact Sub-Area
27SB34	6947162.78992	3312699.60513	Texas State Plane North Central	NAD 1983	Low Impact Sub-Area
27SB38	6946811.52253	3312676.88553	Texas State Plane North Central	NAD 1983	Low Impact Sub-Area
XXSB15	6950200.61426	3317005.96158	Texas State Plane North Central	NAD 1983	Low Impact Sub-Area
XXSB17	6950489.48197	3317521.42271	Texas State Plane North Central	NAD 1983	Low Impact Sub-Area
XXSB20	6950904.17373	3316695.23677	Texas State Plane North Central	NAD 1983	Low Impact Sub-Area
18SD08	6953193.92000	3316993.95800	Texas State Plane North Central	NAD 1983	Waste Sub-Area
18SD07	6953012.95900	3316473.65100	Texas State Plane North Central	NAD 1983	Waste Sub-Area
18SD06	6953087.59300	3316644.95000	Texas State Plane North Central	NAD 1983	Waste Sub-Area
18SD05	6953187.53000	3316427.98900	Texas State Plane North Central	NAD 1983	Waste Sub-Area
18SD04	6953354.65500	3316965.42800	Texas State Plane North Central	NAD 1983	Waste Sub-Area
18SD03	6953720.94000	3317518.97400	Texas State Plane North Central	NAD 1983	Waste Sub-Area
16SD02	6952656.65400	3313082.86400	Texas State Plane North Central	NAD 1983	Waste Sub-Area
12WW07	6954009.02000	3311435.92000	Texas State Plane North Central	NAD 1983	Waste Sub-Area
12WW05	6954555.72000	3311400.83000	Texas State Plane North Central	NAD 1983	Waste Sub-Area
12WW02	6954164.65000	3311823.85000	Texas State Plane North Central	NAD 1983	Waste Sub-Area
12WW01	6954372.89000	3311748.90000	Texas State Plane North Central	NAD 1983	Waste Sub-Area
12SB01	6954425.72900	3311613.97100	Texas State Plane North Central	NAD 1983	Waste Sub-Area
Planned Surface Water and Sediment Replacement Samples					
LHAAP-HB-ABERA-06	6951990.80009	3314012.99996	Texas State Plane North Central	NAD 1983	Harrison Bayou
LHAAP-HB-ABERA-04	6952661.49986	3314293.39999	Texas State Plane North Central	NAD 1984	Harrison Bayou
LHAAP-HB-ABERA-05	6952698.59986	3313957.00008	Texas State Plane North Central	NAD 1985	Harrison Bayou
LHAAP-HB-ABERA-02	6954124.34929	3315451.50841	Texas State Plane North Central	NAD 1986	Harrison Bayou
LHAAP-HB-ABERA-01	6954605.93200	3315753.06042	Texas State Plane North Central	NAD 1987	Harrison Bayou
LHAAP-HB-ABERA-03	6953031.32000	3314394.30069	Texas State Plane North Central	NAD 1988	Harrison Bayou
LHAAP-HB-ABERA-07	6947604.30296	3312986.46987	Texas State Plane North Central	NAD 1989	Harrison Bayou
LHAAP-HB-ABERA-08	6947024.91678	3312963.47829	Texas State Plane North Central	NAD 1990	Harrison Bayou

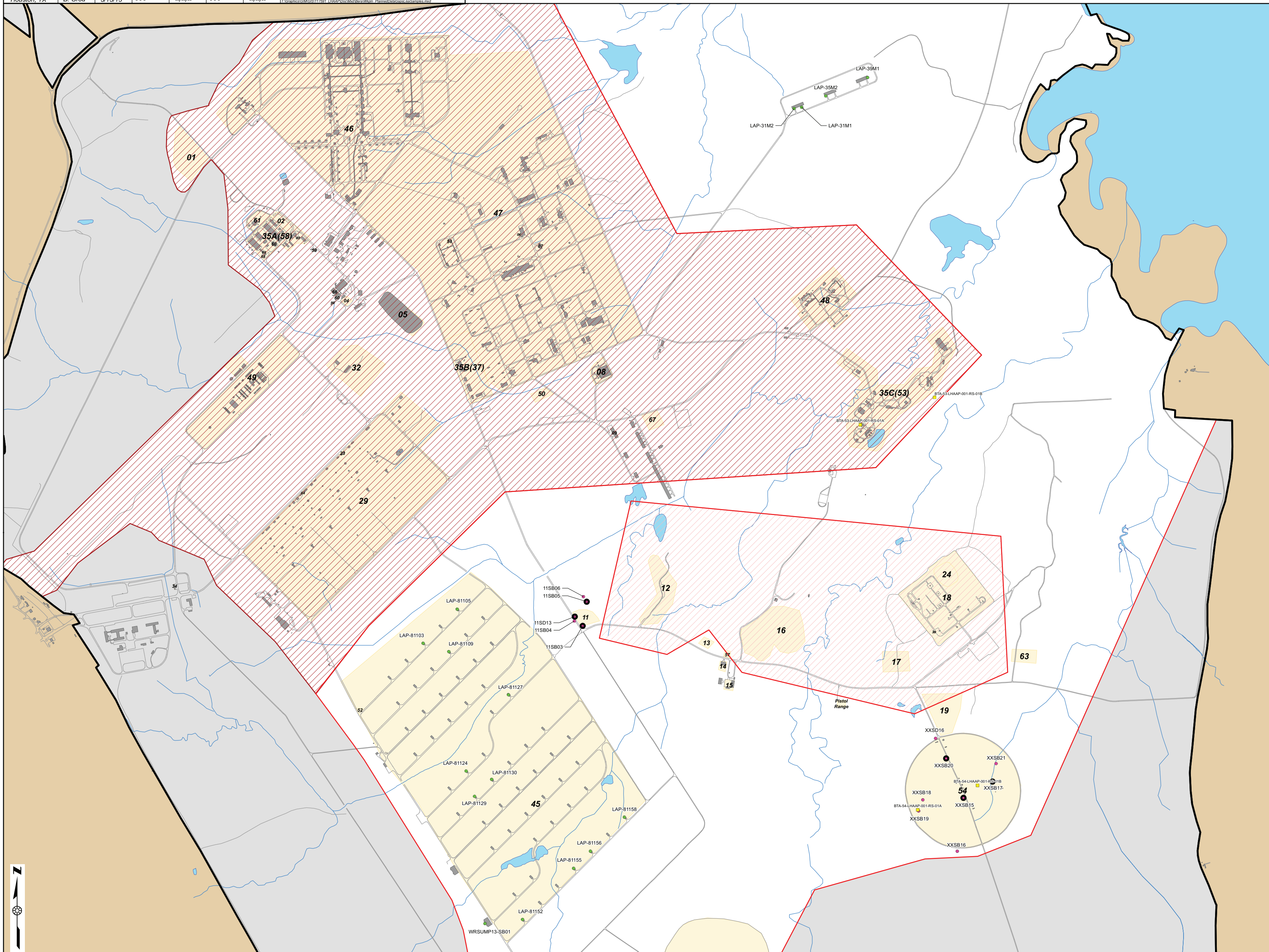
This page is intentionally left blank.

FIGURES

00187988

This page is intentionally left blank.

OFFICE	DRAWN BY		CHECKED BY		APPROVED BY		FILE PATH
Houston, TX	B. Grod	5/15/13	- - -	--/--/--	- - -	--/--/--	T:\Graphics\GIM\GIS\117591_LHAAP\Doc\Mxd\Bera\Wkpln_PlannedDataGapsLisaSamples.mxd



Legend

- Planned Explosives Sample Location
- Cape Environmental Samples 2006
- Post-BERA and Non-ITS explosives sample.
- 2,4-DNT and 2,6-DNT (SVOC) data available for this sample.
- Low Impact Sub-Area
- Industrial Sub-Area
- Waste Sub-Area
- Roads
- Buildings
- Streams
- Lakes
- LHAAP Boundary

Note:
Blow-up maps for each sub-area are presented in Appendix D (Low Impact Sub-Area), Appendix D (Industrial Sub-Area) and Appendix F (Waste Sub-Area).

0 500 1,000
Feet

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

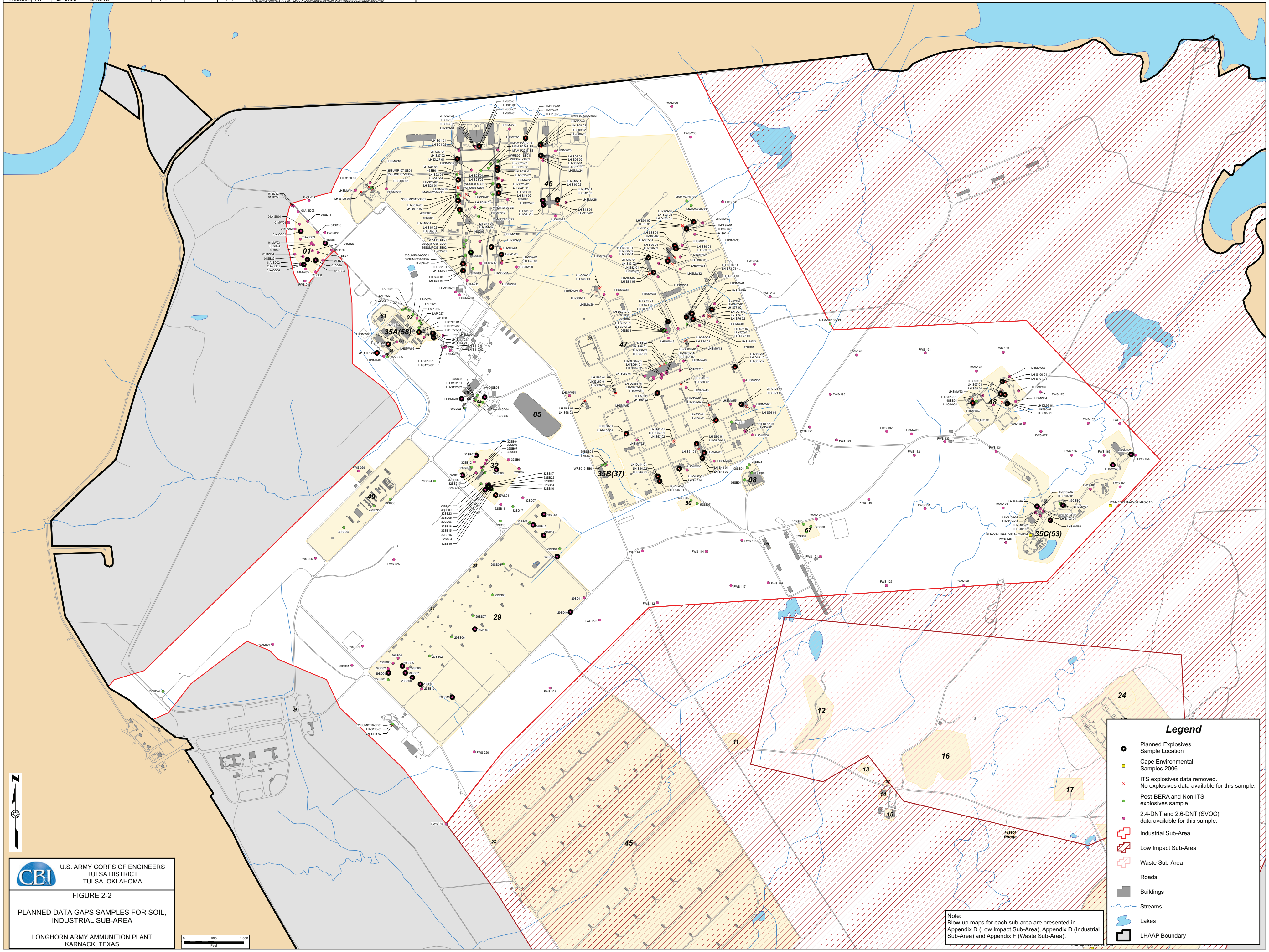
FIGURE 2-1

PLANNED DATA GAPS SAMPLES FOR SOIL, LOW IMPACT SUB-AREA

LONGHORN ARMY AMMUNITION PLANT
KARNACK, TEXAS

OFFICE	DRAWN BY		CHECKED BY		APPROVED BY		FILE PATH
Houston, TX	B. Grod	5/15/13	- - -	--/--/--	- - -	--/--/--	T:\Graphics\GIM\GIS\117591_LHAAP\Doc\Mxd\Bera\Wkpln_PlannedDataGapsIsaSamples.mxd

00187991



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

FIGURE 2-2

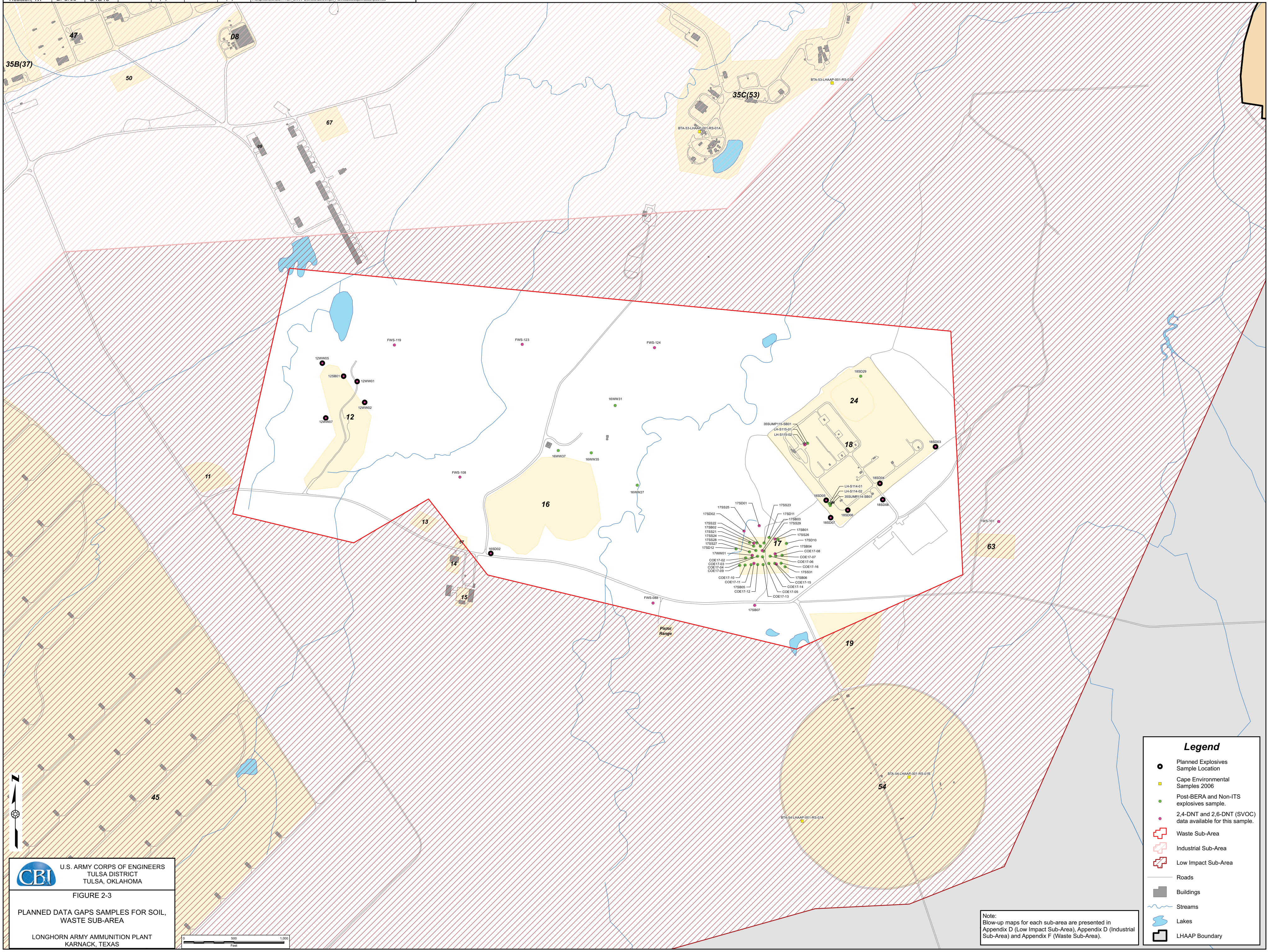
PLANNED DATA GAPS SAMPLES FOR SOIL, INDUSTRIAL SUB-AREA

LONGHORN ARMY AMMUNITION PLANT
KARNACK, TEXAS

00187992

00187993

OFFICE	DRAWN BY		CHECKED BY		APPROVED BY		FILE PATH
Houston, TX	B. Grod	5/15/13	- - -	--/--/--	- - -	--/--/--	T:\Graphics\GIM\GIS\117591_LHAAP\Doc\Mxd\Bera\Wkpln_PlannedDataGapsWsaSamples.mxd



Note:
Blow-up maps for each sub-area are presented in Appendix D (Low Impact Sub-Area), Appendix D (Industrial Sub-Area) and Appendix F (Waste Sub-Area).

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

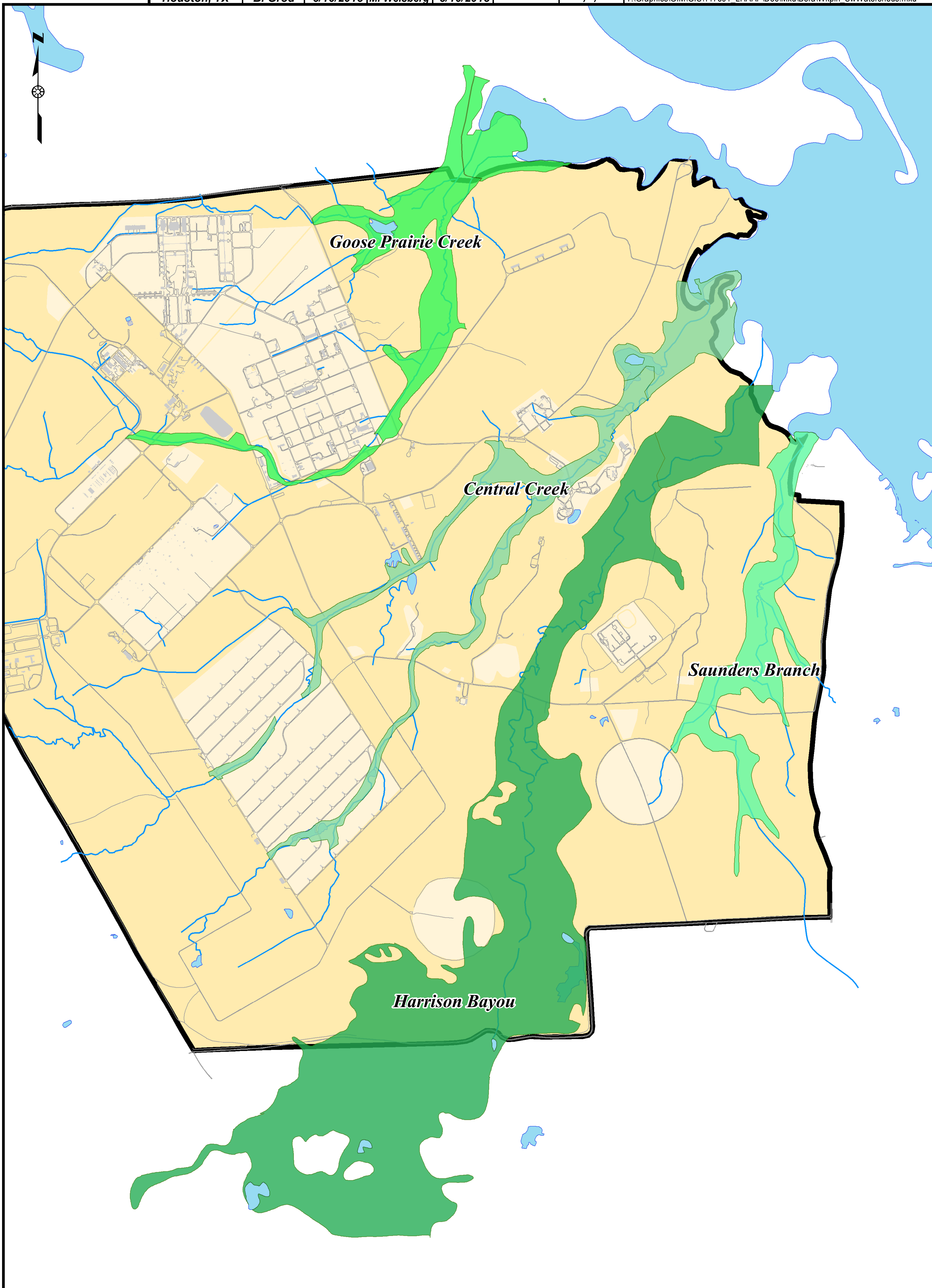
FIGURE 2-3

PLANNED DATA GAPS SAMPLES FOR SOIL, WASTE SUB-AREA

LONGHORN ARMY AMMUNITION PLANT
KARNACK, TEXAS

00187995

OFFICE	DRAWN BY		CHECKED BY		APPROVED BY		FILE PATH
Houston, TX	B. Grod	5/16/2013	M. Weisberg	5/16/2013	---	--/--/--	T:\Graphics\GIM\GIS\117591_LHAAP\Doc\Mxd\Bera\Wkpln_SwWatersheds.mxd



LEGEND

- Central Creek
- Goose Prairie Creek
- Harrison Bayou
- Saunders Branch
- Roads
- Buildings
- Streams
- Lakes
- LHAAP Boundary

0 1,112.5 2,225 4,450 Feet

CB&I

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

FIGURE 3-1

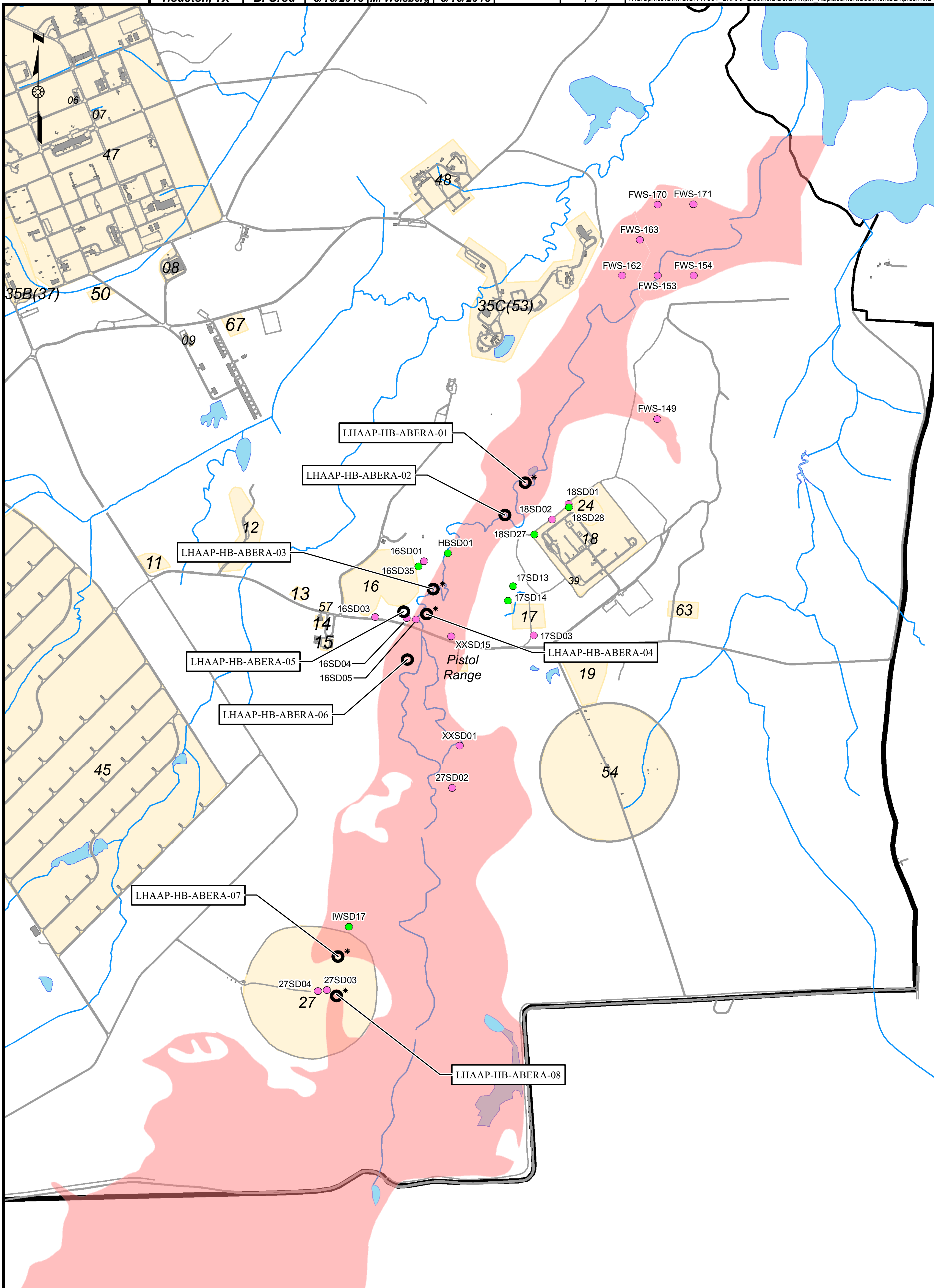
WATERSHEDS AT LONGHORN ARMY AMMUNITION PLANT

LONGHORN ARMY AMMUNITION PLANT
KARNACK, TEXAS

00187996

00187997

OFFICE	DRAWN BY		CHECKED BY		APPROVED BY		FILE PATH
Houston, TX	B. Grod	5/16/2013	M. Weisberg	5/16/2013	---	--/--/--	T:\Graphics\GIM\GIS\117591_LHAAP\Doc\Mxd\Bera\Wkpln_ReplacementSedimentSamples.mxd



LEGEND

- Planned Explosives Sediment Sample Location
- Planned Explosives Surface Water Sample Location (if water present)
- Post-BERA and Non-ITS explosives Sample
- 2,4-DNT and 2,6-DNT (SVOC) data available for this sample
- Watershed
- Roads
- Buildings
- Streams
- Lakes
- LHAAP Boundary

0 650 1,300 2,600 Feet

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

FIGURE 3-2

PLANNED REPLACEMENT SEDIMENT AND SURFACE WATER SAMPLES IN THE HARRISON BAYOU WATERSHED

LONGHORN ARMY AMMUNITION PLANT
KARNACK, TEXAS

APPENDIX A

Data Gap Memoranda for Explosives in Soil, and for Explosives in Sediment and Surface Water

[On compact disc]

This page is intentionally left blank.

DRAFT FINAL

DATA GAP MEMORANDUM
FOR EXPLOSIVES IN SOIL AT THE
LONGHORN ARMY AMMUNITION PLANT, KARNACK, TX

Contract No. W912BV-10-D-2010

Task Order 0004

PREPARED FOR:

U.S. Army Corps of Engineers, Tulsa District
1645 South 101 East Avenue
Tulsa, OK 74128

PREPARED BY:

AGEISS Inc.
1202 Bergen Parkway, Suite 310
Evergreen, CO 80439

CB&I
1401 Enclave Parkway, Suite 250
Houston, TX 77077

May 2013

TABLE OF CONTENTS

Section **Page**

LIST OF TABLES

Table **Page**

LIST OF FIGURES

Figure **Page**

LIST OF APPENDICES

ABBREVIATION / ACRONYM LIST

BERA	baseline ecological risk assessment
bgs	below ground surface
COC	chemical of concern
DNT	dinitrotoluene
EcoPRG	ecological preliminary remediation goal
EPC	exposure point concentration
ESA	Environmental Site Assessment
HMX	octogen
ISA	Industrial Sub-Area
ITS-ENV	Intertek Testing Services Environmental Laboratories, Inc.
LHAAP	Longhorn Army Ammunition Plant
LISA	Low Impact Sub-Area
mg/kg	milligrams per kilogram
NT	nitrotoluenes
RDX	cyclotrimethylenetrinitramine
Shaw	Shaw Environmental and Infrastructure
SVOC	semi-volatile organic compound
TCEQ	Texas Commission on Environmental Quality
TNT	trinitrotoluene
µg/L	micrograms per liter
UCL	upper confidence limit on the mean
USACE	United States Army Corps of Engineers
USEPA	United States Environmental Protection Agency
WSA	Waste Sub-Area

1.0 INTRODUCTION

This memorandum and its companion document, *Data Gap Memorandum for Explosives in Sediment and Surface Water* (AGEISS 2013) summarizes information previously sent to Longhorn Army Ammunition Plant (LHAAP) stakeholders in the February 2011 through March 2012 timeframe. It also contains a recommendation for the collection of additional samples to address data gaps, and presents figures indicating recommended sample locations and number of samples.

1.1 Background

In 2003, Shaw Environmental and Infrastructure (Shaw) (now CB&I) was tasked by the United States Army Corps of Engineers (USACE), Tulsa District, to perform an installation-wide baseline ecological risk assessment (BERA) at LHAAP, located in Karnack, Texas. This BERA included Steps 3 through 8 of the 8-Step ecological risk assessment process; Steps 1 and 2 had been previously performed by Jacobs Engineering (Jacobs, 2001a, 2002, and 2003). The BERA was finalized in November, 2007 (Shaw, 2007). The BERA included a synthesis of many environmental investigations that had previously been performed by other subcontractors at the facility in prior years, and one of the first challenges for Shaw was to compile all relevant environmental data available for the facility.

The primary dataset used to calculate potential risks to various representative receptors in the BERA was comprised of data from 1993 through 2003. These data are referred to herein as “the BERA dataset.” Additional data from samples collected between 2003 and the time when the BERA was finalized in 2007 were also discussed separately in the BERA to ensure that more recent sampling information did not affect overall site conclusions. These data were referred to in the BERA and herein as the “post-BERA dataset.”

Explosives data are of primary concern at LHAAP due to its history as an ammunition plant whose primary mission was to produce 2,4,6-trinitrotoluene (TNT) flake. Explosives data collected for the LHAAP investigation in the 1993 to 1995 timeframe analyzed by Intertek Testing Services Environmental Laboratories, Inc. (ITS-ENV) in Richardson, TX, were deemed unusable by the U.S. Environmental Protection Agency (USEPA) for environmental decision making (Jacobs, 2001b). Although the determination that the ITS-ENV data were unusable was made prior to Shaw’s involvement on the project, the quality problems with the ITS-ENV explosives data were known when the BERA was initiated, and all data associated with ITS-ENV (as determined by the code “ITS” in the Laboratory Identification field of the electronic database) were eliminated from Shaw’s BERA dataset.

After the BERA was approved and finalized, a data review performed as part of the remediation design for LHAAP-17 revealed that a number of historical samples in the BERA dataset with explosives data from the 1993-1995 timeframe likely originated from the ITS-ENV laboratory, even though the electronic database provided to Shaw by the Army did not carry unusable data qualifiers for these results. A review of the hard copy Phase I and II reports was performed, and it was confirmed that many of these data were from the ITS-ENV laboratory. Therefore, ITS-ENV data that were incorrectly or cryptically coded for their laboratory source appear to have been inadvertently retained in the dataset and used to quantify ecological risk in the BERA.

1.2 Prior Communications Regarding Data Gaps

Once it was discovered that the BERA had inadvertently used ITS-ENV data, Shaw was asked to determine how the removal of these data affected the BERA conclusions. To address this question, Shaw performed an evaluation on the impact of the ITS-ENV data removal, including evaluations for each LHAAP sub-area on 1) how exposure point concentrations (EPC) and numerical risk calculations changed after the ITS-ENV data were removed, and 2) what (if any) significant data gaps remained after the removal of the ITS-ENV data.

The three terrestrial exposure units at LHAAP are “sub-areas” that were delineated based on their common historical uses and similar ecological habitat (Shaw, 2007). These sub-areas include the Low Impact Sub-Area (LISA), the Industrial Sub-Area (ISA), and the Waste Sub-Area (WSA). The WSA was the only sub-area where explosives compounds were identified as chemicals of concern (COC) in the BERA.

Shaw prepared a series of memoranda for LHAAP stakeholders describing the impacts to the BERA conclusions resulting from the removal of the ITS-ENV from the BERA dataset (taking into account additional data that have been obtained from ongoing investigations since the BERA was finalized), including responding to comments from both the Texas Commission on Environmental Quality (TCEQ) and the USEPA Region 6. Transmittal of these emails, memos, and responses to comments occurred in the February 2011 through March 2012 timeframe, approximately, at which time both the TCEQ and USEPA requested the USACE to proceed with a formal proposal for addressing any data gaps in the LHAAP BERA resulting from the removal of the ITS-ENV data.

1.3 Addressing Identified Data Gaps

Sections 2, 3, and 4 in this Memorandum summarize the impact of the removal of the ITS-ENV data from the BERA for the LISA (Section 2.0), ISA (Section 3.0), and WSA (Section 4.0). Once consensus is reached on the basic framework for addressing the data gaps, additional details will be provided in a formal Work Plan (including a Sample Analysis Plan, Health and Safety Plan, and other standard work plan components). After the Work Plan is approved and the additional samples described therein have been collected, a BERA Addendum Report will be issued to present the results of the sampling (including re-calculated 95% upper confidence limits on the mean [UCLs], revised food chain models, revised hot-spot evaluation for small-ranging receptors, etc.) and a revised analysis of potential impacts to ecological receptors.

A subset of the results from any new samples may also be used to perform a statistical comparison with the rejected ITS-ENV results for one or more LHAAP sites where explosives are a concern but have not been remediated. It is possible that results of this statistical test may show that individual explosive compounds do not have statistically significantly greater concentrations in the new data set compared with the rejected ITS-ENV data set. This finding would lend additional support to the conclusions previously presented in the BERA. Final conclusions and recommendations for explosives compounds in the three sub-areas will also be presented in the BERA Addendum Report.

2.0 LOW IMPACT SUB-AREA

The LISA is an approximately 3,000+ acre sub-area that includes the following sites:

- LHAAP-11 – Suspected TNT Burial Site
- LHAAP-13 – TNT Burial Site/Acid Dump
- LHAAP-14 – Area 54 Burial Ground
- LHAAP-27 – South Test Area
- LHAAP-45 – Container Storage Area
- LHAAP-52 – Magazine Washout Area
- LHAAP-63 – Former Burial Pits
- LHAAP-XX, also known as LHAAP-54 – Ground Signal Test Area

The LISA sites had been investigated prior to the BERA, with the conclusion of minimal impact.

2.1 Low Impact Sub-Area Data Gaps Evaluation

Table 2-1 presents the list of soil samples with explosives data for the LISA. The samples are color-coded to indicate the status of explosives data available in their analytical results. **Figure 2-1** presents the LISA sample locations. **Appendix A** presents larger scale "zoom in" maps of the LISA for improved clarity and readability. The BERA dataset for the LISA included 33 soil samples analyzed for explosives, 17 of which are suspected ITS-ENV data. These 17 samples were also analyzed for semi-volatile organic compounds (SVOC) that were analyzed by a different laboratory. The following considerations are noted:

- All samples were non-detect for explosives, regardless of whether they were analyzed by ITS-ENV. Valid data for 2,4-dinitrotoluene (DNT) and 2,6-DNT were available for all LISA soil samples as part of the SVOC suite, and these explosives were non-detect. The SVOC data had comparable reporting limits to the explosives data for these compounds. Furthermore, all other detected organic chemicals detected in the LISA were either below their respective screening values or were spurious detections (i.e., detected at 5% frequency or lower), or both (see Table 6 through Table 19 of the BERA, Shaw, 2007).

- Process-related contaminants such as explosives that are relatively immobile tend to co-occur. Therefore, the lack of any identified contaminants in this sub-area (explosives for samples with non-rejected explosives data, non-explosives and DNTs for all samples) supports the assumption that releases have not occurred in the LISA.

- The LISA contains no explosives manufacturing facilities, nor are there any known records of releases of explosive compounds in the LISA.

- Previous investigations had already concluded that sites within the LISA were non-impacted, and releases are neither known nor suspected to have occurred at the LISA.

The ITS-ENV explosives data that were removed were from LHAAP-11 (five out of five samples), LHAAP-27 (three out of three samples), and LHAAP-54 (nine out of nine samples), while the valid explosives data that were not eliminated were from LHAAP-45. However, additional soil samples were collected from LHAAP-27 and LHAAP-54 by CAPE in 2006. A munitions constituents summary report was recently developed for LHAAP-27 and LHAAP-54 (Shaw, 2011), where additional soil data collected by CAPE and additional groundwater data collected by the USEPA and Army in 2009 for these two LISA sites were presented. For LHAAP-27, even though 2,4,6-TNT had been detected in two surface soil samples in 1982, no explosives constituents (1,3,5-trinitrobenzene, 1,3-dinitrobenzene, 2,4,6-TNT, 2,4-DNT, 2,6-DNT, 2-amino-4,6-DNT, 2-nitrotoluene, 3-nitrotoluene, 4-amino-2,6-DNT, 4-nitrotoluene, HMX, nitrobenzene, RDX, and tetryl) were identified in any surface or subsurface soil samples

Table 2-1. Sample Summary for Total Soil, Low Impact Sub-Area

Location Total Soil [c]	Sample No [b]	Date	Depth (ft bgs)	Analyses
11SB03	LH11-SB03 (0-2)	3/3/93	0 - 2	Explosives, General Chemistry, Metals, SVOC, VOC
11SB04	LH11-SB04 (0-2)	3/3/93	0 - 2	Explosives, General Chemistry, Metals, SVOC, VOC
11SB05	LH11-SB05 (0-2)	3/4/93	0 - 2	Explosives, General Chemistry, Metals, SVOC, VOC
11SB06	LH11-SB06 (0-2)	3/4/93	0 - 2	Explosives, General Chemistry, Metals, SVOC, VOC
11SD13	LH11-SD13	3/31/93	0 - 0	Explosives, General Chemistry, Metals, SVOC, VOC
27SB34	LH27-SB34(0-3)	3/19/93	0 - 3	Explosives, General Chemistry, Metals, SVOC, VOC
27SB34	LH27-SB34(0-3)QQC	3/19/93	0 - 3	Explosives, General Chemistry, Metals, SVOC, VOC
27SB38	LH27-SB38(0-2)	3/20/93	0 - 2	Explosives, General Chemistry, Metals, Pest/PCB, SVOC, VOC
LAP-31M1	LAP-31M1	7/12/00	0 - 0.5	Explosives, Metals, Perchlorate, SVOC
LAP-31M2	LAP-31M2	7/12/00	0 - 0.5	Explosives, Metals, Perchlorate, SVOC
LAP-35M2	LAP-35M2	7/12/00	0 - 0.5	Explosives, Metals, Perchlorate, SVOC
LAP-39M1	LAP-39M1	7/12/00	0 - 0.5	Explosives, Metals, Perchlorate, SVOC
LAP-81103	LAP-81103	7/10/00	0 - 0.5	Explosives, Metals, Perchlorate, SVOC
LAP-81105	LAP-81105	7/10/00	0 - 0.5	Explosives, Metals, Perchlorate, SVOC
LAP-81109	LAP-81109	7/10/00	0 - 0.5	Explosives, Metals, Perchlorate, SVOC
LAP-81124	LAP-81124	7/10/00	0 - 0.5	Explosives, Metals, Perchlorate, SVOC
LAP-81127	LAP-81127	7/10/00	0 - 0.5	Explosives, Metals, Perchlorate, SVOC
LAP-81129	LAP-81129	7/10/00	0 - 0.5	Explosives, Metals, Perchlorate, SVOC
LAP-81130	LAP-81130	7/10/00	0 - 0.5	Explosives, Metals, Perchlorate, SVOC
LAP-81152	LAP-81152	7/10/00	0 - 0.5	Explosives, Metals, Perchlorate, SVOC
LAP-81152	LAP-81152-FD	7/10/00	0 - 0.5	Explosives
LAP-81155	LAP-81155	7/10/00	0 - 0.5	Explosives, Metals, Perchlorate, SVOC
LAP-81156	LAP-81156	7/10/00	0 - 0.5	Explosives, Metals, Perchlorate, SVOC
LAP-81158	LAP-81158	7/12/00	0 - 0.5	Explosives, Metals, Perchlorate, SVOC
XXSB15	LHXX-SB15(0-2)	3/9/93	0 - 2	Explosives, General Chemistry, Metals, SVOC, VOC
XXSB16	LHXX-SB16(0-3)	3/9/93	0 - 3	Explosives, General Chemistry, Metals, SVOC, VOC
XXSB17	LHXX-SB17(0-2)	3/9/93	0 - 2	Explosives, General Chemistry, Metals, SVOC, VOC
XXSB18	LHXX-SB18 (0-2)	3/10/93	0 - 2	Explosives, General Chemistry, Metals, SVOC, VOC
XXSB19	LHXX-SB19(0-2.5	3/9/93	0 - 2.5	Explosives, General Chemistry, Metals, SVOC, VOC
XXSB20	LHXX-SB20(0-2.5	3/10/93	0 - 2.5	Explosives, General Chemistry, Metals, SVOC, VOC
XXSB21	LHXX-SB21(0-2.5	3/10/93	0 - 2.5	Explosives, General Chemistry, Metals, SVOC, VOC
XXSB21	LHXX-SB21(0-2.5QC	3/10/93	0 - 2.5	Explosives, General Chemistry, Metals, SVOC, VOC
XXSD16	LHXX-SD16	3/31/93	0 - 0	Explosives, General Chemistry, Metals, SVOC, VOC
Post-BERA Samples				
WRSUMP13-SB01	WRSUMP13-SB01-01	11/15/06	0 - 0.5	Explosives *
WRSUMP13-SB01	WRSUMP13-SB01-02	11/15/06	1 - 2	Explosives *

[a] Sample list is based on Table 6-3 of the Baseline Ecological Risk Assessment (Shaw, 2007). The sample list is condensed to only show explosives data pertinent to the discussion in the Response to Comments memo regarding the removal of ITS data. Samples not analyzed for explosives, and ITS samples that were previously eliminated in the BERA, are not presented.

[b] Field duplicates are indicated by the addition of "QC", "QQC", "DUP", or "FD" to the sample number.

[c] Total soil is defined as samples 0 to 3 feet bgs. Deeper samples were also considered surface soil if at least 50% of their sampling depth interval was less than 3 ft bgs (e.g., 2-4 ft bgs).

* Analyses list is not comprehensive. Sample may include additional analytical suites.

General Chemistry parameters include: chloride, conductivity, nitrate, sulfate, pH, percent solids, and total solids. Samples may not have been analyzed for all parameters.

PAH = Polynuclear aromatic hydrocarbons

Pest = Pesticides

PCB = Polychlorinated biphenyls

SVOC = Semivolatile organic compounds

TPH = Total petroleum hydrocarbons

VOC = Volatile organic compounds

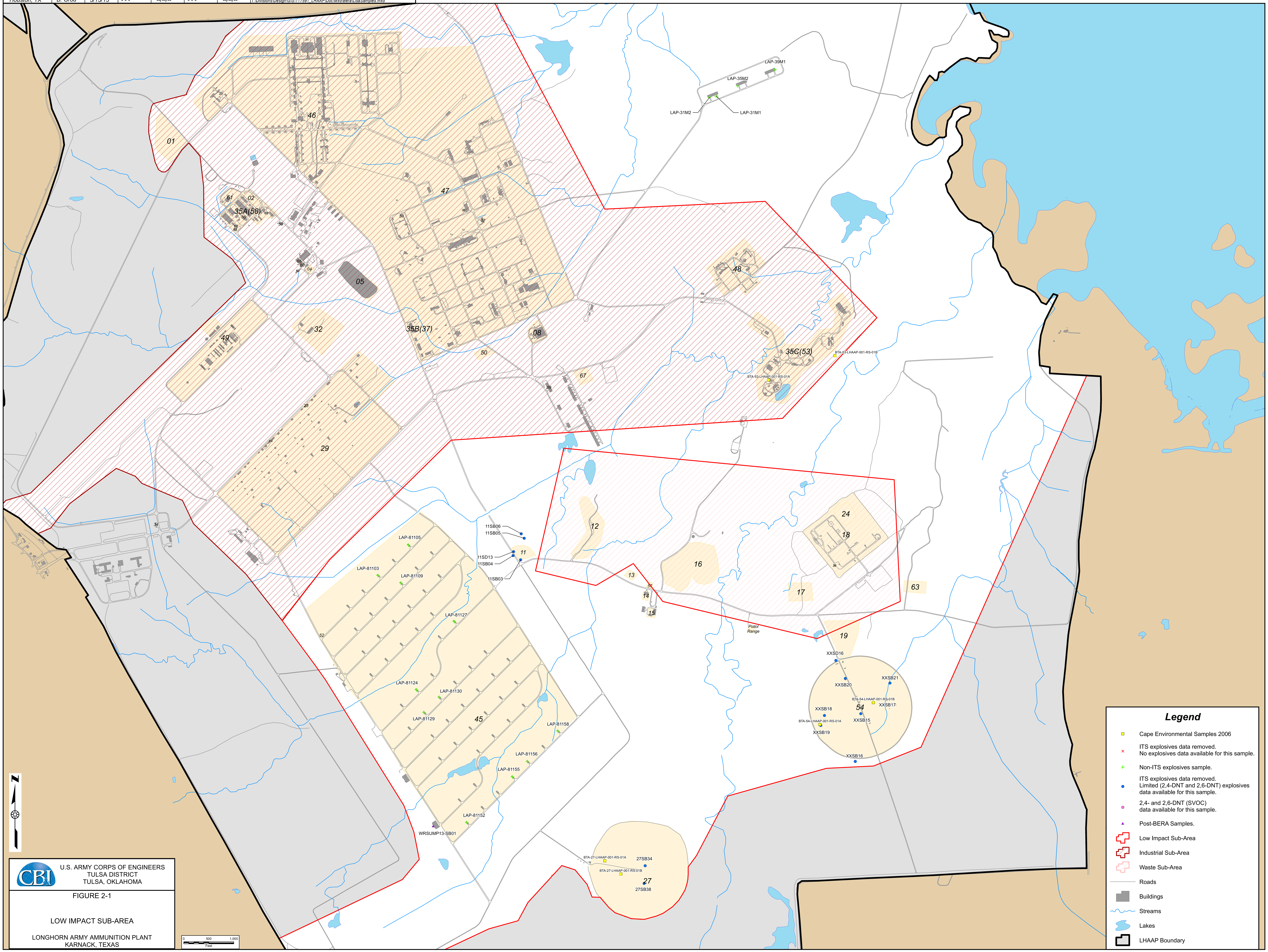
Color Coding:

(green) *= not suspected of having explosives analysis run by ITS lab (not within 1993-1994 timeframe).*

(blue) *= has ITS explosives data, but also has some explosives (2,4-DNT and 2,6-DNT) run as SVOCs*

00188010

OFFICE	DRAWN BY		CHECKED BY		APPROVED BY		FILE PATH
Houston, TX	B. Grod	5/15/13	- - -	--/--/--	- - -	--/--/--	T:\Divisions\Design\GIS\117591_LHAAP\Doc\Mxd\Bera\LisaSamples.mxd



collected in 2006 and there was no indication of the presence of explosives compounds in any samples. Similarly, for LHAAP-54, no explosives were identified in any soil samples and there was no indication of the presence of explosives in any pre- or post-detonation samples. Although groundwater is typically not a medium of concern for ecological receptors, the groundwater samples collected for these two sites can provide evidence of contamination in soil that may have leached to groundwater.

For LHAAP-27, results from the October 2009 sampling identified 2-amino-4,6-DNT in one groundwater sample at a concentration of 0.14J micrograms per liter (µg/L). For LHAAP-54, 2-amino-4,6-DNT was detected in two monitoring wells at concentrations of 0.22 µg/L and 0.30 µg/L. 3-Nitrotoluene was detected in one well at a an estimated (J-qualified) concentration of 0.24 µg/L. No explosives were detected in any of the four U.S. Army split samples. The conclusion of the summary report was that explosives are not of concern in LHAAP-27 and LHAAP-54 (Shaw, 2011). The elimination of approximately 50% of the explosives data reduces the spatial coverage of these chemicals at the LISA, which results in an uncertainty regarding the conclusion that explosions are not problematic in this sub-area. However, the fact that other organic COCs were not of concern, including two explosives compounds analyzed as SVOCs, lends credence to the hypothesis that the presence of explosive contaminants is unlikely. Furthermore, the munitions constituents summary report for two of the three sites whose explosives data were eliminated concluded that explosives were not of concern.

The third site, LHAAP-11, is a very small site (approximately 2 acres) that is described as a "pit" or ground scar. A review of aerial photographs as presented in the Plexus Report documents changes in ground cover at this site, and did not identify any concerns at this area (Plexus, 2005). Further, its small size reduces the likelihood that populations of ecological receptors would be impacted even if contamination was present. It is also unlikely that the food source for receptors higher on the food chain (e.g., foxes, hawks, etc.), such as small mammals that serve as prey, would be biologically significant for this small site, even assuming that contamination might result in adverse impacts to survivability, reproduction, or growth of prey species.

2.2 Low Impact Sub-Area Data Gaps Recommendations

Explosives data for 17 samples were eliminated from the LISA, including all the samples from LHAAP-11, LHAAP-27, and LHAAP-54. However, the uncertainty regarding the loss of these data is tempered by several factors. Historical knowledge of the sites within the LISA based on previous investigations provides no indication that a release of explosives occurred within this sub-area. Although the explosives data set has been reduced by the elimination of the faulty data, valid data that are available (i.e., non-rejected explosives data, and data for other organic compounds) do not suggest that any release has occurred in the LISA. Furthermore, all 17 samples with ITS-ENV explosives data did include limited (DNTs) explosives data as part of the SVOC analysis, all of which were non-detect. It is noted, however, that DNTs are only a small part of the explosives analytical suite, which typically contains 1,3,5-trinitrobenzene, 1,3-dinitrobenzene, 2-amino-4,6-dinitrotoluene, 4-amino-2,6-dinitrotoluene, nitrobenzene, HMX, RDX, 2,4-DNT, 2,6-DNT, 2,4,6-TNT, niobium, nitrotoluene (o-, m-, and p-toluene), and Tetryl.

Although the information presented in this Section supports the conclusions of the BERA of no further action for the LISA, to improve the level of confidence that the BERA conclusions for explosives are still valid for the LISA, AGEISS recommends collecting six soil samples (three surface soil and three subsurface soil samples) from locations where ITS-ENV data were eliminated at two of the three sites within the LISA whose explosives data were removed (i.e., LHAAP-11 and LHAAP-54). For the third site with rejected data, LHAAP-27, only two sample locations were previously sampled, so only four samples (one surface and subsurface sample from each of the two sample locations) are proposed for this site. This would result in a total of 16 additional samples. These additional data, in combination with valid explosives data at the LISA, are expected to be sufficient for confirming that explosives are not chemicals of concern at this sub-area. Specific re-sampling recommendations are presented in Section 5.

3.0 INDUSTRIAL SUB-AREA

The ISA is an approximately 2,330-acre sub-area that includes the following sites:

- LHAAP-01 – Inert Burning Grounds – 1.5 acres
- LHAAP-04 – Pilot Wastewater Treatment Plant – 1.4 acres
- LHAAP-08 – Sewage Treatment Plant – 2 acres
- LHAAP-29 – Former TNT Production Area – 85 acres
- LHAAP-32 – Former TNT Waste Disposal Plant – 9 acres
- LHAAP-35A (58) – Shop Area – 15 acres
- LHAAP-35B (37) – Chemical Laboratory – 8 acres
- LHAAP-35C (53) – Static Test Area – 26 acres
- LHAAP-46 – Plant 2 Area – 190 acres
- LHAAP-47 – Plant 3 Area – 275 acres
- LHAAP-48 – Y Area – 16 acres
- LHAAP-49 – Acid Storage Area – 19.5 acres
- LHAAP-50 – Former Sump Water Tank – 1 acre
- LHAAP-60 – Pesticide Storage Buildings – less than 1 acre
- LHAAP-67 – Above-Ground Storage Tank Farm – 12 acres

Historical activities in the ISA include TNT production, wastewater and sewage treatment, chemical laboratory, shop, test areas, pyrotechnic/rocket motor production, and pesticide storage.

3.1 Industrial Sub-Area Data Gaps Evaluation

Table 3-1 presents the list of soil samples with explosives data for the ISA. The samples are color-coded to indicate the status of explosives data available in their analytical results. **Figure 3-1** presents the ISA sample locations. **Appendix B** presents larger scale “zoom in” maps of the ISA for improved clarity and readability. The BERA soil dataset for the ISA had a total of 476 samples that were analyzed for the full suite of explosives. An evaluation of the ISA data set reveals the following if the ITS-ENV data are removed (note: QA/QC samples are not included in the tallies below, nor are samples that were eliminated during the BERA because they were known ITS-ENV data):

- 201 soil samples (42%) lose all their explosives data
- An additional 166 soil samples (35%) lose all their explosives data except for 2,4-DNT and 2,6-DNT, which were analyzed as part of the SVOC suite.
- 109 of the original BERA soil samples (23%) are retained with their full explosives data suite intact.
- In addition to these 109 samples with explosives data, an additional 256 soil samples (54%) (i.e., the 166 ITS-ENV samples with limited SVOC explosives data plus an additional 90 samples with SVOC explosives data that did not have ITS-ENV data) retained limited (2,4- and 2,6-DNT only) explosives data.
- Therefore, with the ITS-ENV data removed, data for explosives compounds other than 2,4-DNT and 2,6-DNT are only available for 109 of the original 476 samples. Data for 2,4-DNT and 2,6-DNT are available for 365 of the original 476 samples.
- An additional 42 soil samples analyzed for explosives after the BERA was finalized are also available. These data were included in the BERA as part of the “post-BERA” data set evaluation, and provide additional coverage. These samples are primarily located in LHAAP-32 and LHAAP-46. As depicted in Table 15-13 of the BERA (Shaw, 2007), only 1 or 2 (depending on the compound) of the 42 samples had detectable concentrations of any explosives compound.

Table 3-1. Sample Summary for Total Soil, Industrial Sub-Area

Location	Sample No [b]	Date	Depth (ft bgs)	Analyses
Total Soil [c]				
01A-SB01	LH01A-SB01-2001	12/15/93	0 - 0	Explosives, General Chemistry, Metals, SVOC, VOC
01A-SB01	LH01A-SB01-2002	12/15/93	2.5 - 2.5	Explosives, General Chemistry, Metals, SVOC, VOC
01A-SB02	LH01A-SB02-2001	12/14/93	0 - 0	Explosives, General Chemistry, Metals, SVOC, VOC
01A-SB02	LH01A-SB02-2002	12/14/93	2.5 - 2.5	Explosives, General Chemistry, Metals, SVOC, VOC
01A-SB03	LH01A-SB03-2001	12/14/93	0 - 0	Explosives, General Chemistry, Metals, SVOC, VOC
01A-SB03	LH01A-SB03-2002	12/14/93	2.5 - 2.5	Explosives, General Chemistry, Metals, SVOC, VOC
01A-SB04	LH01A-SB04-2001	12/13/93	0 - 0	Explosives, General Chemistry, Metals, SVOC, VOC
01A-SB04	LH01A-SB04-2002	12/13/93	2.5 - 2.5	Explosives, General Chemistry, Metals, SVOC, VOC
01A-SD01	LH01A-SD01-3001	12/10/93	0 - 0	Explosives, General Chemistry, Metals, SVOC, VOC
01A-SD01	LH01A-SD01-3001QC	12/10/93	0 - 0	Explosives, General Chemistry, Metals, SVOC, VOC
01A-SD02	LH01A-SD02-3001	12/10/93	0 - 0	Explosives, General Chemistry, Metals, SVOC, VOC
01A-SD03	LH01A-SD03-3001	12/12/93	0 - 0	Explosives, General Chemistry, Metals, SVOC, VOC
01MW01	LH01A-MW01-2001	12/2/93	0 - 0	Explosives, General Chemistry, Metals, SVOC, VOC
01MW01	LH01A-MW01-2002	12/2/93	2.5 - 2.5	Explosives, General Chemistry, Metals, SVOC, VOC
01MW02	LH01A-MW02-2001	12/5/93	0 - 0	Explosives, General Chemistry, Metals, SVOC, VOC
01MW02	LH01A-MW02-2002	12/5/93	2.5 - 2.5	Explosives, General Chemistry, Metals, SVOC, VOC
01MW03	LH01A-MW03-2001	12/7/93	0 - 0	Explosives, General Chemistry, Metals, SVOC, VOC
01MW03	LH01A-MW03-2002	12/7/93	2.5 - 2.5	Explosives, General Chemistry, Metals, SVOC, VOC
01MW04	LH01A-MW04-2001	12/10/93	0 - 0	Explosives, General Chemistry, Metals, SVOC, VOC
01MW04	LH01A-MW04-2002	12/10/93	2.5 - 2.5	Explosives, General Chemistry, Metals, SVOC, VOC
01MW05	LH01A-MW05-2001	12/8/93	0 - 0	Explosives, General Chemistry, Metals, SVOC, VOC
01MW05	LH01A-MW05-2002	12/8/93	2.5 - 2.5	Explosives, General Chemistry, Metals, SVOC, VOC
01SB22	LH01-SB22 0-2.5	3/15/93	0 - 2.5	Explosives, General Chemistry, Metals, SVOC, VOC
01SB22	LH01-SB22 0-2.5QC	3/15/93	0 - 2.5	Explosives, General Chemistry, Metals, SVOC, VOC
01SB23	LH01-SB23 0-2.5	3/15/93	0 - 2.5	Explosives, General Chemistry, Metals, SVOC, VOC
01SB24	LH01-SB24 0-2.5	3/16/93	0 - 2.5	Explosives, General Chemistry, Metals, SVOC, VOC
01SB25	LH01-SB25 0-2.5	3/16/93	0 - 2.5	Explosives, General Chemistry, Metals, SVOC, VOC
01SB26	LH01-SB26 0-2.5	3/16/93	0 - 2.5	Explosives, General Chemistry, Metals, SVOC, VOC
01SB26	LH01-SB26 0-2.5QC	3/16/93	0 - 2.5	Explosives, General Chemistry, Metals, SVOC, VOC
01SB27	LH01-SB27 0-2.5	3/17/93	0 - 2.5	Explosives, General Chemistry, Metals, SVOC, VOC
01SB28	C930319-01SB28-N00	3/19/93	0 - 0	Explosives, General Chemistry, Metals, SVOC, VOC
01SB28	LH01-SB28 (0-2.	3/17/93	0 - 2.5	Explosives, General Chemistry, Metals, SVOC, VOC
01SB29	C930330-01SB29-N00	3/30/93	0 - 0	Explosives, General Chemistry, Metals, SVOC, VOC
01SB29	LH01-SB29 (0-2.	3/17/93	0 - 2.5	Explosives, General Chemistry, Metals, SVOC, VOC
01SD06	LH01-SD06	3/31/93	0 - 0	Explosives, General Chemistry, Metals, SVOC, VOC
01SD07	C930318-01SD07-N00	3/18/93	0 - 0	Explosives, General Chemistry, Metals, SVOC, VOC
01SD07	LH01-SD07	3/31/93	0 - 0	Explosives, General Chemistry, Metals, SVOC, VOC

Location	Sample No [b]	Date	Depth (ft bgs)	Analyses
Total Soil [c]				
01SD08	C930320-01SD08-N00	3/20/93	0 - 0	Explosives, General Chemistry, Metals, SVOC, VOC
01SD08	C930320-01SD08-QC00	3/20/93	0 - 0	Explosives, General Chemistry, Metals, SVOC, VOC
01SD08	LH01-SD08	3/31/93	0 - 0	Explosives, General Chemistry, Metals, SVOC, VOC
01SD08	LH01-SD08-QC	3/31/93	0 - 0	Explosives, General Chemistry, Metals, SVOC, VOC
01SD09	C930318-01SD09-N00	3/18/93	0 - 0	Explosives, General Chemistry, Metals, SVOC, VOC
01SD09	LH01-SD09	3/31/93	0 - 0	Explosives, General Chemistry, Metals, SVOC, VOC
01SD10	C930330-01SD10-N00	3/30/93	0 - 0	Explosives, General Chemistry, Metals, SVOC, VOC
01SD10	LH01-SD10	3/31/93	0 - 0	Explosives, General Chemistry, Metals, SVOC, VOC
01SD11	C930330-01SD11-N00	3/30/93	0 - 0	Explosives, General Chemistry, Metals, SVOC, VOC
01SD11	LH01-SD11	3/31/93	0 - 0	Explosives, General Chemistry, Metals, SVOC, VOC
01SD12	C930330-01SD12-N00	3/30/93	0 - 0	Explosives, General Chemistry, Metals, SVOC, VOC
01SD12	C930330-01SD12-QC00	3/30/93	0 - 0	Explosives, General Chemistry, Metals, SVOC, VOC
01SD12	LH01-SD12	3/31/93	0 - 0	Explosives, General Chemistry, Metals, SVOC, VOC
04SB03	04SB03(0-0.5)	12/14/00	0 - 0.5	Dioxin/Furans, Explosives, Metals, Perchlorate, Pest/PCB, SVOC, VOC
04SB03	04SB03(0-0.5)QC	12/14/00	0 - 0.5	Dioxin/Furans, Explosives, Metals, Perchlorate, Pest/PCB, SVOC, VOC
04SB03	04SB03(1-3)	12/7/00	1 - 3	Dioxin/Furans, Explosives, Metals, Perchlorate, Pest/PCB, SVOC, VOC
04SB04	04SB04(0-0.5)	12/14/00	0 - 0.5	Dioxin/Furans, Explosives, Metals, Perchlorate, Pest/PCB, SVOC, VOC
04SB04	04SB04(0-0.5)QC	12/14/00	0 - 0.5	Dioxin/Furans, Explosives, Metals, Perchlorate, Pest/PCB, SVOC, VOC
04SB04	04SB04(1-3)	12/6/00	1 - 3	Dioxin/Furans, Explosives, Metals, Perchlorate, Pest/PCB, SVOC, VOC
04SB05	04SB05(0-0.5)	12/14/00	0 - 0.5	Dioxin/Furans, Explosives, Metals, Perchlorate, Pest/PCB, SVOC, VOC
04SB05	04SB05(1-3)	12/6/00	1 - 3	Dioxin/Furans, Explosives, Metals, Perchlorate, Pest/PCB, SVOC, VOC
04SB06	04SB06(0-0.5)	12/14/00	0 - 0.5	Dioxin/Furans, Explosives, Metals, Perchlorate, Pest/PCB, SVOC, VOC
04SB06	04SB06(1-3)	12/6/00	1 - 3	Dioxin/Furans, Explosives, Metals, Perchlorate, Pest/PCB, SVOC, VOC
08SB01	08SB01(1-3)	12/6/00	1 - 3	Dioxin/Furans, Explosives, Metals, Perchlorate, Pest/PCB, SVOC, VOC
08SB03	08SB03(0-0.5)	12/14/00	0 - 0.5	Dioxin/Furans, Explosives, Metals, Perchlorate, Pest/PCB, SVOC, VOC
08SB03	08SB03(1-3)	12/6/00	1 - 3	Dioxin/Furans, Explosives, Metals, Perchlorate, Pest/PCB, SVOC, VOC
08SB04	08SB04(0-0.5)	12/14/00	0 - 0.5	Dioxin/Furans, Explosives, Metals, Perchlorate, Pest/PCB, SVOC, VOC
08SB04	08SB04(1-3)	12/6/00	1 - 3	Dioxin/Furans, Explosives, Metals, Perchlorate, Pest/PCB, SVOC, VOC
08SB05	08SB05(0-0.5)	12/7/00	0 - 0.5	Explosives, Metals, SVOC, VOC
08SB05	08SB05(1-3)	12/7/00	1 - 3	Explosives, Metals, SVOC, VOC
08SB05	08SB05(1-3)QC	12/7/00	1 - 3	Explosives, Metals, SVOC, VOC
29SB01	29SB01(0-2)	5/18/93	0 - 2	Explosives, General Chemistry, Metals [c], SVOC, VOC
29SB02	29SB02(0-2)	5/26/93	0 - 2	Explosives, General Chemistry, Metals [c], SVOC, VOC
29SB03	29SB03(0-2)	5/26/93	0 - 2	Explosives, General Chemistry, Metals [c], SVOC, VOC
29SB04	29SB04(0-2)	5/29/93	0 - 2	Explosives, General Chemistry, Metals [c], SVOC, VOC
29SB05	29SB05(0-2)	5/27/93	0 - 2	Explosives, General Chemistry, Metals [c], SVOC, VOC
29SB06	29SB06(0-2)	5/19/93	0 - 2	Explosives, General Chemistry, Metals [c], SVOC, VOC
29SB07	29SB07(0-2)	5/19/93	0 - 2	Explosives, General Chemistry, Metals [c], SVOC, VOC
29SB08	29SB08(0-2)	5/27/93	0 - 2	Explosives, General Chemistry, Metals [c], SVOC, VOC

Location	Sample No [b]	Date	Depth (ft bgs)	Analyses
Total Soil [c]				
29SB09	29SB09(0-2)	5/28/93	0 - 2	Explosives, General Chemistry, Metals [c], SVOC, VOC
29SB09	29SB09(0-2)QC	5/28/93	0 - 2	Explosives, General Chemistry, Metals [c], SVOC, VOC
29SB10	29SB10(0-2)	5/19/93	0 - 2	Explosives, General Chemistry, Metals [c], SVOC, VOC
29SB11	29SB11(0-2)	5/25/93	0 - 2	Explosives, General Chemistry, Metals [c], SVOC, VOC
29SB12	29SB12(0-2)	5/30/93	0 - 2	Explosives, General Chemistry, Metals [c], SVOC, VOC
29SB13	29SB13(0-2)	5/29/93	0 - 2	Explosives, General Chemistry, Metals [c], SVOC, VOC
29SB14	29SB14(0-2)	5/30/93	0 - 2	Explosives, General Chemistry, Metals [c], SVOC, VOC
29SB15	29SB15-(0-2)	6/3/93	0 - 2	Explosives, General Chemistry, Metals [c], SVOC, VOC
29SD01	29SD01(0.5)	4/29/93	0 - 0.5	Explosives, General Chemistry, Metals [c], SVOC, VOC
29SD10	29SD10(0-0.5)	4/28/93	0 - 0.5	Explosives, General Chemistry, Metals [c], SVOC, VOC
29SD11	29SD11(0-0.5)	4/28/93	0 - 0.5	Explosives, General Chemistry, Metals [c], SVOC, VOC
29SD24	C-29SD24-981008	10/8/98	0 - 0	Explosives, Metals, Pest/PCB, SVOC, VOC
29SD26	29SD26	10/7/98	0 - 0	Explosives, Metals, VOC
29SS01	29SS01(0-0.5)	7/24/98	0 - 0.5	Dioxin/Furans, Explosives, Metals, Pest/PCB, SVOC, VOC
29SS02	29SS02(0-0.5)	7/25/98	0 - 0.5	Dioxin/Furans, Explosives, Metals, Pest/PCB, SVOC, VOC
29SS02	29SS02(0-0.5)QC	7/25/98	0 - 0.5	Dioxin/Furans, Explosives, Metals, Pest/PCB, SVOC, VOC
29SS03	29SS03(0-0.5)	7/25/98	0 - 0.5	Dioxin/Furans, Explosives, Metals, Pest/PCB, SVOC, VOC
29SS04	29SS04(0-0.5)	7/25/98	0 - 0.5	Dioxin/Furans, Explosives, Metals, Pest/PCB, SVOC, VOC
29SS05	29SS05(0-0.5)	7/25/98	0 - 0.5	Dioxin/Furans, Explosives, Metals, Pest/PCB, SVOC, VOC
29SS06	29SS06(0-0.5)	7/25/98	0 - 0.5	Dioxin/Furans, Explosives, Metals, Pest/PCB, SVOC, VOC
29SS06	29SS06(1-3)	7/25/98	1 - 3	Dioxin/Furans, Explosives, Metals, Pest/PCB, SVOC, VOC
29SS06	29SS06(1-3)QC	7/25/98	1 - 3	Dioxin/Furans, Explosives, Metals, Pest/PCB, SVOC, VOC
29SS07	29SS07(0-0.5)	7/25/98	0 - 0.5	Dioxin/Furans, Explosives, Metals, Pest/PCB, SVOC, VOC
29SS07	29SS07(1-3)	7/25/98	1 - 3	Dioxin/Furans, Explosives, Metals, Pest/PCB, SVOC, VOC
29SS08	29SS08(0-0.5)	7/25/98	0 - 0.5	Dioxin/Furans, Explosives, Metals, Pest/PCB, SVOC, VOC
29SS08	29SS08(1-3)	7/25/98	1 - 3	Dioxin/Furans, Explosives, Metals, Pest/PCB, SVOC, VOC
29WL02	LH29-WL-02	5/13/93	0 - 0	Explosives, SVOC
32SB01	32SB01(0-2)	6/3/93	0 - 2	Explosives, General Chemistry, Metals [c], SVOC, VOC
32SB02	32SB02(0-2)	5/31/93	0 - 2	Explosives, General Chemistry, Metals [c], SVOC, VOC
32SB03	32SB03(0-2)	5/25/93	0 - 2	Explosives, General Chemistry, Metals [c], Pest/PCB, SVOC, VOC
32SB04	32SB04(0-2)	6/3/93	0 - 2	Explosives, General Chemistry, Metals [c], SVOC, VOC
32SB05	32SB05(0-2)	5/29/93	0 - 2	Explosives, General Chemistry, Metals [c], SVOC, VOC
32SB06	32SB06(0-2)	6/1/93	0 - 2	Explosives, General Chemistry, Metals [c], SVOC, VOC
32SB07	32SB07(0-2)	5/18/93	0 - 2	Explosives, General Chemistry, Metals [c], SVOC, VOC
32SB07	32SB07(0-2)QC	5/18/93	0 - 2	General Chemistry, Metals [c], SVOC
32SB08	32SB08(0-2)	5/25/93	0 - 2	Explosives, General Chemistry, Metals [c], SVOC, VOC
32SB09	32SB09(0-2)	6/4/93	0 - 2	Explosives, General Chemistry, Metals [c], SVOC, VOC
32SB10	32SB10(0-2)	6/4/93	0 - 2	Explosives, General Chemistry, Metals [c], SVOC, VOC
32SB11	32SB11(0-2)	5/26/93	0 - 2	Explosives, General Chemistry, Metals [c], SVOC, VOC

Location Total Soil [c]	Sample No [b]	Date	Depth (ft bgs)	Analyses
32SB12	32SB12(0-2)	5/25/93	0 - 2	Explosives, General Chemistry, Metals [c], Pest/PCB, SVOC, VOC
32SB13	32SB13(0-2)	6/3/93	0 - 2	Explosives, General Chemistry, Metals [c], SVOC, VOC
32SD05	32SD05(0.5)	4/30/93	0 - 0.5	Explosives, General Chemistry, Metals [c], SVOC, VOC
32SD06	32SD06(0.5)	4/30/93	0 - 0.5	Explosives, General Chemistry, Metals [c], SVOC, VOC
32SD07	32SD07(0.5)	4/30/93	0 - 0.5	Explosives, General Chemistry, Metals [c], SVOC, VOC
32SD17	32SD17-981008	10/8/98	0 - 0	Dioxin/Furans, Explosives, Metals, Pest/PCB, SVOC, VOC
32SD17	32SD17QC	10/8/98	0 - 0	Dioxin/Furans, Explosives, Metals, Pest/PCB, SVOC, VOC
32SD18	32SD18-981008	10/8/98	0 - 0	Dioxin/Furans, Explosives, Metals, Pest/PCB, SVOC, VOC
32SS01	32SS01(0-0.5)	7/26/98	0 - 0.5	Dioxin/Furans, Explosives, Metals, Pest/PCB, SVOC, VOC
32SS01	32SS01(0-0.5)QC	7/26/98	0 - 0.5	Dioxin/Furans, Explosives, Metals, Pest/PCB, SVOC, VOC
32SS01	32SS01(1-3)	7/26/98	1 - 3	Dioxin/Furans, Explosives, Metals, Pest/PCB, SVOC, VOC
32SS02	32SS02(0-0.5)	7/26/98	0 - 0.5	Dioxin/Furans, Explosives, Metals, Pest/PCB, SVOC, VOC
32SS02	32SS02(1-3)	7/26/98	1 - 3	Dioxin/Furans, Explosives, Metals, Pest/PCB, SVOC, VOC
32SS03	32SS03(0-0.5)	7/26/98	0 - 0.5	Dioxin/Furans, Explosives, Metals, Pest/PCB, SVOC, VOC
32SS03	32SS03(1-3)	7/26/98	1 - 3	Dioxin/Furans, Explosives, Metals, Pest/PCB, SVOC, VOC
32SS04	32SS04(0-0.5)	7/26/98	0 - 0.5	Dioxin/Furans, Explosives, Metals, Pest/PCB, SVOC, VOC
32SS04	32SS04(1-3)	7/26/98	1 - 3	Dioxin/Furans, Explosives, Metals, Pest/PCB, SVOC, VOC
32SS04	32SS04(1-3)QC	7/26/98	1 - 3	Dioxin/Furans, Explosives, Metals, Pest/PCB, SVOC, VOC
32WL01	32WL01	5/17/93	0 - 0	Explosives
32WL01	32WL01(2.5-3.0)	5/17/93	2.5 - 3	Explosives, VOC
35ASB03	35ASB03(0-0.5)	7/26/98	0 - 0.5	Dioxin/Furans, Explosives, Metals, Pest/PCB, SVOC, VOC
35ASB03	35ASB03(0-0.5)QC	7/26/98	0 - 0.5	Dioxin/Furans, Explosives, Metals, Pest/PCB, SVOC, VOC
35ASB03	35ASB03(1-3)	7/26/98	1 - 3	Dioxin/Furans, Explosives, Metals, Pest/PCB, SVOC, VOC
35ASB05	35ASB05(0-0.5)	7/26/98	0 - 0.5	Dioxin/Furans, Explosives, Metals, Pest/PCB, SVOC, VOC
35ASB05	35ASB05(1-3)	7/26/98	1 - 3	Dioxin/Furans, Explosives, Metals, Pest/PCB, SVOC, VOC
35BSB01	35BSB01(0-0.5)	7/27/98	0 - 0.5	Dioxin/Furans, Explosives, Metals, Pest/PCB, SVOC, VOC
35BSB01	35BSB01(0-0.5)QC	7/27/98	0 - 0.5	Dioxin/Furans, Explosives, Metals, Pest/PCB, SVOC, VOC
35BSB01	35BSB01(1-3)	7/27/98	1 - 3	Dioxin/Furans, Explosives, Metals, Pest/PCB, SVOC, VOC
35CSB01	35CSB01(0-0.5)	7/27/98	0 - 0.5	Dioxin/Furans, Explosives, Metals, Pest/PCB, SVOC, VOC
35CSB01	35CSB01(0-0.5)QC	7/27/98	0 - 0.5	Dioxin/Furans, Explosives, Metals, Pest/PCB, SVOC, VOC
35CSB01	35CSB01(1-3)	7/27/98	1 - 3	Dioxin/Furans, Explosives, Metals, Pest/PCB, SVOC, VOC
46SB01	46SB01(0-0.5)	7/27/98	0 - 0.5	Dioxin/Furans, Explosives, Metals, Pest/PCB, SVOC, VOC
46SB01	46SB01(1-3)	7/27/98	1 - 3	Dioxin/Furans, Explosives, Metals, Pest/PCB, SVOC, VOC
46SB02	46SB02(0-0.5)	7/27/98	0 - 0.5	Dioxin/Furans, Explosives, Metals, Pest/PCB, SVOC, VOC
46SB02	46SB02(1-3)	7/27/98	1 - 3	Dioxin/Furans, Explosives, Metals, Pest/PCB, SVOC, VOC
46SB03	46SB03(0-0.5)	7/27/98	0 - 0.5	Dioxin/Furans, Explosives, Metals, Pest/PCB, SVOC, VOC
46SB03	46SB03(0-0.5)QC	7/27/98	0 - 0.5	Dioxin/Furans, Explosives, Metals, Pest/PCB, SVOC, VOC
46SB03	46SB03(1-3)	7/27/98	1 - 3	Dioxin/Furans, Explosives, Metals, Pest/PCB, SVOC, VOC
46SD01	46SD01-981109	11/9/98	0 - 0	Explosives, General Chemistry, Metals, SVOC, VOC

Location	Sample No [b]	Date	Depth (ft bgs)	Analyses
Total Soil [c]				
46SD02	46SD02-981109	11/9/98	0 - 0	Dioxin/Furans, Explosives, General Chemistry, Metals, Pest/PCB, SVOC, VOC
46SD05	46SD05-981110	11/10/98	0 - 0	Dioxin/Furans, Explosives, General Chemistry, Metals, Pest/PCB, SVOC, VOC
46SD05	46SD05QC	11/10/98	0 - 0	Dioxin/Furans, Explosives, General Chemistry, Metals, Pest/PCB, SVOC, VOC
46SD06	46SD06-981110	11/10/98	0 - 0	Explosives, General Chemistry, Metals, Pest/PCB, SVOC, VOC
47SB01	47SB01(1-3)	7/27/98	1 - 3	Dioxin/Furans, Explosives, Metals, Pest/PCB, SVOC, VOC
47SB01	C-47SB01(0-0.5)-9807	7/27/98	0 - 0.5	Explosives, Metals, Pest/PCB, SVOC, VOC
47SB02	47SB02(1-3)	7/27/98	1 - 3	Dioxin/Furans, Explosives, Metals, Pest/PCB, SVOC, VOC
47SB02	C-47SB02(0-0.5)-9807	7/27/98	0 - 0.5	Explosives, Metals, Pest/PCB, SVOC, VOC
47SB03	47SB03(1-3)	7/27/98	1 - 3	Dioxin/Furans, Explosives, Metals, Pest/PCB, SVOC, VOC
47SB03	47SB03(1-3)QC	7/27/98	1 - 3	Dioxin/Furans, Explosives, Metals, Pest/PCB, SVOC, VOC
47SB03	C-47SB03(0-0.5)-9807	7/27/98	0 - 0.5	Explosives, Metals, Pest/PCB, SVOC, VOC
48SB01	48SB01(0-0.5)	7/28/98	0 - 0.5	Dioxin/Furans, Explosives, Metals, Pest/PCB, SVOC, VOC
48SB01	48SB01(1-3)	7/28/98	1 - 3	Dioxin/Furans, Explosives, Metals, Pest/PCB, SVOC, VOC
48SB01	48SB01(1-3)QC	7/28/98	1 - 3	Dioxin/Furans, Explosives, Metals, Pest/PCB, SVOC, VOC
49SB34	49SB34(0-0.5)	12/7/00	0 - 0.5	Dioxin/Furans, Explosives, General Chemistry, Metals, Perchlorate, Pest/PCB, SVOC, VOC
49SB34	49SB34(1-3)	12/7/00	1 - 3	Dioxin/Furans, Explosives, General Chemistry, Metals, Perchlorate, Pest/PCB, SVOC, VOC
49SB35	49SB35(0-0.5)	12/7/00	0 - 0.5	Dioxin/Furans, Explosives, General Chemistry, Metals, Perchlorate, Pest/PCB, SVOC, VOC
49SB35	49SB35(0-0.5)QC	12/7/00	0 - 0.5	Dioxin/Furans, Explosives, General Chemistry, Metals, Perchlorate, Pest/PCB, SVOC, VOC
49SB35	49SB35(1-3)	12/7/00	1 - 3	Dioxin/Furans, Explosives, General Chemistry, Metals, Perchlorate, Pest/PCB, SVOC, VOC
49SB36	49SB36(0-0.5)	12/7/00	0 - 0.5	Dioxin/Furans, Explosives, General Chemistry, Metals, Perchlorate, Pest/PCB, SVOC, VOC
49SB36	49SB36(1-3)	12/7/00	1 - 3	Dioxin/Furans, Explosives, General Chemistry, Metals, Perchlorate, Pest/PCB, SVOC, VOC
50SB06	50SB06(0-0.5)	7/28/98	0 - 0.5	Dioxin/Furans, Explosives, Metals, Pest/PCB, SVOC, VOC
50SB06	50SB06(0-0.5)QC	7/28/98	0 - 0.5	Dioxin/Furans, Explosives, Metals, Pest/PCB, SVOC, VOC
50SB06	50SB06(1-3)	7/28/98	1 - 3	Dioxin/Furans, Explosives, Metals, Pest/PCB, SVOC, VOC
50SS07	50SS07(0-0.5)	7/28/98	0 - 0.5	Dioxin/Furans, Explosives, Metals, Pest/PCB, SVOC, VOC
60SB22	60SB22(0-0.5)	7/28/98	0 - 0.5	Dioxin/Furans, Explosives, Metals, Pest/PCB, SVOC, VOC
60SB22	60SB22(0-0.5)QC	7/28/98	0 - 0.5	Dioxin/Furans, Explosives, Metals, Pest/PCB, SVOC, VOC
60SB22	60SB22(1-3)	7/28/98	1 - 3	Dioxin/Furans, Explosives, Metals, Pest/PCB, SVOC, VOC
67SB01	67SB01(0-0.5)	12/14/00	0 - 0.5	Dioxin/Furans, Explosives, Metals, SVOC, VOC
67SB01	67SB01(1-3)	12/6/00	1 - 3	Explosives, Metals, SVOC, VOC
67SB02	67SB02(0-0.5)	12/14/00	0 - 0.5	Dioxin/Furans, Explosives, Metals, SVOC, VOC
67SB02	67SB02(1-2)	12/6/00	1 - 2	Explosives, Metals, SVOC, VOC

Location	Sample No [b]	Date	Depth (ft bgs)	Analyses
Total Soil [c]				
67SB03	67SB03(0-0.5)	12/7/00	0 - 0.5	Explosives, Metals, SVOC, VOC
67SB03	67SB03(1-3)	12/7/00	1 - 3	Explosives, Metals, SVOC, VOC
CCSD01	CCSD01	9/17/98	0 - 0	Dioxin/Furans, Explosives, General Chemistry, Metals, Pest/PCB, SVOC, VOC
FWS-016	C-SS-016	8/27/02	0 - 0.5	Metals, Pesticides, SVOC
FWS-021	C-SS-021	10/2/02	0 - 0.5	Metals, Pesticides, SVOC
FWS-022	C-SS-022	10/2/02	0 - 0.5	Dioxin/Furans, Metals, Pesticides, SVOC
FWS-025	C-SS-025	10/2/02	0 - 0.5	Metals, Pesticides, SVOC
FWS-026	C-SS-026	10/2/02	0 - 0.5	Metals, Pesticides, SVOC
FWS-029	C-SS-029	10/2/02	0 - 0.5	Metals, Pesticides, SVOC
FWS-035	C-SS-035	9/25/02	0 - 0.5	Metals, Pest/PCB, SVOC
FWS-036	C-SS-036	9/25/02	0 - 0.5	Metals, Pest/PCB, SVOC
FWS-038	C-SS-038	9/25/02	0 - 0.5	Metals, Pest/PCB, SVOC
FWS-112	CLNWR112	9/9/03	0 - 0.5	Dioxin/Furans, Metals, Pest/PCB, SVOC
FWS-113	CLNWR113	9/9/03	0 - 0.5	Metals, Pest/PCB, SVOC
FWS-113	CL113DUP	9/9/03	0 - 0.5	Metals, Pest/PCB, SVOC
FWS-114	CLNWR114	9/9/03	0 - 0.5	Metals, Pest/PCB, SVOC
FWS-115	CLNWR115	9/9/03	0 - 0.5	Metals, Pest/PCB, SVOC
FWS-116	CLNWR116	9/9/03	0 - 0.5	Metals, Pest/PCB, SVOC
FWS-117	CLNWR117	9/9/03	0 - 0.5	Metals, Pest/PCB, SVOC
FWS-121	CLNWR121	9/9/03	0 - 0.5	Metals, Pest/PCB, SVOC
FWS-122	CLNWR122	9/9/03	0 - 0.5	Metals, Pest/PCB, SVOC
FWS-125	CLNWR125	9/9/03	0 - 0.5	Metals, Pest/PCB, SVOC
FWS-126	CLNWR126	9/9/03	0 - 0.5	Metals, Pest/PCB, SVOC
FWS-128	CLNWR128	9/9/03	0 - 0.5	Dioxin/Furans, Metals, Pest/PCB, SVOC
FWS-129	CLNWR129	9/9/03	0 - 0.5	Metals, Pest/PCB, SVOC
FWS-130	CLNWR130	9/9/03	0 - 0.5	Metals, Pest/PCB, SVOC
FWS-131	CLNWR131	9/9/03	0 - 0.5	Metals, Pest/PCB, SVOC
FWS-131	CL131DUP	9/9/03	0 - 0.5	Metals, Pest/PCB, SVOC
FWS-132	CLNWR132	9/9/03	0 - 0.5	Metals, Pest/PCB, SVOC
FWS-133	CLNWR133	9/9/03	0 - 0.5	Metals, Pest/PCB, SVOC
FWS-134	CLNWR134	9/9/03	0 - 0.5	Metals, Pest/PCB, SVOC
FWS-160	CLNWR160	9/9/03	0 - 0.5	Metals, Pest/PCB, SVOC
FWS-160	CL160DUP	9/9/03	0 - 0.5	Metals, Pest/PCB, SVOC
FWS-161	CLNWR161	9/9/03	0 - 0.5	Metals, Pest/PCB, SVOC
FWS-164	CLNWR164	9/9/03	0 - 0.5	Dioxin/Furans, Metals, Pest/PCB, SVOC
FWS-165	CLNWR165	9/9/03	0 - 0.5	Metals, Pest/PCB, SVOC
FWS-166	CLNWR166	9/9/03	0 - 0.5	Metals, Pest/PCB, SVOC
FWS-167	CLNWR167	9/9/03	0 - 0.5	Dioxin/Furans, Metals, Pest/PCB, SVOC
FWS-168	CLNWR168	9/9/03	0 - 0.5	Metals, Pest/PCB, SVOC

Location Total Soil [c]	Sample No [b]	Date	Depth (ft bgs)	Analyses
FWS-176	CLNWR176	9/9/03	0 - 0.5	Dioxin/Furans, Metals, Pest/PCB, SVOC
FWS-177	CLNWR177	9/9/03	0 - 0.5	Metals, Pest/PCB, SVOC
FWS-178	CLNWR178	9/9/03	0 - 0.5	Dioxin/Furans, Metals, Pest/PCB, SVOC
FWS-189	CLNWR189	9/9/03	0 - 0.5	Metals, Pest/PCB, SVOC
FWS-190	CLNWR190	9/9/03	0 - 0.5	Metals, Pest/PCB, SVOC
FWS-191	CLNWR191	9/9/03	0 - 0.5	Metals, Pest/PCB, SVOC
FWS-192	CLNWR192	9/9/03	0 - 0.5	Metals, Pest/PCB, SVOC
FWS-193	CLNWR193	9/9/03	0 - 0.5	Dioxin/Furans, Metals, Pest/PCB, SVOC
FWS-194	CLNWR194	9/9/03	0 - 0.5	Metals, Pest/PCB, SVOC
FWS-194	CL194DUP	9/9/03	0 - 0.5	Metals, Pest/PCB, SVOC
FWS-195	CLNWR195	9/9/03	0 - 0.5	Metals, Pest/PCB, SVOC
FWS-196	CLNWR196	9/9/03	0 - 0.5	Metals, Pest/PCB, SVOC
FWS-220	CLNWR220	9/9/03	0 - 0.5	Metals, Pest/PCB, SVOC
FWS-221	CLNWR221	9/9/03	0 - 0.5	Metals, Pest/PCB, SVOC
FWS-222	CLNWR222	9/9/03	0 - 0.5	Metals, Pest/PCB, SVOC
FWS-229	CLNWR229	9/9/03	0 - 0.5	Metals, Pest/PCB, SVOC
FWS-230	CLNWR230	9/9/03	0 - 0.5	Metals, Pest/PCB, SVOC
FWS-231	CL231DUP	9/9/03	0 - 0.5	Metals, Pest/PCB, SVOC
FWS-231	CLNWR231	9/9/03	0 - 0.5	Metals, Pest/PCB, SVOC
FWS-233	CLNWR233	9/9/03	0 - 0.5	Metals, Pest/PCB, SVOC
FWS-234	CLNWR234	9/9/03	0 - 0.5	Metals, Pest/PCB, SVOC
LAP-021	LAP-0210	7/10/00	0 - 0.5	Explosives, SVOC
LAP-021	LAP-0211	7/10/00	0 - 0.5	Explosives, SVOC
LAP-021	LAP-021A	7/10/00	0 - 0.5	Explosives, Metals, Perchlorate, SVOC
LAP-021	LAP-021B	7/10/00	1 - 1.5	Explosives, Metals, Perchlorate, SVOC, VOC
LAP-022	LAP-022A	7/10/00	0 - 0.5	Explosives, Metals, Perchlorate, SVOC
LAP-022	LAP-022B	7/10/00	1 - 1.5	Explosives, Metals, Perchlorate, SVOC, VOC
LAP-023	LAP-023A	7/10/00	0 - 0.5	Explosives, Metals, Perchlorate, SVOC
LAP-023	LAP-023B-FD	7/10/00	0 - 0.5	Explosives
LAP-023	LAP-023B	7/10/00	1 - 1.5	Explosives, Metals, Perchlorate, SVOC, VOC
LAP-024	LAP-024A	7/10/00	0 - 0.5	Explosives, Metals, Perchlorate, SVOC
LAP-024	LAP-024B	7/10/00	1 - 1.5	Explosives, Metals, Perchlorate, SVOC, VOC
LAP-025	LAP-025A	7/10/00	0 - 0.5	Metals, Perchlorate, SVOC
LAP-025	LAP-025B	7/10/00	1 - 1.5	Metals, Perchlorate, SVOC, VOC
LAP-026	LAP-026A	7/10/00	0 - 0.5	Explosives, Metals, Perchlorate, SVOC
LAP-026	LAP-026B	7/10/00	1 - 1.5	Explosives, Metals, Perchlorate, SVOC, VOC
LAP-027	LAP-027A	7/10/00	0 - 0.5	Explosives, Metals, Perchlorate, SVOC
LAP-027	LAP-027B	7/10/00	1 - 1.5	Explosives, Metals, Perchlorate, SVOC, VOC
LAP-028	LAP-028A	7/10/00	0 - 0.5	Explosives, Metals, Perchlorate, SVOC

Location Total Soil [c]	Sample No [b]	Date	Depth (ft bgs)	Analyses
LAP-028	LAP-028B	7/10/00	1 - 1.5	Explosives, Metals, Perchlorate, SVOC, VOC
LH-DL063-01	LH-DL063-01	8/5/93	1 - 1.5	Explosives, Metals, SVOC, VOC
LH-DL064-01	LH-DL064-01	8/5/93	2 - 2.5	Explosives, Metals, SVOC, VOC
LH-DL065-01	LH-DL065-01	8/5/93	1.5 - 2	Explosives, Metals, SVOC, VOC
LH-DL065-01	LH-DL065-01 QC	8/5/93	1.5 - 2	Explosives, Metals, SVOC, VOC
LH-DL072-01	LH-DL072-01	8/4/93	2 - 2.5	Metals, SVOC, VOC
LH-DL27-01	LH-DL27-01	6/24/93	1.5 - 2.5	Explosives, Metals, SVOC, VOC
LH-DL29-01	LH-DL29-01	6/25/93	2 - 3	Explosives, Metals, SVOC, VOC
LH-DL44-01	LH-DL44-01	7/10/93	2.1 - 2.8	Explosives, Metals, SVOC, VOC
LH-DL45-01	LH-DL45-01	7/10/93	2.3 - 3	Explosives, Metals, SVOC, VOC
LH-DL47-01	LH-DL47-01	7/9/93	0.5 - 1.5	Explosives, Metals, SVOC, VOC
LH-DL50-01	LH-DL50-01	7/11/93	2 - 2.9	Explosives, Metals, SVOC, VOC
LH-DL52-01	LH-DL52-01	8/3/93	1.3 - 1.7	Metals, SVOC, VOC
LH-DL53-01	LH-DL53-01	7/13/93	0 - 0	Explosives, Metals, SVOC, VOC
LH-DL58-01	LH-DL58-01	6/26/93	2.1 - 2.9	Explosives, Metals, SVOC, VOC
LH-DL61-01	LH-DL61-01	8/6/93	2 - 3	Explosives, Metals, SVOC, VOC
LH-DL69-01	LH-DL69-01	6/26/93	2.5 - 3	Explosives, Metals, SVOC, VOC
LH-DL71-01	LH-DL71-01	7/24/93	2 - 3	Explosives, Metals, SVOC, VOC
LH-DL723-01	LH-DL723-01	6/26/93	1 - 2	Explosives, Metals, SVOC, VOC
LH-DL73-01	LH-DL73-01	6/26/93	2 - 2.7	Explosives, Metals, SVOC, VOC
LH-DL74-01	LH-DL74-01	6/26/93	2 - 2.7	Explosives, Metals, SVOC, VOC
LH-DL75-01	LH-DL75-01	6/26/93	2 - 2.5	Explosives, Metals, SVOC
LH-DL76-01	LH-DL76-01	6/26/93	2 - 2.5	Explosives, Metals, SVOC, VOC
LH-DL77-01	LH-DL77-01	6/26/93	2 - 2.5	Explosives, Metals, SVOC, VOC
LH-DL85-01	LH-DL85-01	6/26/93	2.5 - 3	Explosives, Metals, SVOC, VOC
LH-DL91	LH-DL91	7/23/93	2.5 - 3	Explosives, Metals, SVOC, VOC
LH-DL92-01	LH-DL92-01	7/23/93	2.5 - 3	Explosives, Metals, SVOC, VOC
LH-DL93-01	LH-DL93-01	7/27/93	2.5 - 3	Explosives, Metals, SVOC, VOC
LH-DL95-01	LH-DL95-01	6/26/93	2 - 2.5	Explosives, Metals, SVOC, VOC
LH-S01-01	LH-S01-01_1	6/26/93	0.5 - 1.5	Metals, SVOC, VOC
LH-S01-02	LH-S01-02_1	6/26/93	0.5 - 1.5	Metals, SVOC, VOC
LH-S017-01	LH-S017-01_1	8/8/93	0.5 - 1.5	Explosives, Metals, SVOC, VOC
LH-S017-01	LH-S017-01 QC	8/8/93	0.5 - 1.5	Explosives (2,4-Dinitrotoluene, 2,6-Dinitrotoluene), Metals, SVOC, VOC
LH-S017-01	LH-S017-01_2	8/8/93	2.5 - 3	Explosives, Metals, SVOC, VOC
LH-S017-02	LH-S017-02_1	8/8/93	0.5 - 1	Explosives, Metals, SVOC, VOC
LH-S017-02	LH-S017-02_2	8/8/93	2.5 - 3	Explosives, Metals, SVOC, VOC
LH-S018-01	LH-S018-01_1	8/8/93	0.5 - 1.1	Explosives, Metals, SVOC, VOC
LH-S018-01	LH-S018-01_2	8/8/93	1.1 - 1.6	Explosives, Metals, SVOC, VOC
LH-S02-01	LH-S02-01_1	6/26/93	0.5 - 2.5	Metals, SVOC, VOC

Location Total Soil [c]	Sample No [b]	Date	Depth (ft bgs)	Analyses
LH-S02-02	LH-S02-02_1	6/26/93	0.5 - 2.5	Metals, SVOC, VOC
LH-S021-01	LH-S021-01_1	8/6/93	1 - 1.5	Explosives, Metals, SVOC, VOC
LH-S021-01	LH-S021-01 QC	8/6/93	1 - 1.5	Explosives (2,4-Dinitrotoluene, 2,6-Dinitrotoluene), Metals, SVOC, VOC
LH-S021-02	LH-S021-02_1	8/6/93	0.5 - 1	Explosives, Metals, SVOC, VOC
LH-S021-02	LH-S021-02_2	8/6/93	2 - 2.5	Explosives, Metals, SVOC, VOC
LH-S025-01	LH-S025-01_1	8/6/93	0.5 - 1	Explosives, Metals, SVOC, VOC
LH-S025-01	LH-S025-01 QC	8/6/93	0.5 - 1	Explosives (2,4-Dinitrotoluene, 2,6-Dinitrotoluene), Metals, SVOC, VOC
LH-S025-02	LH-S025-02_1	8/6/93	0.5 - 1	Explosives, Metals, SVOC, VOC
LH-S025-02	LH-S025-02_2	8/6/93	1.5 - 2	Explosives, Metals, SVOC, VOC
LH-S026-01	LH-S026-01_1	8/8/93	0.5 - 1	Explosives, Metals, SVOC, VOC
LH-S026-01	LH-S026-01 QC	8/8/93	0.5 - 1	Explosives (2,4-Dinitrotoluene, 2,6-Dinitrotoluene), Metals, SVOC, VOC
LH-S026-02	LH-S026-02_1	8/8/93	0.5 - 1	Explosives, Metals, SVOC, VOC
LH-S026-02	LH-S026-02_2	8/8/93	1 - 1.5	Explosives, Metals, SVOC, VOC
LH-S03-01	LH-S03-01_1	7/10/93	0 - 2	Explosives, Metals, SVOC, VOC
LH-S03-02	LH-S03-02_1	7/10/93	0 - 2	Explosives, Metals, SVOC, VOC
LH-S04-01	LH-S04-01_1	7/9/93	0 - 2	Explosives, Metals, SVOC, VOC
LH-S04-02	LH-S04-02_1	7/9/93	0 - 2	Explosives, Metals, SVOC, VOC
LH-S05-01	LH-S05-01_1	7/9/93	0 - 2	Explosives, Metals, SVOC, VOC
LH-S05-02	LH-S05-02_1	7/9/93	0 - 2	Explosives, Metals, SVOC, VOC
LH-S06-01	LH-S06-01_1	7/9/93	0 - 2	Explosives, Metals, SVOC, VOC
LH-S06-01	LH-S06-01 QC	7/9/93	0 - 2	Explosives (2,4-Dinitrotoluene, 2,6-Dinitrotoluene), Metals, SVOC, VOC
LH-S06-02	LH-S06-02_1	7/9/93	0 - 2	Explosives, Metals, SVOC, VOC
LH-S062-01	LH-S062-01_1	8/5/93	0.5 - 1.2	Explosives, Metals, SVOC, VOC
LH-S062-01	LH-S062-01 QC	8/5/93	0.5 - 1.2	Explosives, Metals, SVOC, VOC
LH-S062-01	LH-S062-01_2	8/5/93	2.5 - 3	Explosives, Metals, SVOC, VOC
LH-S063-01	LH-S063-01_1	8/5/93	1 - 1.5	Explosives, Metals, SVOC, VOC
LH-S063-01	LH-S063-01_2	8/5/93	2 - 2.5	Explosives, Metals, SVOC, VOC
LH-S063-01	LH-S063-01_3	8/5/93	2.5 - 3	Explosives, Metals, SVOC, VOC
LH-S064-01	LH-S064-01_1	8/5/93	1.5 - 2	Explosives, Metals, SVOC, VOC
LH-S064-01	LH-S064-01_3	8/5/93	0.5 - 1	Explosives, Metals, SVOC, VOC
LH-S064-02	LH-S064-02_1	8/5/93	1 - 1.5	Explosives, Metals, SVOC, VOC
LH-S064-02	LH-S064-02_2	8/5/93	2.5 - 3	Explosives, Metals, SVOC, VOC
LH-S065-01	LH-S065-01_1	8/5/93	0.5 - 1	Explosives, Metals, SVOC, VOC
LH-S065-01	LH-S065-01_2	8/5/93	2 - 2.5	Explosives, Metals, SVOC, VOC
LH-S065-02	LH-S065-02_1	8/5/93	0.5 - 1	Explosives, Metals, SVOC, VOC
LH-S07-01	LH-S07-01_1	6/25/93	0.5 - 2.5	Explosives, Metals, SVOC, VOC
LH-S07-02	LH-S07-02_1	6/25/93	0 - 2	Explosives, Metals, SVOC, VOC
LH-S07-02	LH-S07-02_2	6/25/93	2 - 4	Explosives, Metals, SVOC, VOC
LH-S072-01	LH-S072-01_1	8/4/93	0.5 - 1	Metals, SVOC, VOC

Location Total Soil [c]	Sample No [b]	Date	Depth (ft bgs)	Analyses
LH-S072-02	LH-S072-02_1	8/4/93	0.5 - 1	Metals, SVOC, VOC
LH-S08-01	LH-S08-01_1	7/12/93	0 - 2	Explosives, Metals, SVOC, VOC
LH-S08-02	LH-S08-02_1	7/12/93	0 - 2	Explosives, Metals, SVOC, VOC
LH-S09-01	LH-S09-01_1	6/26/93	0.5 - 1.5	Explosives, Metals, SVOC, VOC
LH-S09-01	LH-S09-01 QC	6/26/93	0.5 - 1.5	Explosives (2,4-Dinitrotoluene, 2,6-Dinitrotoluene), Metals, SVOC, VOC
LH-S09-02	LH-S09-02_1	6/26/93	0.5 - 1.5	Explosives, Metals, SVOC, VOC
LH-S100-01	LH-S100-01_1	6/26/93	0.5 - 1.5	Explosives, Metals, SVOC, VOC
LH-S100-01	LH-S100-01 QC	6/26/93	0.5 - 1.5	Explosives (2,4-Dinitrotoluene, 2,6-Dinitrotoluene), Metals, SVOC, VOC
LH-S100-01	LH-S100-01_2	6/26/93	1.5 - 3	Explosives, Metals, SVOC, VOC
LH-S10-01	LH-S10-01_1	6/26/93	0.5 - 2.5	Metals, SVOC, VOC
LH-S10-02	LH-S10-02_1	7/11/93	0 - 2	Explosives, Metals, SVOC, VOC
LH-S101-01	LH-S101-01_1	6/26/93	0.5 - 1.5	Explosives, Metals, SVOC, VOC
LH-S102-01	LH-S102-01_1	8/3/93	0.5 - 2	Metals, SVOC, VOC
LH-S102-01	LH-S102-01 QC	8/3/93	0.5 - 2	Metals, SVOC, VOC
LH-S102-02	LH-S102-02_1	8/3/93	0.5 - 2	Metals, SVOC, VOC
LH-S103-01	LH-S103-01_1	7/24/93	0.5 - 2	Metals, SVOC, VOC
LH-S103-02	LH-S103-02_1	7/25/93	0.5 - 2	Metals, SVOC, VOC
LH-S104-01	LH-S104-01_1	8/3/93	1.5 - 2.5	Metals, SVOC, VOC
LH-S104-02	LH-S104-02_1	8/3/93	0.5 - 2	Metals, SVOC, VOC
LH-S104-02	LH-S104-02 QC	8/3/93	0.5 - 2	Metals, SVOC, VOC
LH-S105-01	LH-S105-01_1	8/3/93	0.5 - 2	Metals, SVOC, VOC
LH-S105-02	LH-S105-02_1	8/3/93	0.5 - 2	Metals, SVOC, VOC
LH-S107-01	LH-S107-01 QC	6/26/93	0.5 - 1.5	Explosives, Metals, SVOC, VOC
LH-S107-01	LH-S107-01_2	6/26/93	1 - 1.5	Explosives, Metals, SVOC, VOC
LH-S107-01	LH-S107-01_3	6/26/93	2 - 2.5	Explosives, Metals, SVOC, VOC
LH-S108-01	LH-S108-01_1	6/26/93	0.5 - 1.5	Explosives, Metals, SVOC, VOC
LH-S108-01	LH-S108-01_2	6/26/93	2 - 2.5	Explosives, Metals, SVOC, VOC
LH-S109-01	LH-S109-01_1	6/26/93	0.5 - 1.5	Explosives, Metals, SVOC, VOC
LH-S109-01	LH-S109-01_2	6/26/93	2 - 2.5	Explosives, Metals, SVOC, VOC
LH-S110-01	LH-S110-01_1	8/4/93	0.5 - 2	Metals, SVOC, VOC
LH-S11-01	LH-S11-01_1	6/25/93	0 - 2	Explosives, Metals, SVOC, VOC
LH-S11-02	LH-S11-02_1	6/26/93	0.5 - 1.5	Metals, SVOC, VOC
LH-S111-01	LH-S111-01_1	7/8/93	0 - 2	Explosives, Metals, SVOC, VOC
LH-S111-01	LH-S111-01_2	7/8/93	2 - 4	Explosives, Metals, SVOC, VOC
LH-S112-01	LH-S112-01_1	7/8/93	0 - 2	Explosives, Metals, SVOC, VOC
LH-S113-01	LH-S113-01_1	8/4/93	0.5 - 2	Explosives, Metals, SVOC, TPH, VOC
LH-S117-01	LH-S117-01_1	8/4/93	0.5 - 2	Explosives, Metals, SVOC, TPH, VOC
LH-S118-01	LH-S118-01_1	7/8/93	0 - 2	Explosives, Metals, SVOC, VOC
LH-S118-01	LH-S118-01_2	7/8/93	2 - 4	Explosives, Metals, SVOC, VOC

Location	Sample No [b]	Date	Depth (ft bgs)	Analyses
Total Soil [c]				
LH-S118-02	LH-S118-02_1	7/8/93	0 - 2	Explosives, Metals, SVOC, VOC
LH-S118-02	LH-S118-02_2	7/8/93	2 - 4	Explosives, Metals, SVOC, VOC
LH-S119-01	LH-S119-01_1	8/4/93	0.5 - 2	Metals, SVOC, VOC
LH-S119-01	LH-S119-01 QC	8/4/93	0.5 - 2	Metals, SVOC, VOC
LH-S119-02	LH-S119-02_1	8/4/93	0.5 - 2	Metals, SVOC, VOC
LH-S120-01	LH-S120-01_1	8/4/93	0.5 - 2	Metals, SVOC, VOC
LH-S120-02	LH-S120-02 _1	8/4/93	0.5 - 2	Metals, SVOC, VOC
LH-S12-01	LH-S12-01_1	7/11/93	0 - 2	Explosives, Metals, SVOC, VOC
LH-S12-02	LH-S12-02_1	7/11/93	0 - 2	Explosives, Metals, SVOC, VOC
LH-S121-01	LH-S121-01_1	8/4/93	0.5 - 1.5	Explosives, Metals, SVOC, VOC
LH-S121-02	LH-S121-02_1	8/4/93	0.5 - 1.5	Explosives, Metals, SVOC, VOC
LH-S122-01	LH-S122-01_1	8/3/93	0.5 - 1.2	Metals, SVOC, VOC
LH-S122-01	LH-S122-01 QC	8/3/93	0.5 - 1.2	Metals, SVOC, VOC
LH-S122-02	LH-S122-02_1	8/3/93	0.5 - 1	Metals, SVOC, VOC
LH-S123-01	LH-S123-01_1	6/26/93	0.5 - 1.5	Explosives, Metals, SVOC, VOC
LH-S13-01	LH-S13-01_1	7/10/93	0 - 2	Explosives, Metals, SVOC, VOC
LH-S13-01	LH-S13-01 QC	7/10/93	0 - 2	Explosives (2,4-Dinitrotoluene, 2,6-Dinitrotoluene), Metals, SVOC, VOC
LH-S13-02	LH-S13-02_1	7/10/93	0 - 2	Explosives, Metals, SVOC, VOC
LH-S14-01	LH-S14-01_1	7/8/93	0.5 - 1.5	Explosives, Metals, SVOC, VOC
LH-S14-02	LH-S14-02_1	7/8/93	0.5 - 1.5	Explosives, Metals, SVOC, VOC
LH-S15-01	LH-S15-01_1	7/8/93	0.5 - 1.5	Explosives, Metals, SVOC, VOC
LH-S15-02	LH-S15-02_1	7/8/93	0.5 - 1.5	Explosives, Metals, SVOC, VOC
LH-S16-01	LH-S16-01_1	7/8/93	0.5 - 1.5	Explosives, Metals, SVOC, VOC
LH-S19-01	LH-S19-01	8/6/93	1 - 1.5	Explosives, Metals, SVOC, VOC
LH-S19-01	LH-S19-01_1	8/6/93	1.5 - 2	Explosives, Metals, SVOC, VOC
LH-S19-02	LH-S19-02_1	8/6/93	1 - 1.5	Explosives, Metals, SVOC, VOC
LH-S20-01	LH-S20-01_1	6/25/93	0.5 - 2	Explosives, Metals, SVOC, VOC
LH-S20-01	LH-S20-01_2	6/25/93	2 - 4	Explosives, Metals, SVOC, VOC
LH-S20-02	LH-S20-02_1	6/25/93	0.5 - 2	Explosives, Metals, SVOC, VOC
LH-S22-01	LH-S22-01_1	6/25/93	0.5 - 2.5	Explosives, Metals, SVOC, VOC
LH-S22-02	LH-S22-02_1	6/25/93	0.5 - 2.5	Explosives, Metals, SVOC, VOC
LH-S23-01	LH-S23-01_1	7/25/93	0.5 - 1	Explosives, Metals, SVOC, VOC
LH-S23-01	LH-S23-01 QC	7/25/93	0.5 - 1	Explosives (2,4-Dinitrotoluene, 2,6-Dinitrotoluene), Metals, SVOC, VOC
LH-S23-02	LH-S23-02_1	7/25/93	1 - 1.5	Metals, SVOC, VOC
LH-S24-01	LH-S24-01_1	6/25/93	0.5 - 2	Explosives, Metals, SVOC, VOC
LH-S24-01	LH-S24-01_2	6/25/93	2 - 4	Explosives, Metals, SVOC, VOC
LH-S27-01	LH-S27-01_1	6/24/93	0.5 - 2	Explosives, Metals, SVOC, VOC
LH-S27-02	LH-S27-02 _1	6/24/93	0.5 - 1.5	Explosives, Metals, SVOC, VOC
LH-S29-01	LH-S29-01_1	6/25/93	0.5 - 2.5	Explosives, Metals, SVOC, VOC

Location	Sample No [b]	Date	Depth (ft bgs)	Analyses
Total Soil [c]				
LH-S29-02	LH-S29-02_1	6/25/93	0 - 2	Explosives, Metals, SVOC, VOC
LH-S29-02	LH-S29-02_2	6/25/93	2 - 4	Explosives, Metals, SVOC, VOC
LH-S30-01	LH-S30-01_1	6/25/93	0.5 - 2.5	Explosives, Metals, SVOC, VOC
LH-S31-01	LH-S31-01_1	7/21/93	0.5 - 1	Explosives, Metals, SVOC, VOC
LH-S32-01	LH-S32-01_1	6/25/93	0.5 - 2.5	Explosives, Metals, SVOC, VOC
LH-S33-01	LH-S33-01_1	7/21/93	0.5 - 1	Explosives, Metals, SVOC, VOC
LH-S34-01	LH-S34-01_2	7/10/93	0.5 - 1.5	Explosives, Metals, SVOC, VOC
LH-S35-01	LH-S35-01_1	6/25/93	0.5 - 2	Explosives, Metals, SVOC, VOC
LH-S37-01	LH-S37-01_1	7/25/93	0.5 - 1	Explosives, Metals, SVOC, VOC
LH-S38-01	LH-S38-01_1	6/26/93	0.5 - 1.5	Metals, SVOC, VOC
LH-S39-01	LH-S39-01 QC	6/26/93	0.5 - 1.5	Explosives (2,4-Dinitrotoluene, 2,6-Dinitrotoluene), Metals, SVOC, VOC
LH-S39-01	LH-S39-01_1	6/26/93	0.5 - 1.5	Explosives, Metals, SVOC, VOC
LH-S40-01	LH-S40-01_1	6/26/93	0.5 - 1.5	Metals, SVOC, VOC
LH-S41-01	LH-S41-01_1	6/25/93	0.5 - 1.5	Explosives, Metals, SVOC, VOC
LH-S42-01	LH-S42-01_1	6/25/93	0.5 - 1.5	Explosives, Metals, SVOC, VOC
LH-S42-01	LH-S42-01 QC	6/25/93	0.5 - 1.5	Explosives (2,4-Dinitrotoluene, 2,6-Dinitrotoluene), Metals, SVOC, VOC
LH-S42-01	LH-S42-01_2	6/25/93	2.5 - 3.3	Explosives, Metals, SVOC, VOC
LH-S43-01	LH-S43-01_1	6/26/93	0.5 - 1	Explosives, Metals, SVOC, VOC
LH-S43-01	LH-S43-01_2	6/26/93	1.5 - 2	Explosives, Metals, SVOC, VOC
LH-S44-01	LH-S44-01_1	7/10/93	0.5 - 1.5	Explosives, Metals, SVOC, VOC
LH-S44-02	LH-S44-02_1	7/11/93	0.5 - 1.5	Explosives, Metals, SVOC, VOC
LH-S45-01	LH-S45-01_1	7/10/93	0.5 - 1.5	Explosives, Metals, SVOC, VOC
LH-S47-01	LH-S47-01_1	7/9/93	0.5 - 1.5	Explosives, Metals, SVOC, VOC
LH-S47-01	LH-S47-01_2	7/9/93	2.2 - 3.2	Explosives, Metals, SVOC, VOC
LH-S48-01	LH-S48-01_1	7/27/93	0.5 - 1	Explosives, Metals, SVOC, VOC
LH-S48-02	LH-S48-02	7/27/93	0.5 - 1	Explosives, Metals, SVOC, VOC
LH-S49-01	LH-S49-01_1	7/9/93	0.5 - 1.5	Explosives, Metals, SVOC, VOC
LH-S49-01	LH-S49-01 QC	7/9/93	0.5 - 1.5	Explosives (2,4-Dinitrotoluene, 2,6-Dinitrotoluene), Metals, SVOC, VOC
LH-S50-01	LH-S50-01_1	7/28/93	0.5 - 1.5	Explosives, Metals, SVOC, VOC
LH-S50-01	LH-S50-01_2	7/27/93	0.5 - 1.5	Explosives, Metals, SVOC, VOC
LH-S51-01	LH-S51-01_1	7/11/93	0.5 - 1.5	Explosives, Metals, SVOC, VOC
LH-S51-01	LH-S51-01 QC	7/11/93	0.5 - 1.5	Explosives (2,4-Dinitrotoluene, 2,6-Dinitrotoluene), Metals, SVOC, VOC
LH-S52-01	LH-S52-01_1	8/3/93	0.5 - 1	Metals, SVOC, VOC
LH-S52-01	LH-S52-01_2	8/3/93	1.5 - 2	Metals, SVOC, VOC
LH-S53-01	LH-S53-01_1	7/13/93	0.5 - 1.5	Explosives, Metals, SVOC, VOC
LH-S53-02	LH-S53-02_1	7/13/93	0.5 - 1.5	Explosives, Metals, SVOC, VOC
LH-S54-01	LH-S54-01_1	7/12/93	0 - 2	Explosives, Metals, SVOC, VOC
LH-S55-01	LH-S55-01_1	7/12/93	0 - 2	Explosives, Metals, SVOC, VOC
LH-S55-01	LH-S55-01 QC	7/12/93	0 - 2	Explosives (2,4-Dinitrotoluene, 2,6-Dinitrotoluene), Metals, SVOC, VOC

Location Total Soil [c]	Sample No [b]	Date	Depth (ft bgs)	Analyses
LH-S56-01	LH-S56-01_1	8/5/93	0.5 - 2	Explosives, Metals, SVOC, VOC
LH-S57-01	LH-S57-01_1	7/22/93	0.5 - 1	Explosives, Metals, SVOC, VOC
LH-S57-01	LH-S57-01_2	7/22/93	2 - 3	Explosives, Metals, SVOC, VOC
LH-S57-02	LH-S57-02_1	7/22/93	0.5 - 1	Explosives, Metals, SVOC, VOC
LH-S57-02	LH-S57-02_2	7/22/93	2 - 3	Explosives, Metals, SVOC, VOC
LH-S58-01	LH-S58-01_1	6/26/93	0.5 - 1.5	Explosives, Metals, SVOC, VOC
LH-S59-01	LH-S59-01_1	7/21/93	0.5 - 1	Explosives, Metals, SVOC, VOC
LH-S59-02	LH-S59-02_1	7/21/93	0.5 - 1	Explosives, Metals, SVOC, VOC
LH-S60-01	LH-S60-01_1	7/22/93	0.5 - 1	Explosives, Metals, SVOC, VOC
LH-S60-02	LH-S60-02_2	7/22/93	0.5 - 1	Explosives, Metals, SVOC, VOC
LH-S60-02	LH-S60-02_3	7/22/93	2.5 - 3	Explosives, Metals, SVOC, VOC
LH-S61-01	LH-S61-01_1	8/6/93	0.5 - 3	Explosives, Metals, SVOC, VOC
LH-S61-02	LH-S61-02_1	8/6/93	1 - 3	Explosives, Metals, SVOC, VOC
LH-S66-01	LH-S66-01_1	8/5/93	0.5 - 2	Explosives, Metals, SVOC, VOC
LH-S66-01	LH-S66-01 QC	8/5/93	0.5 - 2	Explosives, Metals, SVOC, VOC
LH-S66-02	LH-S66-02_1	8/5/93	0.5 - 2	Explosives, Metals, SVOC, VOC
LH-S67-01	LH-S67-01_1	8/6/93	0.5 - 2	Explosives, Metals, SVOC, VOC
LH-S68-01	LH-S68-01_1	8/6/93	0.5 - 2	Explosives, Metals, SVOC, VOC
LH-S68-01	LH-S68-01 QC	8/6/93	0.5 - 2	Explosives (2,4-Dinitrotoluene, 2,6-Dinitrotoluene), Metals, SVOC, VOC
LH-S68-02	LH-S68-02	8/6/93	0.5 - 1.5	Explosives, Metals, SVOC, VOC
LH-S68-02	LH-S68-02 QC	8/6/93	0.5 - 1.5	Explosives (2,4-Dinitrotoluene, 2,6-Dinitrotoluene), Metals, SVOC, VOC
LH-S69-01	LH-S69-01_1	6/26/93	0.5 - 1.5	Explosives, Metals, SVOC, VOC
LH-S69-01	LH-S69-01 QC	6/26/93	0.5 - 1.5	Explosives (2,4-Dinitrotoluene, 2,6-Dinitrotoluene), Metals, SVOC, VOC
LH-S69-02	LH-S69-02_1	6/26/93	0.5 - 1.5	Explosives, Metals, SVOC, VOC
LH-S70-01	LH-S70-01_1	7/24/93	0.5 - 2	Explosives, Metals, SVOC, TPH, VOC
LH-S70-02	LH-S70-02_1	7/24/93	0.5 - 2	Explosives, Metals, SVOC, TPH, VOC
LH-S71-01	LH-S71-01_1	7/24/93	1 - 1.5	Explosives, Metals, SVOC, VOC
LH-S71-02	LH-S71-02_1	7/24/93	1 - 1.5	Explosives, Metals, SVOC, VOC
LH-S723-01	LH-S723-01_1	6/26/93	0.5 - 1.5	Explosives, Metals, SVOC, VOC
LH-S723-02	LH-S723-02_1	6/26/93	0.5 - 1.5	Explosives, Metals, SVOC, VOC
LH-S73-01	LH-S73-01_1	6/26/93	0.5 - 1.5	Explosives, Metals, SVOC, VOC
LH-S75-01	LH-S75-01_1	6/26/93	0.5 - 1.5	Explosives, Metals, SVOC, VOC
LH-S75-02	LH-S75-02_1	6/26/93	0.5 - 1.5	Explosives, Metals, SVOC, VOC
LH-S76-01	LH-S76-01_1	6/26/93	0.5 - 1.5	Explosives, Metals, SVOC
LH-S76-01	LH-S76-01_2	6/26/93	2 - 2.5	Explosives, Metals, SVOC
LH-S76-02	LH-S76-02_1	6/26/93	0.5 - 1.5	Explosives, Metals, SVOC, VOC
LH-S77-01	LH-S77-01_1	6/26/93	0.5 - 1.5	Explosives, Metals, SVOC, VOC
LH-S77-01	LH-S77-01 QC	6/26/93	0.5 - 1.5	Explosives (2,4-Dinitrotoluene, 2,6-Dinitrotoluene), Metals, SVOC, VOC
LH-S77-01	LH-S77-01_2	6/26/93	1.5 - 3	Explosives, Metals, SVOC, VOC

Location Total Soil [c]	Sample No [b]	Date	Depth (ft bgs)	Analyses
LH-S77-02	LH-S77-02_1	6/26/93	0.5 - 1.5	Explosives, Metals, SVOC, VOC
LH-S77-02	LH-S77-02_2	6/26/93	2.5 - 3	Explosives, Metals, SVOC, VOC
LH-S78-01	LH-S78-01_1	7/24/93	0.5 - 2	Explosives, Metals, SVOC, VOC
LH-S79-01	LH-S79-01_1	7/24/93	0.5 - 2	Explosives, Metals, SVOC, VOC
LH-S80-01	LH-S80-01_1	7/24/93	0.5 - 2	Explosives, Metals, SVOC, VOC
LH-S80-01	LH-S80-01 QC	7/24/93	0.5 - 2	Explosives (2,4-Dinitrotoluene, 2,6-Dinitrotoluene), Metals, SVOC, VOC
LH-S81-01	LH-S81-01_1	7/23/93	0.5 - 2	Explosives, Metals, SVOC, VOC
LH-S81-02	LH-S81-02_1	7/23/93	0.5 - 2	Explosives, Metals, SVOC, VOC
LH-S82-01	LH-S82-01_1	7/23/93	0.5 - 2	Explosives, Metals, SVOC, VOC
LH-S82-02	LH-S82-02_3	7/24/93	0 - 0	Explosives, Metals, SVOC, VOC
LH-S83-01	LH-S83-01_1	7/23/93	0.5 - 2	Explosives, Metals, SVOC, VOC
LH-S83-02	LH-S83-02_1	7/23/93	0.5 - 2	Explosives, Metals, SVOC, VOC
LH-S83-02	LH-S83-02 QC	7/23/93	0.5 - 2	Explosives (2,4-Dinitrotoluene, 2,6-Dinitrotoluene), Metals, SVOC, VOC
LH-S84-01	LH-S84-01_1	7/21/93	0.5 - 1.5	Explosives, Metals, SVOC, VOC
LH-S84-01	LH-S84-01 QC	7/21/93	0.5 - 1.5	Explosives (2,4-Dinitrotoluene, 2,6-Dinitrotoluene), Metals, SVOC, VOC
LH-S86-01	LH-S86-01_1	7/27/93	0.5 - 2	Explosives, Metals, SVOC, VOC
LH-S86-01	LH-S86-01 QC	7/27/93	0.5 - 2	Explosives (2,4-Dinitrotoluene, 2,6-Dinitrotoluene), Metals, SVOC, VOC
LH-S86-02	LH-S86-02_1	7/27/93	0.5 - 2	Metals, SVOC, VOC
LH-S87-01	LH-S87-01_1	7/22/93	0.5 - 2	Explosives, Metals, SVOC, VOC
LH-S87-01	LH-S87-01_2	6/26/93	2.5 - 3	Explosives, Metals, SVOC, VOC
LH-S88-01	LH-S88-01_1	7/22/93	0.5 - 2	Explosives, Metals, SVOC, VOC
LH-S88-01	LH-S88-01 QC	7/22/93	0.5 - 2	Explosives (2,4-Dinitrotoluene, 2,6-Dinitrotoluene), Metals, SVOC, VOC
LH-S88-02	LH-S88-02_1	7/22/93	0.5 - 2	Explosives, Metals, SVOC, VOC
LH-S89-01	LH-S89-01_1	7/21/93	0.5 - 2	Explosives, Metals, SVOC, VOC
LH-S89-02	LH-S89-02_1	7/21/93	0.5 - 2	Explosives, Metals, SVOC, VOC
LH-S90-01	LH-S90-01_1	7/21/93	0.5 - 1.5	Explosives, Metals, SVOC, VOC
LH-S90-02	LH-S90-02_1	7/21/93	0.5 - 2	Explosives, Metals, SVOC, VOC
LH-S91-01	LH-S91-01_1	7/23/93	0.5 - 1	Explosives, Metals, SVOC, VOC
LH-S91-02	LH-S91-02_1	7/24/93	0.5 - 1	Explosives, Metals, SVOC, VOC
LH-S92-01	LH-S92-01_1	7/23/93	0.5 - 1	Explosives, Metals, SVOC, VOC
LH-S92-01	LH-S92-01 QC	7/23/93	0.5 - 1	Explosives (2,4-Dinitrotoluene, 2,6-Dinitrotoluene), Metals, SVOC, VOC
LH-S92-02	LH-S92-02_1	7/23/93	0.5 - 1	Explosives, Metals, SVOC, VOC
LH-S93-01	LH-S93-01_1	7/24/93	0.5 - 1	Explosives, Metals, SVOC, VOC
LH-S93-02	LH-S93-02 _1	7/24/93	0.5 - 1	Explosives, Metals, SVOC, VOC
LH-S94-01	LH-S94-01_1	8/20/93	0.5 - 1.5	Explosives, Metals, SVOC, VOC
LH-S95-01	LH-S95-01_1	6/26/93	0.5 - 1.5	Explosives, Metals, SVOC, VOC
LH-S95-01	LH-S95-01 QC	6/26/93	0.5 - 1.5	Explosives (2,4-Dinitrotoluene, 2,6-Dinitrotoluene), Metals, SVOC, VOC
LH-S95-02	LH-S95-02_1	6/26/93	0.5 - 1.5	Explosives, Metals, SVOC, VOC
LH-S96-01	LH-S96-01_1	6/26/93	0.5 - 1.5	Explosives, Metals, SVOC, VOC

Location Total Soil [c]	Sample No [b]	Date	Depth (ft bgs)	Analyses
LH-S96-01	LH-S96-01_2	6/26/93	2 - 2.8	Explosives, Metals, SVOC, VOC
LH-S97-01	LH-S97-01_1	6/26/93	0.5 - 1.5	Explosives, Metals, SVOC, VOC
LH-S98-01	LH-S98-01_1	6/26/93	0.5 - 1.5	Explosives, Metals, SVOC, VOC
LH-S98-01	LH-S98-01_2	6/26/93	1.5 - 3	Explosives, Metals, SVOC, VOC
LH-S99-01	LH-S99-01_1	6/26/93	0.5 - 1.5	Explosives, Metals, SVOC, VOC
LH-S99-01	LH-S99-01 QC	6/26/93	0.5 - 1.5	Explosives (2,4-Dinitrotoluene, 2,6-Dinitrotoluene), Metals, SVOC, VOC
LH-S99-01	LH-S99-01_2	6/26/93	2 - 2.8	Explosives, Metals, SVOC, VOC
LHSMW01	LHS-MW1	9/30/94	0 - 0.5	Explosives, Metals, SVOC, VOC
LHSMW02	LHS-MW2	9/30/94	0 - 0.5	Explosives, Metals, SVOC, VOC
LHSMW03	LHS-MW3	9/30/94	0 - 0.5	Explosives, Metals, SVOC, VOC
LHSMW04	LHS-MW4	9/30/94	0 - 0.5	Explosives, Metals, SVOC, VOC
LHSMW05	LHS-MW5	9/30/94	0 - 0.5	Explosives, Metals, SVOC, VOC
LHSMW06	LHS-MW6	9/30/94	0 - 0.5	Explosives, Metals, SVOC, VOC
LHSMW07	LHS-MW7	9/30/94	0 - 0.5	Explosives, Metals, SVOC, TPH, VOC
LHSMW08	LHS-MW8	9/30/94	0 - 0.5	Explosives, Metals, SVOC, VOC
LHSMW09	LHS-MW9	9/30/94	0 - 0.5	Explosives, Metals, SVOC, VOC
LHSMW10	LHS-MW10	9/30/94	0 - 0.5	Explosives, Metals, SVOC, VOC
LHSMW11	LHS-MW11	9/30/94	0 - 0.5	Explosives, Metals, SVOC, VOC
LHSMW12	LHS-MW12	9/30/94	0 - 0.5	Explosives, Metals, SVOC, VOC
LHSMW13	LHS-MW13	9/30/94	0 - 0.5	Explosives, Metals, SVOC, VOC
LHSMW14	LHS-MW14	9/30/94	0 - 0.5	Explosives, Metals, SVOC, VOC
LHSMW15	LHS-MW15	9/30/94	0 - 0.5	Explosives, Metals, SVOC, VOC
LHSMW16	LHS-MW16	9/30/94	0 - 0.5	Explosives, Metals, SVOC, VOC
LHSMW17	LHS-MW17	9/30/94	0 - 0.5	Explosives, Metals, SVOC, VOC
LHSMW18	LHS-MW18	9/30/94	0 - 0.5	Explosives, Metals, SVOC, VOC
LHSMW19	LHS-MW19	9/30/94	0 - 0.5	Explosives, Metals, SVOC, VOC
LHSMW20	LHS-MW20	10/3/94	0 - 0.5	Explosives, Metals, SVOC, VOC
LHSMW21	LHS-MW21	10/3/94	0 - 0.5	Explosives, Metals, SVOC, VOC
LHSMW22	LHS-MW22	10/3/94	0 - 0.5	Explosives, Metals, SVOC, VOC
LHSMW23	LHS-MW23	10/3/94	0 - 0.5	Explosives, Metals, SVOC, VOC
LHSMW24	LHS-MW24	10/3/94	0 - 0.5	Explosives, Metals, SVOC, VOC
LHSMW25	LHS-MW25	10/3/94	0 - 0.5	Explosives, Metals, SVOC, VOC
LHSMW26	LHS-MW26	10/3/94	0 - 0.5	Explosives, Metals, SVOC, VOC
LHSMW27	LHS-MW27	10/3/94	0 - 0.5	Explosives, Metals, SVOC, VOC
LHSMW28	LHS-MW28	10/3/94	0 - 0.5	Explosives, Metals, SVOC, VOC
LHSMW29	LHS-MW29	10/3/94	0 - 0.5	Explosives, Metals, SVOC, VOC
LHSMW30	LHS-MW30	10/3/94	0 - 0.5	Explosives, Metals, SVOC, VOC
LHSMW31	LHS-MW31	10/4/94	0 - 0.5	Explosives, Metals, SVOC, VOC
LHSMW32	LHS-MW32	10/4/94	0 - 0.5	Explosives, Metals, SVOC, VOC

Location	Sample No [b]	Date	Depth (ft bgs)	Analyses
Total Soil [c]				
LHSMW33	LHS-MW33	10/4/94	0 - 0.5	Explosives, Metals, SVOC, VOC
LHSMW34	LHS-MW34	10/4/94	0 - 0.5	Explosives, Metals, SVOC, VOC
LHSMW35	LHS-MW35	10/4/94	0 - 0.5	Explosives, Metals, SVOC, VOC
LHSMW36	LHS-MW36	10/4/94	0 - 0.5	Explosives, Metals, SVOC, VOC
LHSMW37	LHS-MW37	10/4/94	0 - 0.5	Explosives, Metals, SVOC, VOC
LHSMW38	LHS-MW38	10/4/94	0 - 0.5	Explosives, Metals, SVOC, VOC
LHSMW39	LHS-MW39	10/4/94	0 - 0.5	Explosives, Metals, SVOC, VOC
LHSMW40	LHS-MW40	10/4/94	0 - 0.5	Explosives, Metals, SVOC, VOC
LHSMW41	LHS-MW41	10/4/94	0 - 0.5	Explosives, Metals, SVOC, VOC
LHSMW42	LHS-MW42	10/4/94	0 - 0.5	Explosives, Metals, SVOC, VOC
LHSMW43	LHS-MW43	10/5/94	0 - 0.5	Explosives, Metals, SVOC, VOC
LHSMW44	LHS-MW44	10/5/94	0 - 0.5	Explosives, Metals, SVOC, VOC
LHSMW45	LHS-MW45	10/5/94	0 - 0.5	Explosives, Metals, SVOC, VOC
LHSMW46	LHS-MW46	10/5/94	0 - 0.5	Explosives, Metals, SVOC, VOC
LHSMW47	LHS-MW47	10/5/94	0 - 0.5	Explosives, Metals, SVOC, VOC
LHSMW48	LHS-MW48	10/5/94	0 - 0.5	Explosives, Metals, SVOC, VOC
LHSMW49	LHS-MW49	10/5/94	0 - 0.5	Explosives, Metals, SVOC, VOC
LHSMW50	LHS-MW50	10/5/94	0 - 0.5	Explosives, Metals, SVOC, VOC
LHSMW51	LHS-MW51	10/5/94	0 - 0.5	Explosives, Metals, SVOC, VOC
LHSMW52	LHS-MW52	10/5/94	0 - 0.5	Explosives, Metals, SVOC, VOC
LHSMW53	LHS-MW53	10/5/94	0 - 0.5	Explosives, Metals, SVOC, VOC
LHSMW54	LHS-MW54	10/5/94	0 - 0.5	Explosives, Metals, SVOC, VOC
LHSMW55	LHS-MW55	10/5/94	0 - 0.5	Explosives, Metals, SVOC, VOC
LHSMW56	LHS-MW56	10/5/94	0 - 0.5	Explosives, Metals, SVOC, VOC
LHSMW57	LHS-MW57	10/5/94	0 - 0.5	Explosives, Metals, SVOC, VOC
LHSMW58	LHS-MW58	10/5/94	0 - 0.5	Explosives, Metals, SVOC, VOC
LHSMW59	LHS-MW59	10/5/94	0 - 0.5	Explosives, Metals, SVOC, VOC
LHSMW60	LHS-MW60	10/5/94	0 - 0.5	Explosives, Metals, SVOC, VOC
LHSMW61	LHS-MW61	10/5/94	0 - 0.5	Explosives, Metals, SVOC, VOC
LHSMW62	LHS-MW62	10/5/94	0 - 0.5	Explosives, Metals, SVOC, VOC
LHSMW63	LHS-MW63	10/5/94	0 - 0.5	Explosives, Metals, SVOC, VOC
LHSMW64	LHS-MW64	10/5/94	0 - 0.5	Explosives, Metals, SVOC, VOC
LHSMW65	LHS-MW65	10/5/94	0 - 0.5	Explosives, Metals, SVOC, VOC
LHSMW66	LHS-MW66	10/5/94	0 - 0.5	Explosives, Metals, SVOC, VOC
LHSMW67	LHS-MW67	10/5/94	0 - 0.5	Explosives, Metals, SVOC, VOC
LHSMW68	LHS-MW68	10/5/94	0 - 0.5	Explosives, Metals, SVOC, VOC
LHSMW69	LHS-MW69	10/5/94	0 - 0.5	Explosives, Metals, SVOC, VOC
LHSMW70	LHS-MW70	10/5/94	0 - 0.5	Explosives, Metals, SVOC, VOC
LHSMW71	LHS-MW71	10/5/94	0 - 0.5	Explosives, Metals, SVOC, VOC

Location Total Soil [c]	Sample No [b]	Date	Depth (ft bgs)	Analyses
MAM-GP150-SS	MAM-GP150-SS	2/25/04	0 - 0.5	Dioxin/Furans, Explosives, General Chemistry, Metals, PAH, Perchlorate, Pest/PCB
MAM-P2212-SS	MAM-P2212-SS	2/25/04	0 - 0.5	Dioxin/Furans, Explosives, General Chemistry, Metals, PAH, Perchlorate, Pest/PCB
MAM-P2237-SS	MAM-P2237-SS	2/25/04	0 - 0.5	Dioxin/Furans, Explosives, General Chemistry, Metals, PAH, Perchlorate, Pest/PCB
MAM-P2268-SS	MAM-P2268-SS	2/25/04	0 - 0.5	Dioxin/Furans, Explosives, General Chemistry, Metals, PAH, Perchlorate, Pest/PCB
MAM-P2544-SS	MAM-P2544-SS	2/25/04	0 - 0.5	Dioxin/Furans, Explosives, General Chemistry, Metals, PAH, Pest/PCB
MAM-P2571-SS	MAM-P2571-SS	2/25/04	0 - 0.5	Dioxin/Furans, Explosives, General Chemistry, Metals, PAH, Perchlorate, Pest/PCB
MAM-P2571-SS	MAM-P2571-SS-QC	2/25/04	0 - 0.5	Dioxin/Furans, Explosives, General Chemistry, Metals, PAH, Perchlorate, Pest/PCB
MAM-P2586-SS	MAM-P2586-SS	2/25/04	0 - 0.5	Dioxin/Furans, Explosives, General Chemistry, Metals, PAH, Perchlorate, Pest/PCB
MAM-W220-SS	MAM-W220-SS	2/24/04	0 - 0.5	Dioxin/Furans, Explosives, General Chemistry, Metals, PAH, Perchlorate, Pest/PCB
MAM-W220-SS	MAM-W220-SS-QC	2/24/04	0 - 0.5	Dioxin/Furans, Explosives, General Chemistry, Metals, PAH, Perchlorate, Pest/PCB
MAM-W250-SS	MAM-W250-SS	2/24/04	0 - 0.5	Dioxin/Furans, Explosives, General Chemistry, Metals, PAH, Perchlorate, Pest/PCB
Post-BERA Samples				
06SB01	06SB01-01	8/29/06	0 - 0	Explosives *
06SB01	06SB01-02	8/29/06	0 - 0	Explosives *
06SB02	06SB02-01	8/29/06	0 - 0	Explosives *
06SB02	06SB02-02	8/29/06	0 - 0	Explosives *
06SB03	06SB03-01	8/29/06	0 - 0	Explosives *
06SB03	06SB03-02	8/29/06	0 - 0	Explosives *
32SB14	L0001-32SB14	8/16/04	0 - 1	Explosives *
32SB15	L0001-32SB15	8/16/04	0 - 1	Explosives *
32SB16	L0001-32SB16	8/16/04	0 - 1	Explosives *
32SB17	L0001-32SB17	8/17/04	0 - 1	Explosives *
32SB18	L0001-32SB18	8/17/04	0 - 1	Explosives *
32SB19	L0001-32SB19	8/17/04	0 - 1	Explosives *
32SB20	L0001-32SB20	8/17/04	0 - 1	Explosives *
32SB21	L0001-32SB21	8/17/04	0 - 1	Explosives *
32SB22	L0001-32SB22	9/8/04	0 - 1	Explosives *
32SB23	L0001-32SB23	9/8/04	0 - 1	Explosives *

Location Total Soil [c]	Sample No [b]	Date	Depth (ft bgs)	Analyses
35SUMP017-SB01	35-SMP17-SB01-01	9/11/06	0 - 0.5	Explosives *
35SUMP034-SB01	35-SMP34-SB01-01	9/11/06	0 - 0.5	Explosives *
35SUMP034-SB02	35-SMP34-SB02-01	9/11/06	0 - 0.5	Explosives *
35SUMP035-SB01	35-SMP35-SB01-01	9/12/06	0.5 - 0.5	Explosives *
35SUMP035-SB02	35-SMP35-SB02-01	9/12/06	0 - 0.5	Explosives *
35SUMP107-SB01	35-SMP107-SB01-01	9/14/06	0.5 - 0.5	Explosives *
35SUMP107-SB01	35-SMP107-SB01-02	9/14/06	3 - 3	Explosives *
35SUMP107-SB02	35-SMP107-SB02-01	9/14/06	0.5 - 0.5	Explosives *
35SUMP107-SB02	35-SMP107-SB02-02	9/14/06	3 - 3	Explosives *
35SUMP118-SB01	35-SMP118-SB01-01	9/19/06	0.5 - 0.5	Explosives *
55SB02	55SB02-1-2	9/27/06	1 - 2	Explosives *
55SB03	55-SB03-3.0	9/27/06	3 - 3	Explosives *
55SB03	55-SB03-CONTENTS	9/27/06	0 - 0	Explosives *
55SB03	55-SB03-1-2	9/27/06	1 - 2	Explosives *
55SB04	55-SB04-1-2	9/27/06	1 - 2	Explosives *
55SB06	55-SB06-(1-2)	9/27/06	1 - 2	Explosives *
55SB07	55-SB07-(1-2)	9/27/06	1 - 2	Explosives *
WRS008-SB01	WRS008-SB01-01	9/14/06	0.5 - 0.5	Explosives *
WRS008-SB02	WRS008-SB02-01	9/14/06	0.5 - 0.5	Explosives *
WRS019-SB01	WRS019-SB01-01	9/14/06	1.5 - 1.5	Explosives *
WRS019-SB02	WRS019-SB02-01	9/25/06	0.5 - 0.5	Explosives *
WRS021-SB01	WRS021-SB01-01	9/26/06	0.5 - 0.5	Explosives *
WRS021-SB02	WRS021-SB02-01	9/26/06	0.5 - 0.5	Explosives *
WRS10-SB02	WRS10-SB02-01	9/25/06	0.5 - 0.5	Explosives *

Location	Sample No [b]	Date	Depth (ft bgs)	Analyses
Total Soil [c]				
WRS14-SB01	WRS14-SB01-01	9/14/06	1.5 - 1.5	Explosives *
WRSUMP005-SB01	WRSMP005-SB01-01	9/22/06	0.5 - 0.5	Explosives *

[a] Sample list is based on Table 6-3 of the Baseline Ecological Risk Assessment (Shaw, 2007). The sample list is condensed to only show explosives data pertinent to the discussion in the Response to Comments memo regarding the removal of ITS data. Samples not analyzed for explosives, and ITS samples that were previously eliminated in the BERA, are not presented.

[b] Field duplicates are indicated by the addition of "QC", "QA", "FD", "D", or "DUP" to the sample number.

[c] Total soil is defined as samples 0 to 3 feet bgs. Deeper samples were also considered surface soil if at least 50% of their sampling depth interval was less than 3 ft bgs (e.g., 2-4 ft bgs).

* Analyses list is not comprehensive. Sample may include additional analytical suites.

General Chemistry parameters include: chloride, cyanide, fluoride, nitrate, nitrite, sulfate, pH, percent solids, total organic carbon, total phosphorus, and total solids.

Samples may not have been analyzed for all parameters.

"Explosives" includes: 1,3,5-TNB, 1,3-DNB, 2,4,6-TNT, 2,4-DNT, 2,6-DNT, 2-amino-4,6-DNT, 4-amino-2,6-DNT, HMX, m-nitrobenze, niobium, nitrobenzene, o- and p-nitrotoluene, RDX, tetryl

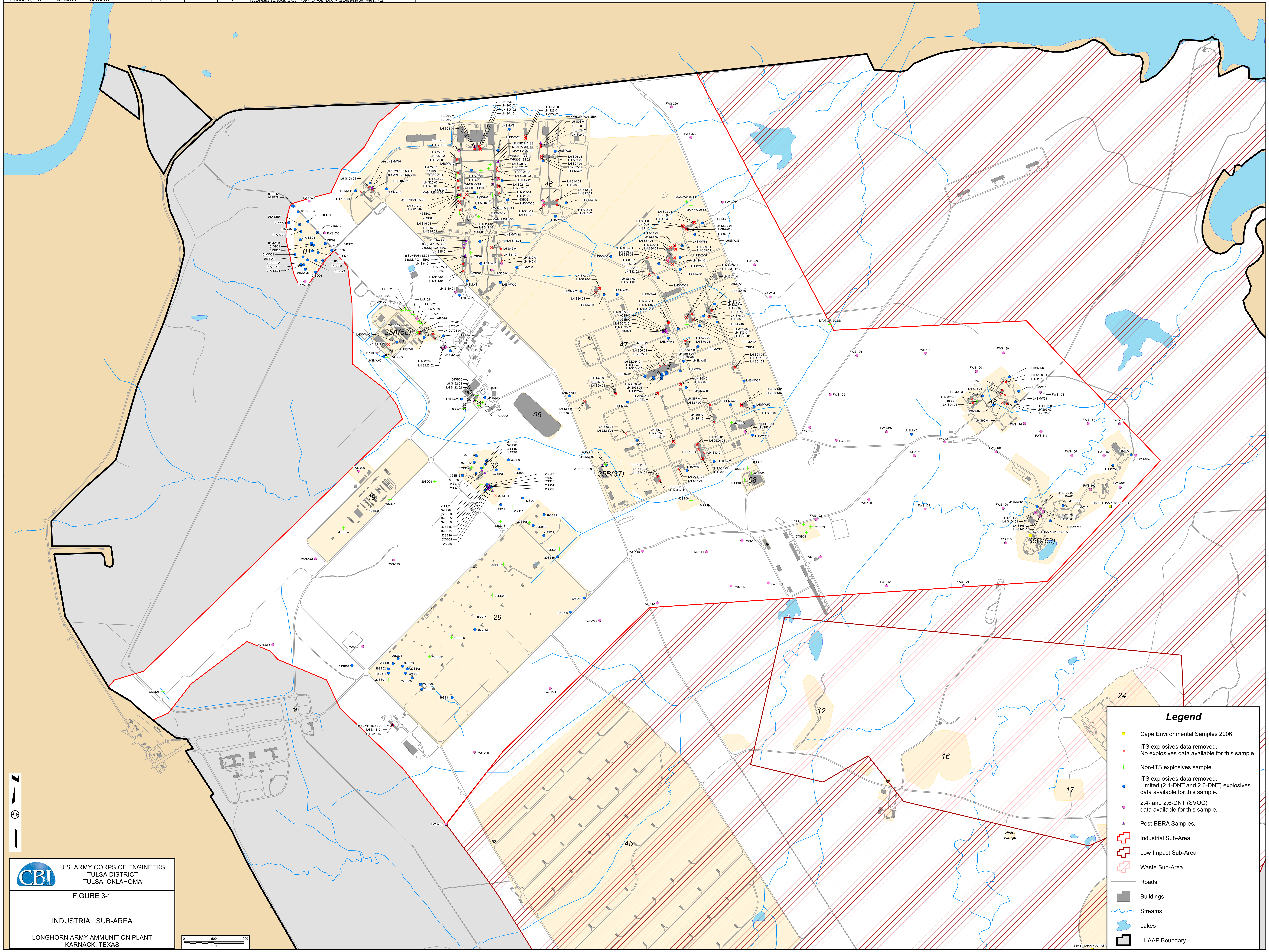
ft bgs = feet below ground surface
PAH = Polynuclear aromatic hydrocarbons
Pest = Pesticides
PCB = Polychlorinated biphenyls
SVOC = Semivolatile organic compounds
TPH = Total petroleum hydrocarbons
VOC = Volatile organic compounds

<u>*Color Coding*</u>:

Yellow	*= suspected of having explosives analysis run by ITS lab (within 1993-1994 timeframe).*
Green	*= not suspected of having explosives analysis run by ITS lab (not within 1993-1994 timeframe).*
Blue	*= has ITS explosives data, but also has some explosives (2,4-DNT and 2,6-DNT) run as SVOCs*
Peach	*= SVOC data analyzed for 2,4- and 2,6-DNT*

00188032

OFFICE	DRAWN BY		CHECKED BY		APPROVED BY		FILE PATH
Houston, TX	B. Grod	5/15/13	- - -	--/--/--	- - -	--/--/--	T:\Divisions\Design\GIS\117591_LHAAP\Doc\Mxd\Bera\IsaSamples.mxd



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

FIGURE 3-1

INDUSTRIAL SUB-AREA

LONGHORN ARMY AMMUNITION PLANT
KARNACK, TEXAS

An environmental site assessment (ESA) report performed by Plexus (Plexus, 2005) provides additional information on the individual sites that comprise the ISA, including a determination as to whether explosives compounds are a potential concern for each site based on site history and other sources of information. This ESA was performed at LHAAP in the same timeframe as the BERA. Importantly, however, the ESA report based its conclusions on a thorough review of more than 450 documents, a site reconnaissance, interviews, aerial photography analysis, and analytical results from samples collected as part of the Phase II ESA. Thus, the ESA study did not base its conclusions significantly (if at all) on the ITS-ENV explosives data. According to the ESA, all of the sites in the ISA, except LHAAP-46, used explosives in their operations. However, the ESA only identified explosives as a chemical of concern in soil at two of these sites: LHAAP-32 and LHAAP-29. Therefore, these two sites are given greater scrutiny, and are discussed in greater detail in the following paragraphs.

LHAAP-32, in the western central portion of the LHAAP installation, covers approximately 9 acres. The TNT Waste Disposal Plant operated here from 1942 to 1945. The plant treated wastewater generated at the nearby TNT Production Area (LHAAP-29). The wastewater was transferred to the disposal area through a 6-inch wooden pipeline and stored in holding tanks until treated. Leaks, overflows, and process spills were likely causes for site contamination (Plexus, 2005). This site had 19 of its 31 explosives sample results rejected when the ITS-ENV data were eliminated; however limited explosives data (DNTs) were available as SVOC data for 17 of these 19 samples (**Table 3-1**). Because LHAAP-32 was a former TNT Waste Disposal Plant (rather than, for example, an HMX facility), DNTs are expected chemicals of concern at this site, and the DNT data are relevant as chemical indicators of any release that may have occurred.

An additional 11 “post-BERA” samples with explosives data are also available for LHAAP-32, providing additional coverage (**Table 3-1**). Furthermore, in 2003, soil and sediment in the foundation of the LHAAP-32 buildings was excavated and removed (Plexus, 2005). A substantial amount of nitrotoluenes (NT) and full-suite explosives data are available for this site even after the ITS-ENV data were rejected. A removal action has also been performed at this site during building/foundation removal (see Administrative Record, Volume 1 of 1, 2003 [BS 031228-031249]). Therefore, uncertainty regarding explosives at LHAAP-32 is believed to be relatively low.

The other site identified in the Plexus report as being of concern for explosives, LHAAP-29, is a heavily wooded, 85-acre site in the western-central portion of the LHAAP installation. This site was a TNT Production Area from October 1942 to August 1945. LHAAP-29 had 19 of its 32 explosives sample results rejected when the ITS-ENV data were eliminated; however, all 19 of the eliminated samples retained limited explosives data (DNTs) available as SVOC data (**Table 3-1**). Because LHAAP-29 was a former TNT production area, DNTs are expected chemicals of concern at this site, and the DNT data are relevant as indicators of potential releases.

No additional “post-BERA” soil samples analyzed for explosives were identified for this site. However, in the evaluation of the “post-BERA” data for the Central Creek watershed, elevated concentrations of NTs were identified in sediment samples at LHAAP-29 in the BERA (Shaw, 2007). The hot spot occurred at sample location 29SD46, which is in a ditch adjacent to 16th Street (see Figure 15-2 of the BERA), and although the BERA did not recommend that any explosives compounds be identified as COCs in the ISA, this area was identified as potentially being a hot spot of concern for local ecological receptors (Shaw, 2007). A limited removal action has been recommended for this area, as described in the LHAAP-29 Feasibility Study (Shaw, 2010).

In summary, although considerable explosives data were rejected for the ISA, only two sites (LHAAP-32 and LHAAP-29) were independently identified as being source areas for explosives. Of these two sites, LHAAP-32 appears to have sufficient data to support the conclusion that explosives are not ecological COCs. LHAAP-29 has fewer remaining data, and also had a hot spot for NT identified in the BERA that is currently recommended for remediation. Therefore, LHAAP-29 is recommended to receive special emphasis in any supplemental sampling effort.

With these considerations in mind, and after reviewing the map of the ISA (**Figure 3-1**), the collection of additional samples is recommended to assert with greater confidence that explosives are not identified as COCs in this sub-area.

3.2 Industrial Sub-Area Recommendations

For this sub-area, 201 soil samples had all of their explosives data eliminated, and 166 additional samples had all of their explosives data with the exception of DNTs eliminated. Explosives compounds are a potential concern in this sub-area due to the manufacturing, testing, and decommissioning of munitions that occurred during the installation's operational history. However, the Plexus (2005) report identified only two sites within the ISA as having concerns for explosives contaminants in soil: LHAAP-29 and LHAAP-32. In LHAAP-29, 19 out of 32 explosives samples were eliminated, but all 19 were analyzed for DNTs as part of the SVOC suite. Because of its history as a TNT production area, the DNT data provide a reasonable indicator as to whether a release has occurred, and the rejection of non-TNT related compounds (e.g., HMX) is of reduced concern. A limited soil removal has also been recommended at LHAAP-29 to remove elevated NTs. For LHAAP-32, a similar amount of explosives data were lost as compared with LHAAP-29. However, a removal action has been performed as part of the building/foundation removal (see Administrative Record, Volume 1 of 1, 2003 [BS 031228-031249]) and additional samples analyzed for explosives have been collected at this site subsequent to the BERA. Therefore, there is less uncertainty involved with this site than for LHAAP-29.

To improve the level of confidence that the BERA conclusions for explosives are still valid for the ISA, the Army recommends collecting additional samples from the ISA to replace the lost ITS-ENV samples. The original recommendation communicated to the TCEQ and EPA was to collect 10 additional soil (five surface and five subsurface) samples from randomly selected previously sampled locations at each of the 15 sites within the ISA whose explosives data were removed, and 20 additional samples (10 surface and 10 subsurface) from LHAAP-29 to account for the higher uncertainty associated with this site, for a total of 170 new soil samples. However, the ISA contains many sites that have high variation of size and lost explosives data. Also, some sites (e.g., LHAAP-08) did not lose any data when the ITS-ENV results are eliminated. Therefore, the revised recommendation is to re-allocate the 170 samples among the sites to more intensively sample larger sites that experienced greater data loss. Specific re-sampling recommendations are presented in Section 5.

4.0 WASTE SUB-AREA

The WSA is approximately 486 acres in size, and is defined by the areas where waste disposal activities occurred at LHAAP. The WSA consists of the following sites:

- LHAAP-12 – Landfill – 7 acres
- LHAAP-16 – Old Landfill – 20 acres
- LHAAP-17 – Burning Ground No. 2 (Flashing Area – 2.6 acres)
- LHAAP-18/24 – Burning Ground No. 3/Unlined Evaporation Pond – 34.5 acres)

As opposed to the ISA and LISA, where no explosives were identified as COCs in the BERA, the BERA identified three NTs (2,4-DNT, 2,6-DNT, and TNT) as COCs in the WSA (Shaw, 2007).

4.1 Waste Sub-Area Data Gaps Evaluation

Table 4-1 presents the list of soil samples with explosives data for the WSA. The samples are color-coded to indicate the status of explosives data available in their analytical results. **Figure 4-1** presents the WSA sample locations. **Appendix C** presents larger scale "zoom in" maps of the WSA for improved clarity and readability. As shown in **Table 4-1**, the BERA soil dataset for the WSA had a total of 72 samples analyzed for the full suite of explosives. A re-analysis of the WSA data set reveals the following if the ITS-ENV data are removed (note: QA/QC samples are not included in the tallies below, nor are samples that were eliminated during the BERA because they were known ITS-ENV data):

- 23 soil samples (32%) lose all their explosives data. However, all of these samples have 2,4-DNT and 2,6-DNT data, which were analyzed as part of the SVOC suite.
- 49 of the original BERA soil samples (68%) are retained with their full explosives data suite intact.
- An additional 32 soil samples (44%) (i.e., the 23 ITS-ENV samples with limited SVOC explosives data plus an additional 9 samples with SVOC explosives data that did not have ITS-ENV data) have limited (2,4- and 2,6-DNT only) explosives data.
- Therefore, with the ITS-ENV data removed, data for explosives compounds except 2,4-DNT and 2,6-DNT are only available for 49 of the original 72 samples. Data for 2,4-DNT and 2,6-DNT are available for all 72 of the original BERA soil samples.
- An additional 43 soil samples analyzed for limited explosives (2,4-DNT, 2,6-DNT, and 2,4,6-TNT only) are available from samples collected subsequent to the BERA. Three of these were identified in the "post-BERA" data set evaluated in the BERA. All explosives compounds in these samples were non-detect (Shaw, 2007). The remaining 40 samples were collected as part of investigation/removal activities at LHAAP-17. These samples provide additional coverage.

4.2 Ninety-five Percent UCL Recalculations

At the request of TCEQ, new 95% UCLs were calculated for the three COCs in the WSA to help determine what impacts removing the ITS-ENV data would have on the BERA conclusions for this sub-area. The 95% UCLs are the exposure point concentrations (EPC) used for ecological receptors at LHAAP (Shaw, 2007). These 95% UCLs were calculated after the ITS-ENV data were eliminated, and after samples from additional samples that had been collected since the BERA was completed were added. For the 95% UCL recalculations, another correction was made in the data set as well: during a review of the data, it was determined that a TNT concentration listed as 10,000 milligrams per kilogram (mg/kg) in the electronic dataset for sample 17SS22 (0-0.5), should actually be 8,400 mg/kg, according to the remedial investigation report (Jacobs, 2001b).

Table 4-1. Sample Summary for Total Soil, Waste Sub-Area

Location	Sample No [b]	Date	Depth (ft bgs)			Analyses
Total Soil [c]						
12SB01	12SB01(1.0-2.0)	6/1/93	1	-	2	Explosives, General Chemistry, Metals, SVOC, VOC
12WW01	12WW01(0-2)	4/27/93	0	-	2	Explosives, General Chemistry, Metals, SVOC, VOC
12WW02	12WW02(0-2)	2/4/88	0	-	2	SVOC
12WW02	C900204-12WW02-N02	2/4/90	0	-	2	SVOC
12WW02	C930428-12WW02-N02	4/28/93	0	-	2	Explosives, General Chemistry, Metals, SVOC, VOC
12WW05	12WW05(0-1.5)	4/19/93	0	-	1.5	Explosives, General Chemistry, Metals, SVOC, VOC
12WW07	12WW07(0-2)	4/19/93	0	-	2	Explosives, General Chemistry, Metals, SVOC, VOC
16SD02	16SD02(0-1)	4/14/93	0	-	1	Explosives, General Chemistry, Metals, SVOC, VOC
16WW27	16WW27(0-0.5)	5/17/97	0	-	0.5	Dioxin/Furans, Explosives, General Chemistry, Metals, Pest/PCB, VOC
16WW27	16WW27(1-3)	5/17/97	1	-	3	Dioxin/Furans, Explosives, General Chemistry, Metals, Pest/PCB, VOC
16WW31	16WW31(0-0.5)	5/29/97	0	-	0.5	Dioxin/Furans, Explosives, General Chemistry, Metals, Pest/PCB, VOC
16WW31	16WW31(1-3)	5/29/97	1	-	3	Dioxin/Furans, Explosives, General Chemistry, Metals, Pest/PCB, VOC
16WW35	16WW35(0-0.5)	6/25/97	0	-	0.5	Dioxin/Furans, Explosives, General Chemistry, Metals, Pest/PCB, VOC
16WW35	16WW35(0-0.5)QC	6/25/97	0	-	0.5	Dioxin/Furans, Explosives, General Chemistry, Metals, Pest/PCB, VOC
16WW35	16WW35(1-3)	6/25/97	1	-	3	Dioxin/Furans, Explosives, General Chemistry, Metals, Pest/PCB, VOC
16WW37	16WW37(0-0.5)	5/31/97	0	-	0.5	Dioxin/Furans, Explosives, General Chemistry, Metals, Pest/PCB, VOC
16WW37	16WW37(1-3)	5/31/97	1	-	3	Dioxin/Furans, Explosives, General Chemistry, Metals, Pest/PCB, VOC
17SB01	17SB01(02)	5/15/93	2.5	-	2.5	Explosives, General Chemistry, Metals, SVOC, VOC
17SB01	17SB01(0-2)	5/15/93	0	-	2	Explosives, General Chemistry, Metals, SVOC, VOC
17SB02	17SB02(0-2)	5/15/93	0	-	2	Explosives, General Chemistry, Metals, SVOC, VOC
17SB03	17SB03(0-2)	5/16/93	0	-	2	Explosives, General Chemistry, Metals, SVOC, VOC
17SB04	17SB04(0-2)	5/15/93	0	-	2	Explosives, General Chemistry, Metals, SVOC, VOC
17SB05	17SB05(0-2)	5/16/93	0	-	2	Explosives, General Chemistry, Metals, SVOC, VOC
17SB06	17SB06(0-2)	5/15/93	0	-	2	Explosives, General Chemistry, Metals, SVOC, VOC
17SB07	17SB07(0-2)	5/16/93	0	-	2	Explosives, General Chemistry, Metals, SVOC, VOC
17SD01	17SD01	4/21/93	0	-	0	Explosives, General Chemistry, Metals, SVOC, VOC
17SD02	17SD02	4/21/93	0	-	0	Explosives, General Chemistry, Metals, SVOC, VOC
17SD10	17SD10	9/17/98	0	-	0	Dioxin/Furans, Explosives, Metals, Pest/PCB, SVOC, VOC
17SD10	17SD10QC	9/17/98	0	-	0	Dioxin/Furans, Explosives, Metals, Pest/PCB, SVOC, VOC
17SD11	17SD11	9/17/98	0	-	0	Explosives, Metals, VOC
17SD12	17SD12	9/17/98	0	-	0	Dioxin/Furans, Explosives, Metals, Pest/PCB, SVOC, VOC
17SS21	17SS21(0-0.5)	7/11/98	0	-	0.5	Explosives
17SS21	17SS21(0-0.5)QC	7/11/98	0	-	0.5	Explosives
17SS21	17SS21(2.5-3)	7/11/98	2.5	-	3	Explosives
17SS22	17SS22(0-0.5)	7/11/98	0	-	0.5	Dioxin/Furans, Explosives, Pest/PCB, SVOC
17SS22	17SS22(1-3)-980711	7/11/98	1	-	3	Dioxin/Furans, Explosives, Pest/PCB, SVOC
17SS23	17SS23(0-0.5)	7/11/98	0	-	0.5	Explosives

Location Total Soil [c]	Sample No [b]	Date	Depth (ft bgs)			Analyses
17SS23	17SS23(2.5-3)	7/11/98	2.5	-	3	Explosives
17SS24	17SS24(0-0.5)	7/11/98	0	-	0.5	Explosives
17SS24	17SS24(2.5-3)	7/11/98	2.5	-	3	Explosives
17SS25	17SS25(0-0.5)	7/11/98	0	-	0.5	Explosives
17SS25	17SS25(2.5-3)	7/11/98	2.5	-	3	Explosives
17SS26	C-17SS26(0-0.5)-9807	7/11/98	0	-	0.5	Dioxin/Furans, Explosives, Pest/PCB, SVOC
17SS26	C-17SS26(1-3)-980711	7/11/98	1	-	3	Dioxin/Furans, Explosives, Pest/PCB, SVOC
17SS27	17SS27(0-0.5)	7/11/98	0	-	0.5	Explosives
17SS27	17SS27(2.5-3)	7/11/98	2.5	-	3	Explosives
17SS28	17SS28(0-0.5)	7/11/98	0	-	0.5	Explosives
17SS28	17SS28(2.5-3)	7/11/98	2.5	-	3	Explosives
17SS29	17SS29(0-0.5)	7/11/98	0	-	0.5	Explosives
17SS29	17SS29(2.5-3)	7/11/98	2.5	-	3	Explosives
17SS31	17SS31(0-0.5)	7/14/98	0	-	0.5	Explosives
17SS31	17SS31(2.5-3)	7/14/98	2.5	-	3	Explosives
17SS31	17SS31(2.5-3)QC	7/14/98	2.5	-	3	Explosives
17WW01	17WW01(0-2)	5/16/93	0	-	2	Explosives, General Chemistry, Metals, SVOC, VOC
18SD03	18SD03(0-0.5)	5/2/93	0	-	0.5	Explosives, General Chemistry, Metals, SVOC, VOC
18SD04	18SD04(0-0.5)	5/2/93	0	-	0.5	Explosives, General Chemistry, Metals, SVOC, VOC
18SD05	18SD05(0-0.5)	5/2/93	0	-	0.5	Explosives, General Chemistry, Metals, SVOC, VOC
18SD06	18SD06(0-0.5)	5/2/93	0	-	0.5	Explosives, General Chemistry, Metals, SVOC, VOC
18SD06	18SD06(0-0.5)QC	5/2/93	0	-	0.5	General Chemistry, Metals, SVOC, VOC
18SD07	18SD07(0-0.5)	5/2/93	0	-	0.5	Explosives, General Chemistry, Metals, SVOC, VOC
18SD07	18SD07(0-0.5)QC	5/2/93	0	-	0.5	Explosives
18SD08	18SD08(0-0.5)	5/2/93	0	-	0.5	Explosives, General Chemistry, Metals, SVOC, VOC
18SD29	18SD29	10/7/98	0	-	0	Dioxin/Furans, Explosives, Metals, Pest/PCB, SVOC, VOC
COE17-02	COE17-02-01	9/1/98	0	-	0.5	Explosives
COE17-03	COE17-03-01	9/1/98	0	-	0.5	Explosives
COE17-03	COE17-03-01QC	9/1/98	0	-	0.5	Explosives
COE17-04	COE17-04-01	9/1/98	0	-	0.5	Explosives
COE17-05	COE17-05-01	9/1/98	0	-	0.5	Explosives
COE17-06	COE17-06-01	9/1/98	0	-	0.5	Explosives
COE17-07	COE17-07-01	9/1/98	0	-	0.5	Explosives
COE17-08	COE17-08-01	9/1/98	0	-	0.5	Explosives
COE17-09	COE17-09-01	9/1/98	0	-	0.5	Explosives
COE17-10	COE17-10-01	9/1/98	0	-	0.5	Explosives
COE17-11	COE17-11-01	9/1/98	0	-	0.5	Explosives
COE17-12	COE17-12-01	9/1/98	0	-	0.5	Explosives
COE17-13	COE17-13-01	9/1/98	0	-	0.5	Explosives

Location	Sample No [b]	Date	Depth (ft bgs)			Analyses
Total Soil [c]						
COE17-14	COE17-14-01	9/1/98	0	-	0.5	Explosives
COE17-15	COE17-15-01	9/1/98	0	-	0.5	Explosives
COE17-16	COE17-16-01	9/1/98	0	-	0.5	Explosives
FWS-088	CLNWR088	9/9/03	0	-	0.5	Metals, Pest/PCB, SVOC
FWS-101	CLNWR101	9/9/03	0	-	0.5	Metals, Pest/PCB, SVOC
FWS-108	CLNWR108	9/9/03	0	-	0.5	Metals, Pest/PCB, SVOC
FWS-119	CLNWR119	9/9/03	0	-	0.5	Metals, Pest/PCB, SVOC
FWS-123	CLNWR123	9/9/03	0	-	0.5	Metals, Pest/PCB, SVOC
FWS-124	CLNWR124	9/9/03	0	-	0.5	Metals, Pest/PCB, SVOC
LH-S114-01	LH-S114-01_1	7/13/93	0.5	-	1.5	Explosives, Metals, SVOC, VOC
LH-S114-02	LH-S114-02_1	7/13/93	0.5	-	1.5	Explosives, Metals, SVOC, VOC
LH-S115-01	LH-S115-01_1	8/4/93	0.5	-	1	Metals, SVOC, VOC
LH-S115-02	LH-S115-02 QC	8/4/93	0.6	-	2.6	Metals, SVOC, VOC
LH-S115-02	LH-S115-02_1	8/4/93	0.6	-	2.6	Metals, SVOC, VOC
Additional Samples [d]						
17EXC01-SB01	17EXC01-SB01(0-2)	9/16/10	0	-	2	Explosives
17EXC01-SB01	17EXC01-SB01(2-4)	9/16/10	2	-	4	Explosives
17EXC01-SB02	17EXC01-SB02(0-2)	9/16/10	0	-	2	Explosives
17EXC01-SB02	17EXC01-SB02(2-4)	9/16/10	2	-	4	Explosives
17EXC01-SB03	17EXC01-SB03(0-2)	9/16/10	0	-	2	Explosives
17EXC01-SB03	17EXC01-SB03(2-4)	9/16/10	2	-	4	Explosives
17EXC01-SB04	17EXC01-SB04(0-2)	9/16/10	0	-	2	Explosives
17EXC01-SB04	17EXC01-SB04(2-4)	9/16/10	2	-	4	Explosives
17EXC01-SB05	17EXC01-SB05(0-2)	9/16/10	0	-	2	Explosives
17EXC02-SB01	17EXC02-SB01(0-2)	8/31/10	0	-	2	Explosives
17EXC02-SB02	17EXC02-SB02(0-2)	8/31/10	0	-	2	Explosives
17EXC02-SB03	17EXC02-SB03(0-2)	8/31/10	0	-	2	Explosives
17EXC02-SB04	17EXC02-SB04(0-2)	9/16/10	0	-	2	Explosives
17EXC02-SB04	17EXC02-SB04(2-3)	9/16/10	2	-	4	Explosives
17EXC02-SB05	17EXC02-SB05(2-4)	9/16/10	2	-	4	Explosives
17EXC02-SB06	17EXC02-SB06(0-2)	8/31/10	0	-	2	Explosives
17EXC03-SB01	17EXC03-SB01(0-2)	8/30/10	0	-	2	Explosives
17EXC03-SB02	17EXC03-SB02(0-2)	8/31/10	0	-	2	Explosives
17EXC03-SB02	17EXC03-SB02(2-3)	8/30/10	0	-	3	Explosives
17EXC03-SB03	17EXC03-SB03(0-2)	8/31/10	0	-	2	Explosives
17EXC03-SB03	17EXC03-SB03(2-4)	8/31/10	2	-	4	Explosives
17EXC03-SB08	17EXC03-SB08(0-2)	8/31/10	0	-	2	Explosives
17EXC03-SB08	17EXC03-SB08(2-4)	8/31/10	2	-	4	Explosives
17EXCO3-SB04	17EXCO3-SB04(0-2)	9/15/10	0	-	2	Explosives

Location / Total Soil [c]	Sample No [b]	Date	Depth (ft bgs)			Analyses
17EXCO3-SB04	17EXCO3-SB04(2-4)	9/15/10	2	-	4	Explosives
17EXCO3-SB05	17EXCO3-SB05(0-2)	9/15/10	0	-	2	Explosives
17EXCO3-SB05	17EXCO3-SB05(2-4)	9/15/10	2	-	4	Explosives
17EXCO3-SB06	17EXCO3-SB06(0-2)	9/15/10	0	-	2	Explosives
17EXCO3-SB06	17EXCO3-SB06(2-4)	9/15/10	2	-	4	Explosives
17EXCO3-SB07	17EXCO3-SB07(0-2)	9/15/10	0	-	2	Explosives
17EXCO3-SB07	17EXCO3-SB07(2-4)	9/15/10	2	-	4	Explosives
17SB-B02	17SB-B02(0-2)	8/30/10	0	-	2	Explosives
17SB-B04	17SB-B04(0-2)	8/30/10	0	-	2	Explosives
17SB-C04	17SB-C04(0-2)	8/30/10	0	-	2	Explosives
17SB-C05	17SB-C05(0-2)	8/31/10	0	-	2	Explosives
17SB-C05	17SB-C05(2.5-3.5)	8/31/10	2.5	-	3.5	Explosives
17SB-D02	17SB-D02(0-2)	8/27/10	0	-	2	Explosives
17SB-D03	17SB-D03(0-2)	8/27/10	0	-	2	Explosives
17SB-D04	17SB-D04(0-2)	8/27/10	0	-	2	Explosives
35SUMP114-SB01	35-SMP114-SB01-01	9/15/06	0.5	-	0.5	Explosives *
35SUMP114-SB01	35-SMP114-SB01-02	9/15/06	0.5	-	0.5	Explosives *
35SUMP115-SB01	35-SMP115-SB01-01	9/19/06	0.5	-	0.5	Explosives *

[a] Sample list is based on Table 6-4 of the Baseline Ecological Risk Assessment (Shaw, 2007). The sample list is condensed to only show explosives data pertinent to the discussion in the Response to Comments memo regarding the removal of ITS data. Samples not analyzed for explosives, and ITS samples that were previously eliminated in the BERA, are not presented.

[b] Field duplicates are indicated by the addition of "QC" to the sample number.

[c] Total soil is defined as samples 0 to 3 feet bgs. Deeper samples were also considered surface soil if at least 50% of their sampling depth interval was less than 3 ft bgs (e.g., 2-4 ft bgs).

[d] Additional samples collected since the ecological risk assessment was finalized and not included in the "post-BERA dataset" evaluated as part of the BERA. Only samples in the depth range appropriate for ecological risk assessment (see footnote c) are shown.

* Analyses list is not comprehensive. Sample may include additional analytical suites.

General Chemistry parameters include: chloride, nitrate, nitrite, sulfate, pH, and percent solids. Samples may not have been analyzed for all parameters.

Pest = Pesticides

PCB = Polychlorinated biphenyls

SVOC = Semivolatile organic compounds

VOC = Volatile organic compounds

Color Coding:

(yellow) *= suspected of having explosives analysis run by ITS lab (within 1993-1994 timeframe).*

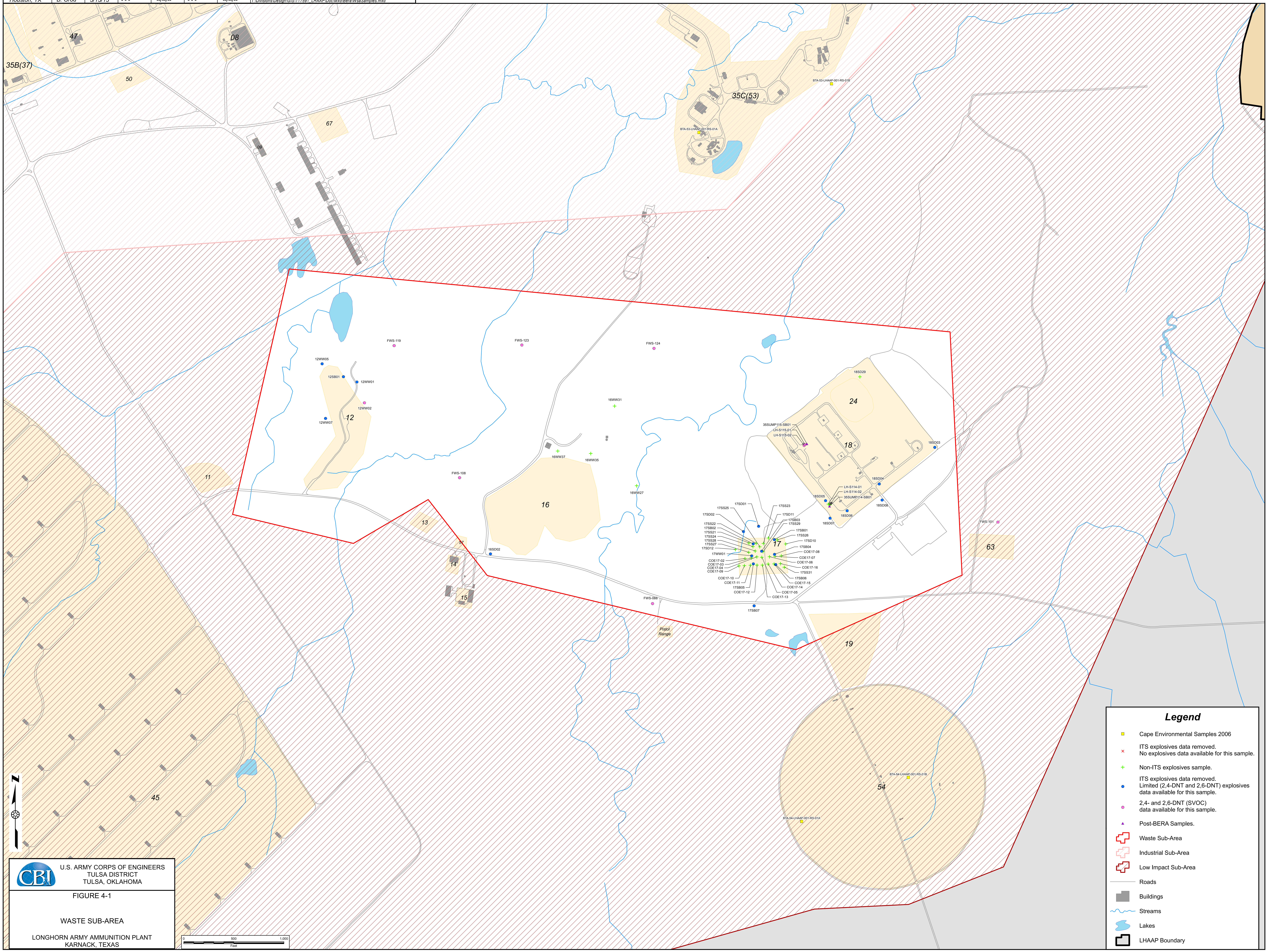
(green) *= not suspected of having explosives analysis run by ITS lab (not within 1993-1994 timeframe).*

(blue) *= has ITS explosives data, but also has some explosives (2,4-DNT and 2,6-DNT) run as SVOCs*

(peach) *= SVOC data analyzed for 2,4- and 2,6-DNT*

00188040

OFFICE	DRAWN BY		CHECKED BY		APPROVED BY		FILE PATH
Houston, TX	B. Grod	5/15/13	- - -	--/--/--	- - -	--/--/--	T:\Divisions\Design\GIS\117591_LHAAP\Doc\Mxd\Bera\WsaSamples.mxd



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

FIGURE 4-1

WASTE SUB-AREA

LONGHORN ARMY AMMUNITION PLANT
KARNACK, TEXAS

The 95% UCLs were compared with the ecological preliminary remediation goals (EcoPRG) for both surface (0 to 0.5 foot below ground surface [bgs]) and total (0 to 3 feet bgs) soil that were developed and presented in the BERA (Shaw, 2007). EcoPRGs are risk-based concentrations for the WSA that are protective of the ecological endpoints of concern. If the EPC is lower than the EcoPRG for a given chemical, then exposure to that chemical is not expected to result in adverse ecological effects. The results of this comparison are presented in **Table 4-2**.

Table 4-2. Revised 95% UCLs for DNTs and TNT, Waste Sub-Area

	Surface Soil (0-0.5')			Total Soil (0-3')		
Eco COC	**95% UCL Used in the BERA**	**Revised 95% UCLs [a]**	**Surface Soil EcoPRG**	**95% UCL Used in the BERA**	**Revised 95% UCLs [a]**	**Total Soil EcoPRG**
TNT	491	724.1 [b]	NA	287	508.6 [b,c]	4.7
TNT (without hotspot) [d]	--	11.18	NA	--	4.3	4.7
2,4-DNT	1.23	1.72	NA	101	0.98	12
2,6-DNT	2.4	3.1	2.7	13.6	1.2	6.8

(all values are in mg/kg)

[a] Data includes all valid explosives results in the BERA and Post-BERA data
[b] Erroneous concentration of 10,000 mg/kg for sample 17SS22(0-0.5) changed to correct value of 8,400 mg/kg.
[c] ProUCL's recommendation of 97.5% Chebyshev UCL ignored in favor of the 95% Chebyshev UCL.
[d] Reported concentration of 8,400 mg/kg from sample 17SS22(0-0.5) removed.
Eco COC – chemical selected as an ecological chemical of concern in the Longhorn Army Ammunition Plant Baseline Ecological Risk Assessment (Shaw, 2007)
EcoPRG – ecological preliminary remediation goal presented in the Longhorn Army Ammunition Plant Baseline Ecological Risk Assessment.
mg/kg – milligrams per killorgam
NA – Not applicable; chemical was not a COC in surface soil
UCL – Upper confidence limit on the mean

This comparison indicates that some EPCs for the COCs are higher (i.e., for TNT in surface soil and total soil, 2,4-DNT in surface soil, and 2,6-DNT in surface soil), and some are lower (2,4-DNT and 2,6-DNT in total soil) after the ITS-ENV data are removed. The reason for the significant reduction in the EPCs for the DNTs in the revised total soil dataset is because several samples collected from a soil depth greater than 0.5 feet with highly elevated DNT concentrations are suspected ITS-ENV data. These eliminated sample results include the following:

Parameter	Sample Location	Sample Number	Sample Date	Start Depth	End Depth	Concentration (mg/kg)
2,4-DNT	17SB02	17SB02(0-2)	15-May-93	0	2	4,000
2,4-DNT	17SB03	17SB03(0-2)	16-May-93	0	2	93
2,4-DNT	17SB04	17SB04(0-2)	15-May-93	0	2	15
2,6-DNT	17SB02	17SB02(0-2)	15-May-93	0	2	500
2,6-DNT	17SB03	17SB03(0-2)	16-May-93	0	2	23

Although elevated concentrations were reported in the ITS-ENV samples and were removed from the database, other sample results are available from nearby locations: sample location 17SB02 is bounded by samples 17SS22, 17SS21, and 17SS24; sample location 17SB03 is bounded by samples 17SS29, 17SS25, and COE17-05; and sample location 17SB04 is bounded to the south by samples COE 17-08, COE 17-07, and COE-17-06 (**Figure 4-1**). Therefore, these eliminated locations appear to be adequately characterized.

4.3 Waste Sub-Area Recommendations

For the WSA, 23 soil samples had all of their explosives data eliminated; however, all 23 samples with rejected ITS-ENV explosives data did include limited (DNTs) explosives data as part of the SVOC analysis. Because potential explosives disposed of at the WSA may include a broader spectrum of compounds than those likely to be found at some sites in the ISA where activities focused on certain end products containing NTs (e.g., a TNT manufacturing plant, for example), the uncertainty regarding non-NT data is more significant in this sub-area. An additional 43 explosives samples were collected as part of recent Feasibility Study activities, of which 40 were collected from LHAAP-17. The explosives 2,4-DNT, 2,6-DNT, and TNT were selected in the BERA as ecological COCs for the WSA.

To improve the level of confidence that the BERA conclusions for explosives are still valid for the WSA, the Army recommends collecting replacement samples for all of the rejected samples within the WSA, with the exception of LHAAP-17, which has more explosives data now – even after the removal of the ITS-ENV data – than it did in the BERA dataset due to the high number of samples collected after the BERA. This would result in a total of 12 new explosives samples in the WSA. Specific re-sampling recommendations are presented in Section 5.

5.0 SOIL DATA GAPS CONCLUSIONS

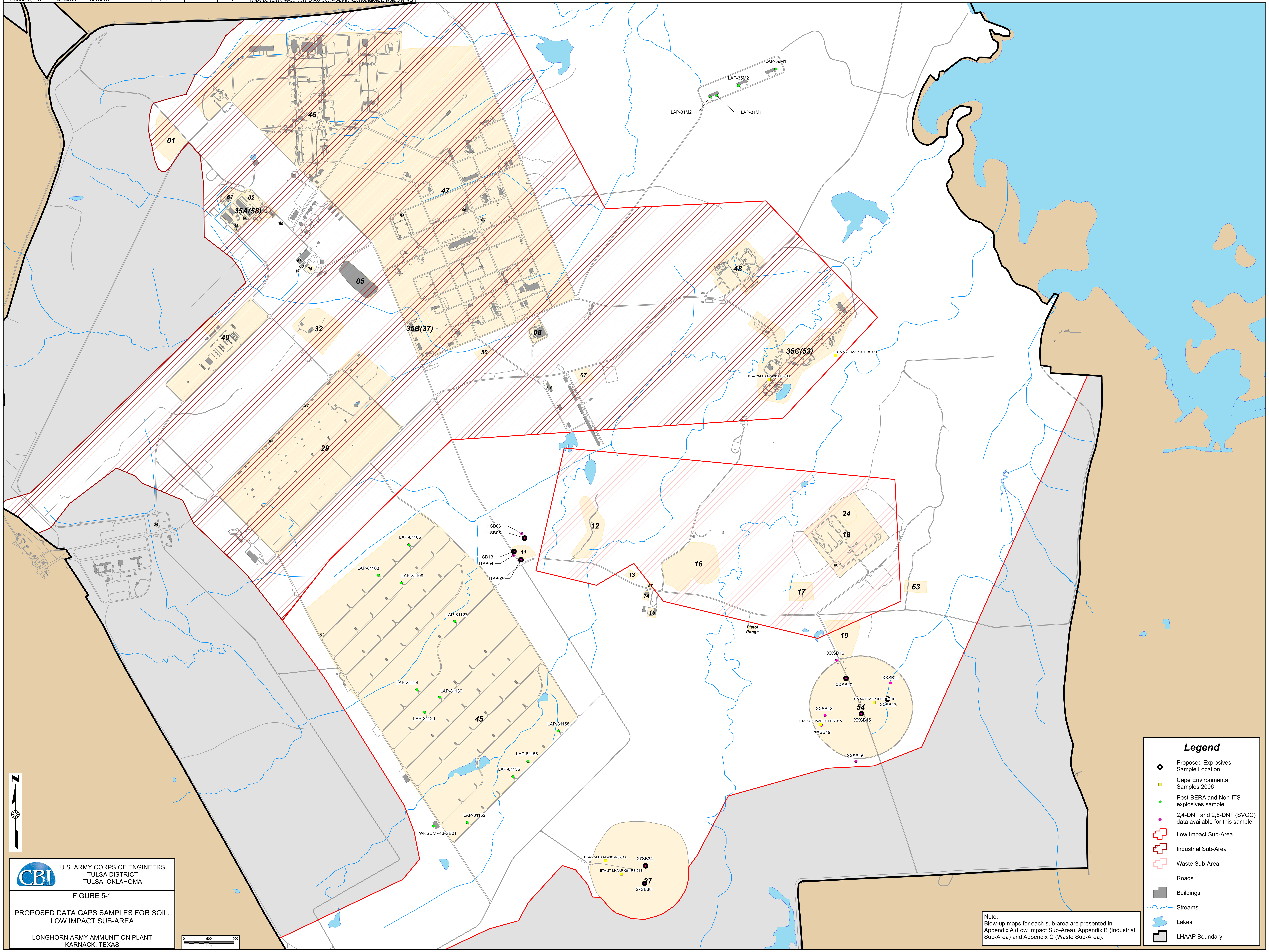
The recommendations presented in this memorandum are intended as a starting point for reaching consensus on the number and location of additional samples that will be collected to address data gaps caused by the elimination of the ITS-ENV data. The final recommended number and location codes for soil samples to replace the ITS-ENV data are presented in **Table 5-1**. A total of 16, 170, and 12 soil samples are proposed to be collected from the LISA, ISA, and WSA, respectively, and analyzed for explosives compounds. Replacement sample locations were selected from the pool of locations with ITS-ENV data removed. Preference for replacement was given to those samples that lost full suites of explosives data and that lacked limited SVOC explosives data. Preference was also given to replacing samples that either previously had detectable levels of explosives in the rejected ITS-ENV data set, or that were near to other locations that had previously detected explosives. After reviewing the BERA dataset, four sample locations (29SB02, 32SB02, 32SB05, and LH-S42-01) that were previously proposed as replacement samples in the Draft version were replaced by four different locations (29SB08, 32SS03, 32SS04, and 46SD02) that contained detectable levels of explosives in rejected samples. No other changes in the replacement sample list were considered necessary. These replacement samples are presented in **Figure 5-1** (LISA), **Figure 5-2** (ISA), and **Figure 5-3** (WSA) for the three sub-areas. These sample locations are also depicted at larger scales in **Appendix A** (LISA), **Appendix B** (ISA), and **Appendix C** (WSA).

A full description of the sampling methodology will be presented in a formal Work Plan, which will be submitted following approval of the soil and surface water/sediment Data Gap memoranda. The rationale for sample number and location will reference this Data Gap memorandum, and the Work Plan will summarize these recommendations and conclusions. New explosives soil sample results obtained from this data gaps effort will be used to revisit the BERA conclusions, based on, but not limited to, a comparison of EPCs presented in the BERA with EPCs generated using the new sample results. The results of this analysis will be presented in a BERA Addendum Report.

Table 5-1. Proposed Replacement Samples to Address Data Gaps in Soil for the Baseline Ecological Risk Assessment

Site	Number of Surface Soil (0-0.5 feet) Samples	Number of Suburface Soil (0.5-3 feet) Samples	Total Number of Samples	Proposed Replacement Sample Locations
Low Impact Sub-Area				
LHAAP-11	3	3	6	11SB03, 11SB05, 11SD13
LHAAP-27	2	2	4	27SB34, 27SB38
LHAAP-54	3	3	6	XXSB15, XXSB17, XXSB20
		LISA Total:	**16**	
Industrial Sub-Area				
LHAAP-01	5	5	10	01A-SB02, 01A-SB04, 01-SD09, 01SB23, 01SB28
LHAAP-04	2	2	4	LHSMW01, LHSMW02
LHAAP-08	0	0	0	NA
LHAAP-29	12	12	24	29SD01, 29SB05, 29SB07, 29SB08, 29SB09, 29SB11, 29SD10, 29WL02, 29SB14, 29SB15, 29SB12, 29SB13
LHAAP-32	8	8	16	32SB13, , 32SB03, 32SB06, 32SB14, 32SS03, 32SS04, 32WL01, 32SD06
LHAAP-35A (58)	5	5	10	LH-S723-01, LH-S111-01, LH-S112-01, LH-S113-01, LH-S117-01
LHAAP-35B (37)	0	0	0	NA
LHAAP-35C (53)	5	5	10	LHSMW67, LHSMW68, LHSMW69, LHSMW70, LHSMW71
LHAAP-46	20	20	40	LH-S30-01, LH-S32-01, LH-S14-02, LH-S16-01, LH-S22-01, LH-S27-01, LH-S05-01, LH-S29-01, LH-S026-01, LH-S025-01, LH-S19-01, LH-S021-01, LH-S43-01, LH-S41-01, LH-S08-01, LH-S06-01, LH-S12-01, LH-S10-01, LH-S11-01, 46SD02
LHAAP-47	23	23	46	LH-S93-01, LH-S92-01, LH-S88-01, LH-S89-02, LH-S86-01, LH-S83-01, LH-S82-01, LH-S73-01, LH-DL74-01, LH-DL75-01, LH-S77-01, LH-S71-01, LH-S61-01, LH-S59-01, LH-S58-01, LH-S55-01, LH-S121-01, LH-S44-01, H-DL45-01, LH-S47-01, LH-S49-01, LH-S48-01, LH-S50-01
LHAAP-48	5	5	10	LH-S94-01, LH-S95-01, LH-S97-01, LH-S98-01, LH-S100-01
LHAAP-49	0	0	0	NA
LHAAP-50	0	0	0	NA
LHAAP-60	0	0	0	NA
LHAAP-67	0	0	0	NA
		ISA Total:	**170**	
Waste Sub-Area				
LHAAP-12	4	1	5	12SB01 (DS), 12WW05 (SS), 12WW01 (SS), 12WW02 (SS), 12WW07 (SS)
LHAAP-16	1	0	1	16SD02 (SS)
LHAAP-18	6	0	6	18SD03, 18SD04, 18SD05, 18SD06, 18SD07, 18SD08 (all SS)
		WSA Total:	**12**	
		TOTAL FOR ALL SUB-AREAS:	**198**	

OFFICE	DRAWN BY		CHECKED BY		APPROVED BY		FILE PATH
Houston, TX	B. Grod	5/15/13	- - -	--/--/--	- - -	--/--/--	T:\Divisions\Design\GIS\117591_LHAAP\Doc\Mxd\Bera\ProposedDataGapsLisaSamples.mxd



CB&I

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

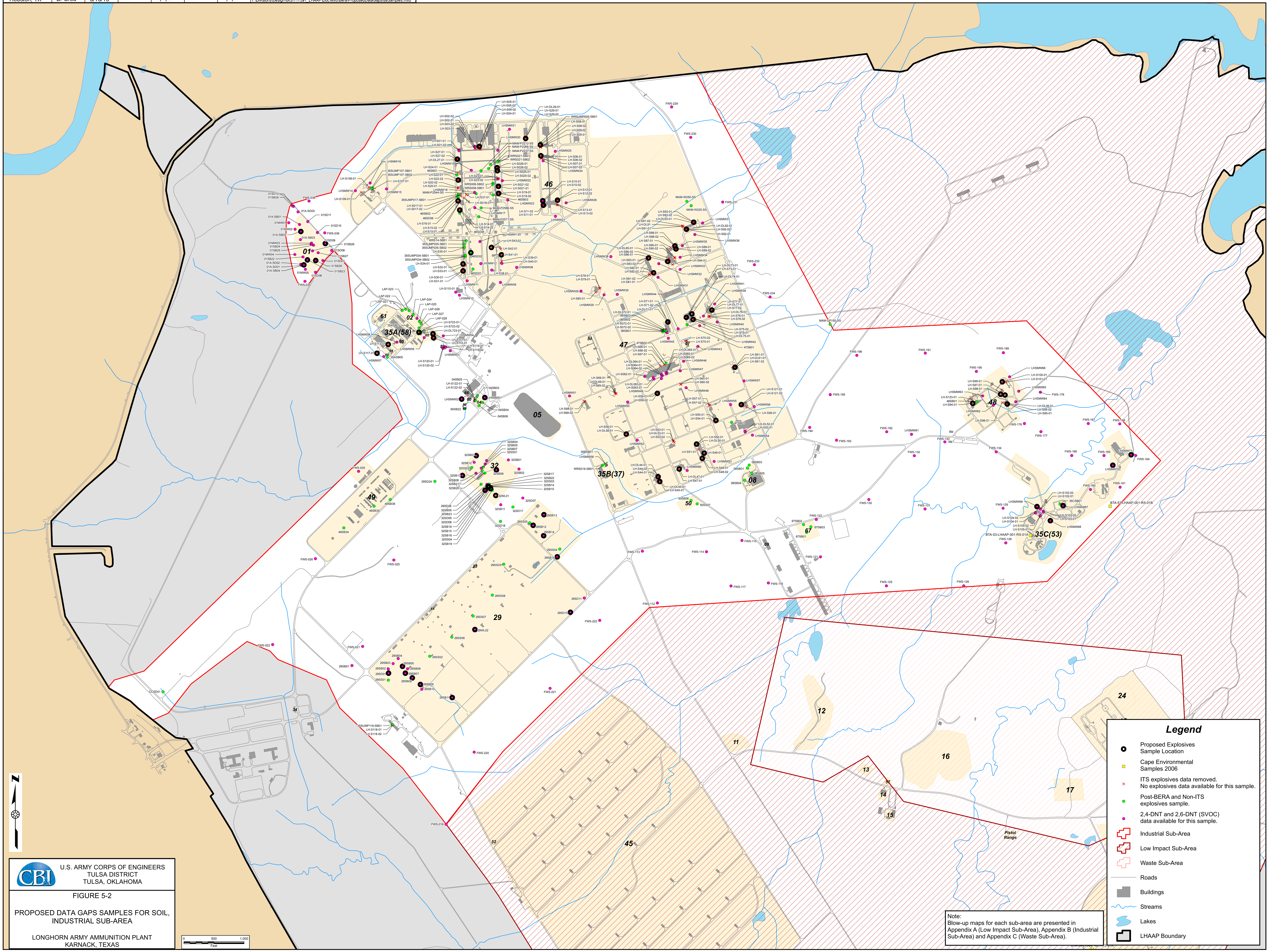
FIGURE 5-1

PROPOSED DATA GAPS SAMPLES FOR SOIL, LOW IMPACT SUB-AREA

LONGHORN ARMY AMMUNITION PLANT
KARNACK, TEXAS

00188046

OFFICE	DRAWN BY		CHECKED BY		APPROVED BY		FILE PATH
Houston, TX	B. Grod	5/15/13	- - -	--/--/--	- - -	--/--/--	T:\Divisions\Design\GIS\117591_LHAAP\Doc\Mxd\Bera\ProposedDataGapsIsaSamples.mxd



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

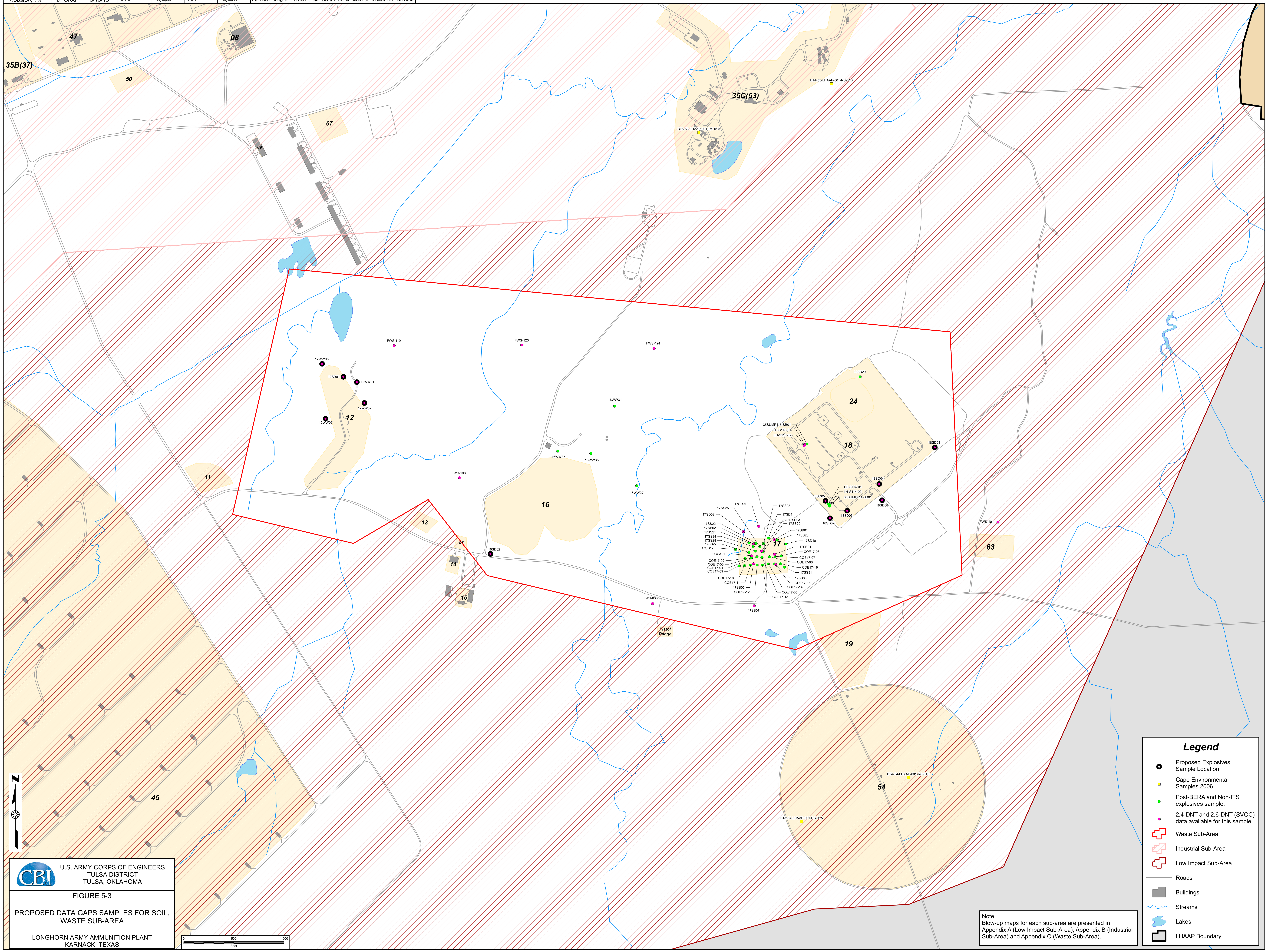
FIGURE 5-2

PROPOSED DATA GAPS SAMPLES FOR SOIL, INDUSTRIAL SUB-AREA

LONGHORN ARMY AMMUNITION PLANT
KARNACK, TEXAS

00188047

OFFICE	DRAWN BY		CHECKED BY		APPROVED BY		FILE PATH
Houston, TX	B. Grod	5/15/13	- - -	--/--/--	- - -	--/--/--	T:\Divisions\Design\GIS\117591_LHAAP\Doc\Mxd\Bera\ProposedDataGapsWsaSamples.mxd



Note:
Blow-up maps for each sub-area are presented in Appendix A (Low Impact Sub-Area), Appendix B (Industrial Sub-Area) and Appendix C (Waste Sub-Area).

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

FIGURE 5-3

PROPOSED DATA GAPS SAMPLES FOR SOIL, WASTE SUB-AREA

LONGHORN ARMY AMMUNITION PLANT
KARNACK, TEXAS

6.0 REFERENCES

AGEISS, 2013, Data Gap Memorandum for Explosives in Sediment and Surface Water at the Longhorn Army Ammunition Plant, Karnack, Texas, Denver, CO.

Jacobs, 2001a, Final Ecological Risk Assessment, A Supplement to the Remedial Investigation Report Site 16 Landfill, Longhorn Army Ammunition Plant, Karnack, Texas, Oak Ridge, TN.

Jacobs, 2001b, Final Remedial Investigation Report for the Group 2 Sites, Longhorn Army Ammunition Plant, Karnack, Texas, Oak Ridge, TN, April.

Jacobs, 2002, Final Baseline Human Health and Ecological Risk Assessment Report for the Group 2 Sites, Longhorn Army Ammunition Plant, Karnack, Texas, Oak Ridge, TN.

Jacobs, 2003, Final Baseline Human Health and Ecological Risk Assessment Report for the Group 4 Sites, Longhorn Army Ammunition Plant, Karnack, Texas, Oak Ridge, TN.

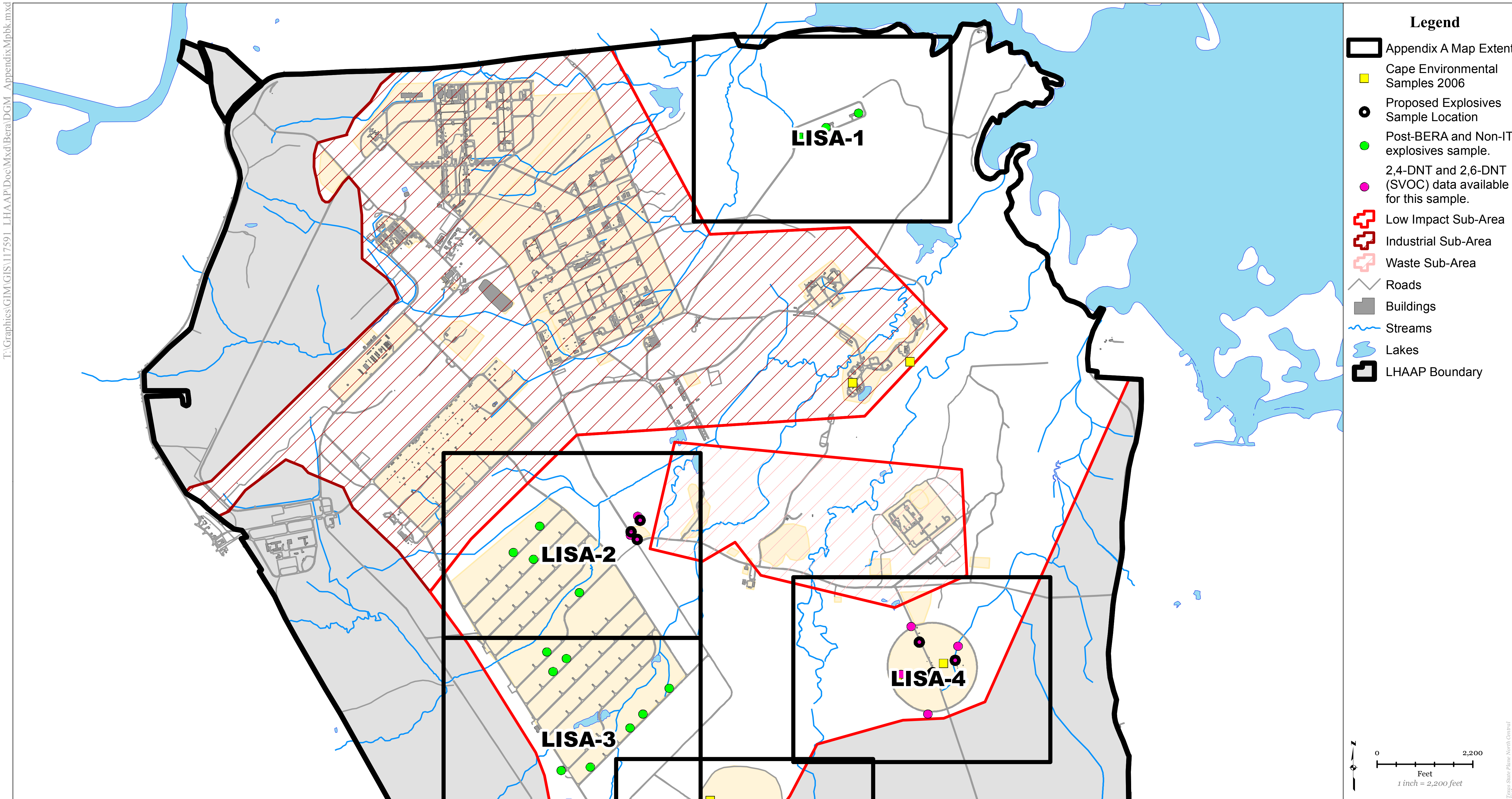
Plexus, 2005, Final Environmental Site Assessment, Phase I and Phase II Report, Production Areas, Longhorn Army Ammunition Plan, Karnack, Texas, Columbia, Maryland, February.

Shaw, 2007, Final Installation-Wide Baseline Ecological Risk Assessment, Longhorn Army Ammunition Plant, Karnack, Texas, Houston, Texas, November.

Shaw, 2011, Final Munitions Constituents Data Summary Report, South Test Area/Bomb Test Area, LHAAP-001-R and Ground Signal Test Area, LHAAP-003-R, Longhorn Army Ammunition Plant, Karnack, Texas, Houston, Texas, June.

APPENDIX A

Large Scale Maps of Low Impact Sub-Area Sample Locations

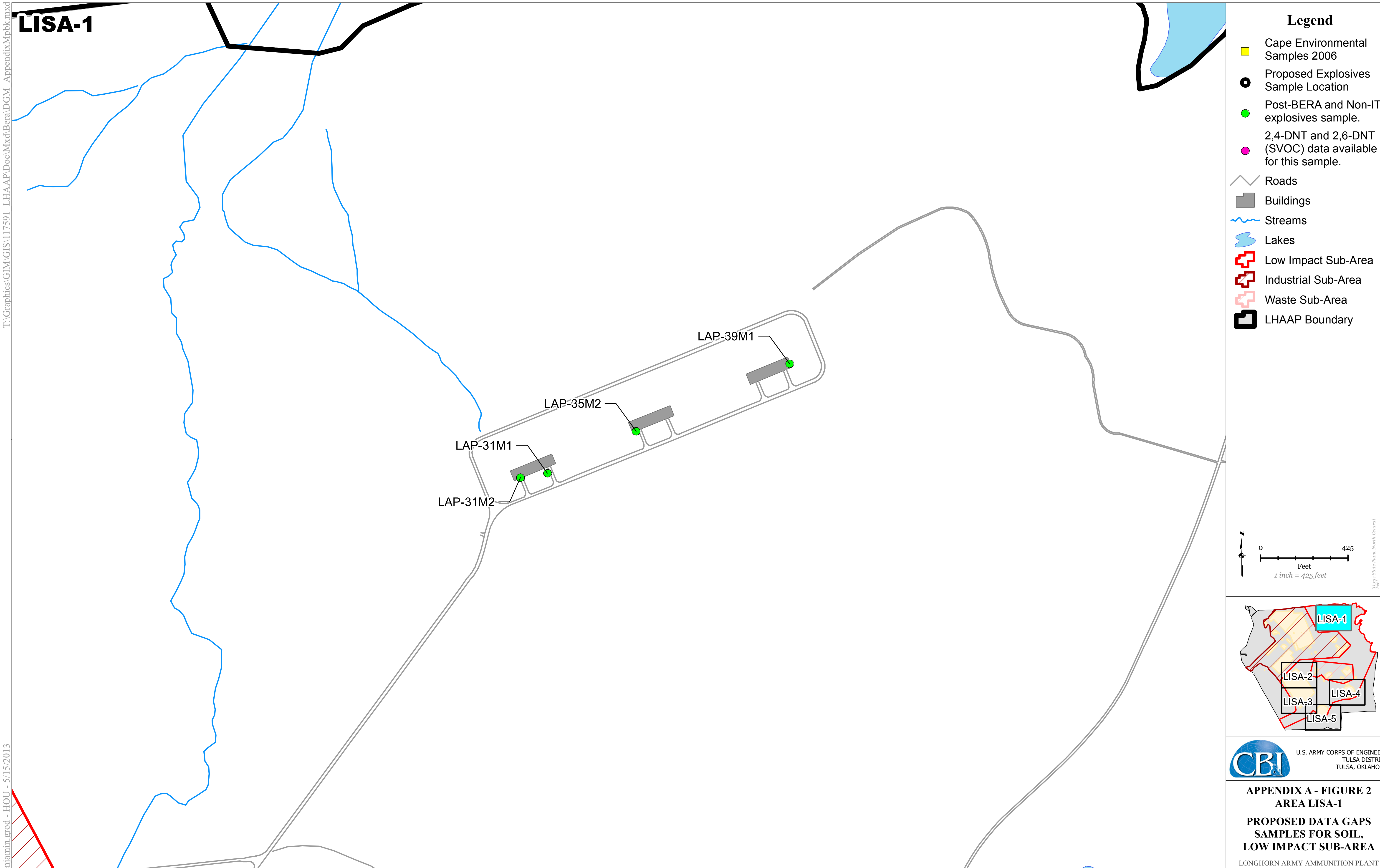


U.S. ARMY CORPS OF ENGINEERS
TULSA DISTRICT
TULSA, OKLAHOMA

APPENDIX A
FIGURE 1
OVERVIEW MAP
PROPOSED DATA GAPS SAMPLES FOR SOIL, LOW IMPACT SUB-AREA
LONGHORN ARMY AMMUNITION PLANT
KARNACK, TEXAS

T:\Graphics\GIM\GIS\117591_LHAAP\Doc\Mxd\Bera\DGM_AppendixMpbk.mxd

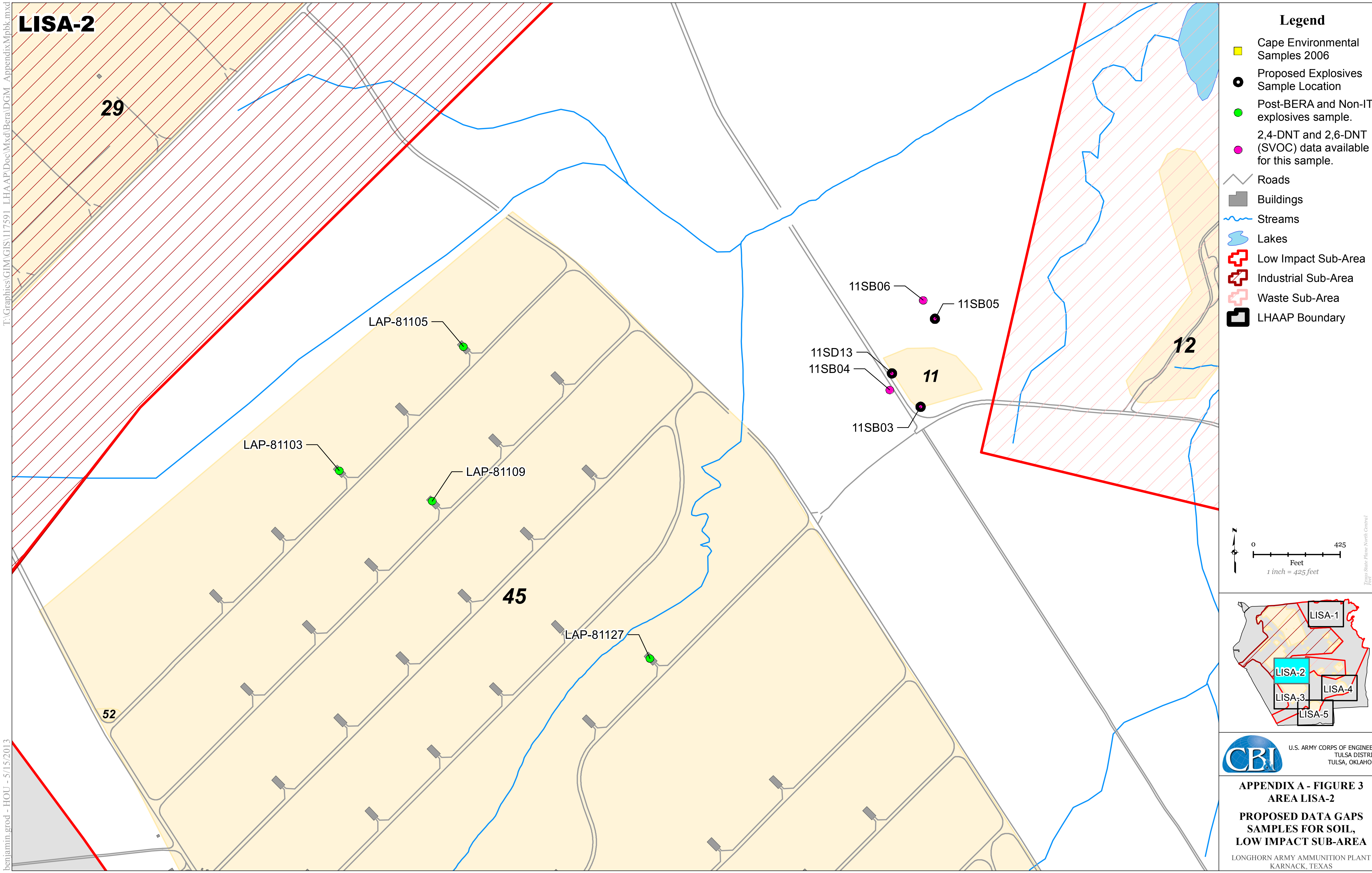
benjamin.grod - HOU - 5/15/2013



T:\Graphics\GIM\GIS\117591_LHAAP\Doc\Mxd\Bera\DGM_AppendixMpbk.mxd

benjamin.grod - HOU - 5/15/2013

00188052

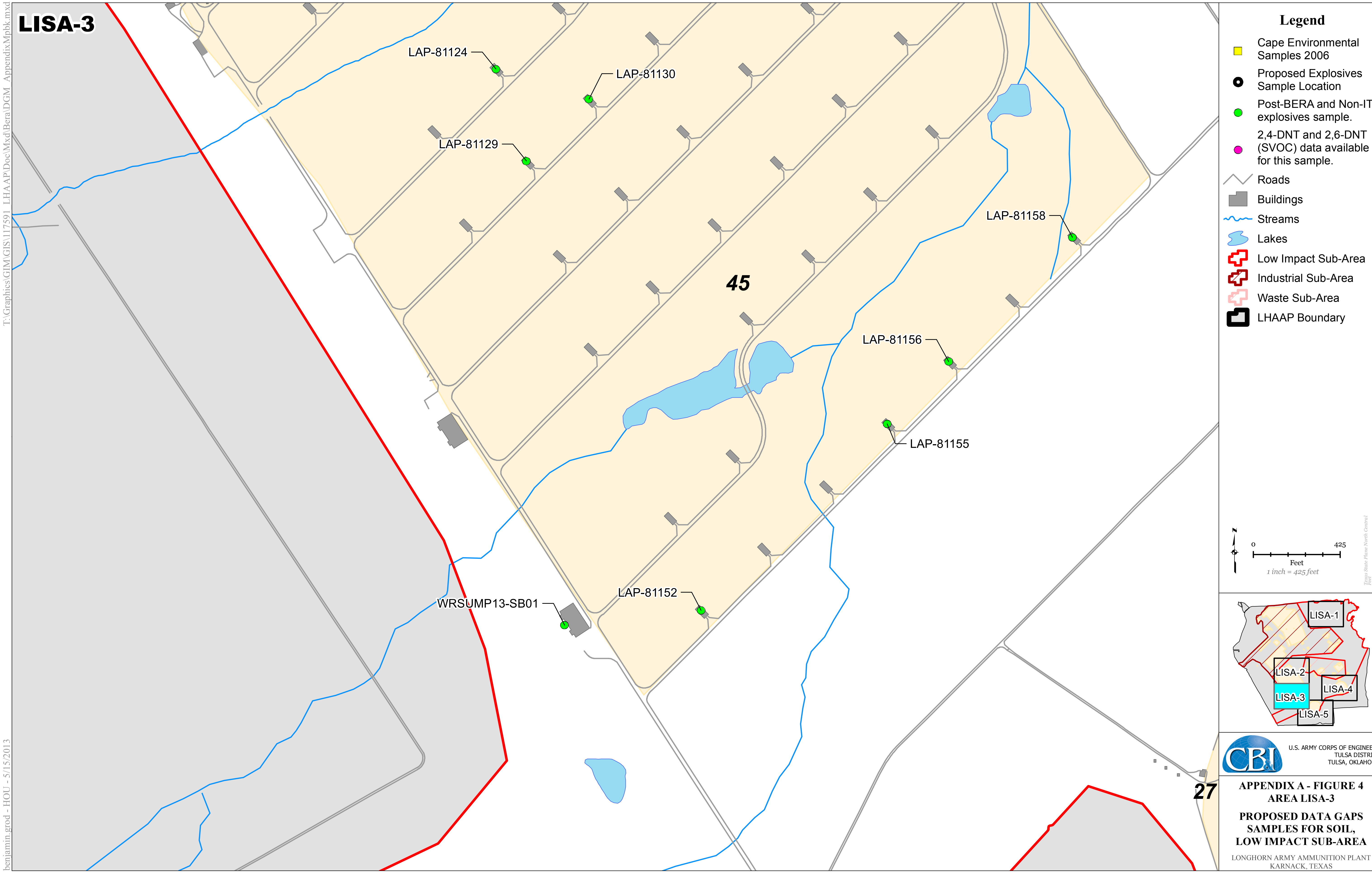


U.S. ARMY CORPS OF ENGINEERS
TULSA DISTRICT
TULSA, OKLAHOMA

APPENDIX A - FIGURE 3
AREA LISA-2

PROPOSED DATA GAPS SAMPLES FOR SOIL, LOW IMPACT SUB-AREA

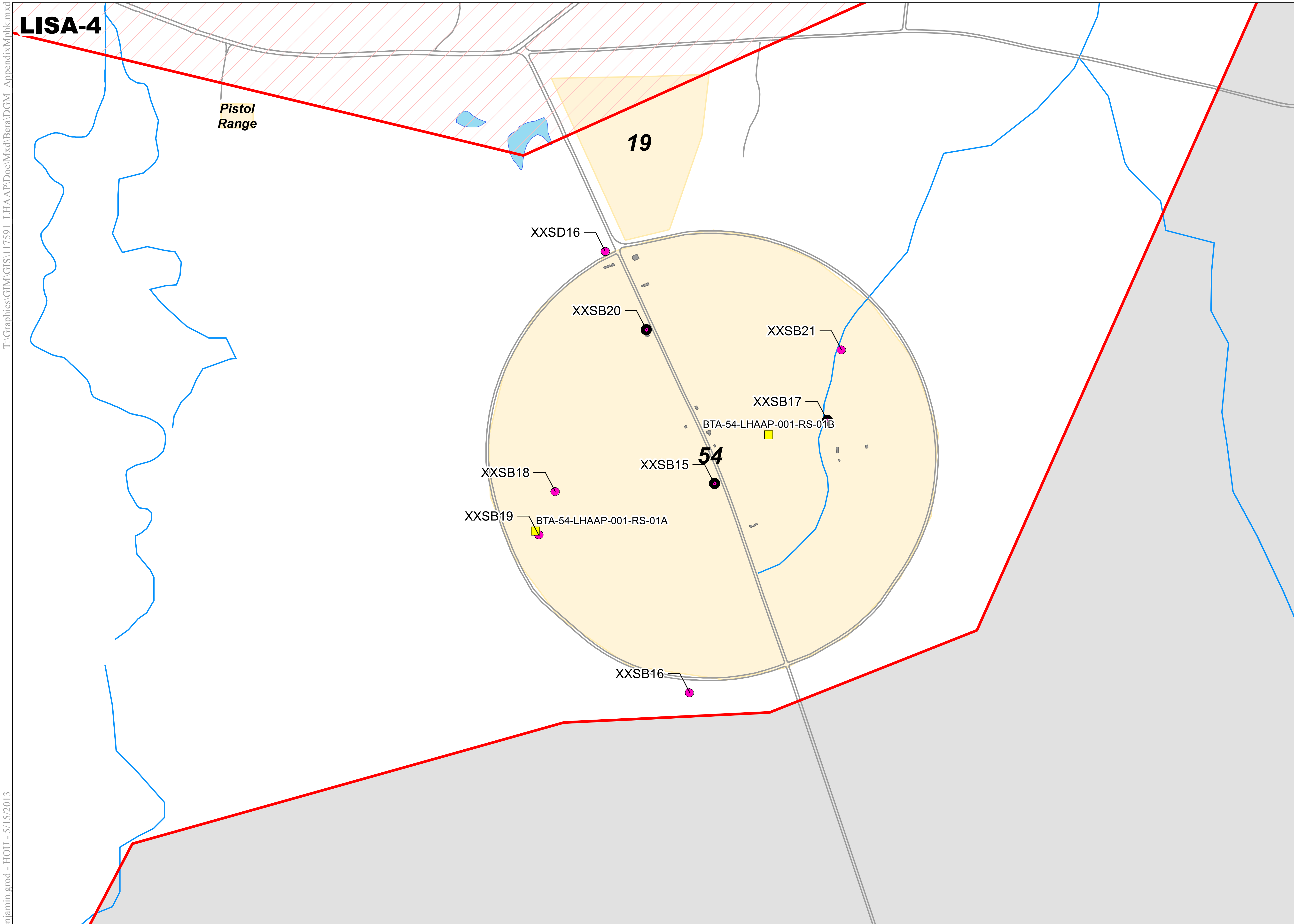
LONGHORN ARMY AMMUNITION PLANT
KARNACK, TEXAS



APPENDIX A - FIGURE 4
AREA LISA-3

PROPOSED DATA GAPS SAMPLES FOR SOIL, LOW IMPACT SUB-AREA

LONGHORN ARMY AMMUNITION PLANT
KARNACK, TEXAS



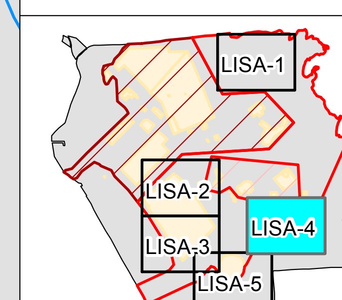
Legend

- Cape Environmental Samples 2006
- Proposed Explosives Sample Location
- Post-BERA and Non-ITS explosives sample.
- 2,4-DNT and 2,6-DNT (SVOC) data available for this sample.
- Roads
- Buildings
- Streams
- Lakes
- Low Impact Sub-Area
- Industrial Sub-Area
- Waste Sub-Area
- LHAAP Boundary

N

0 425
Feet
1 inch = 425 feet

Texas State Plane North Central Feet



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

APPENDIX A - FIGURE 5
AREA LISA-4

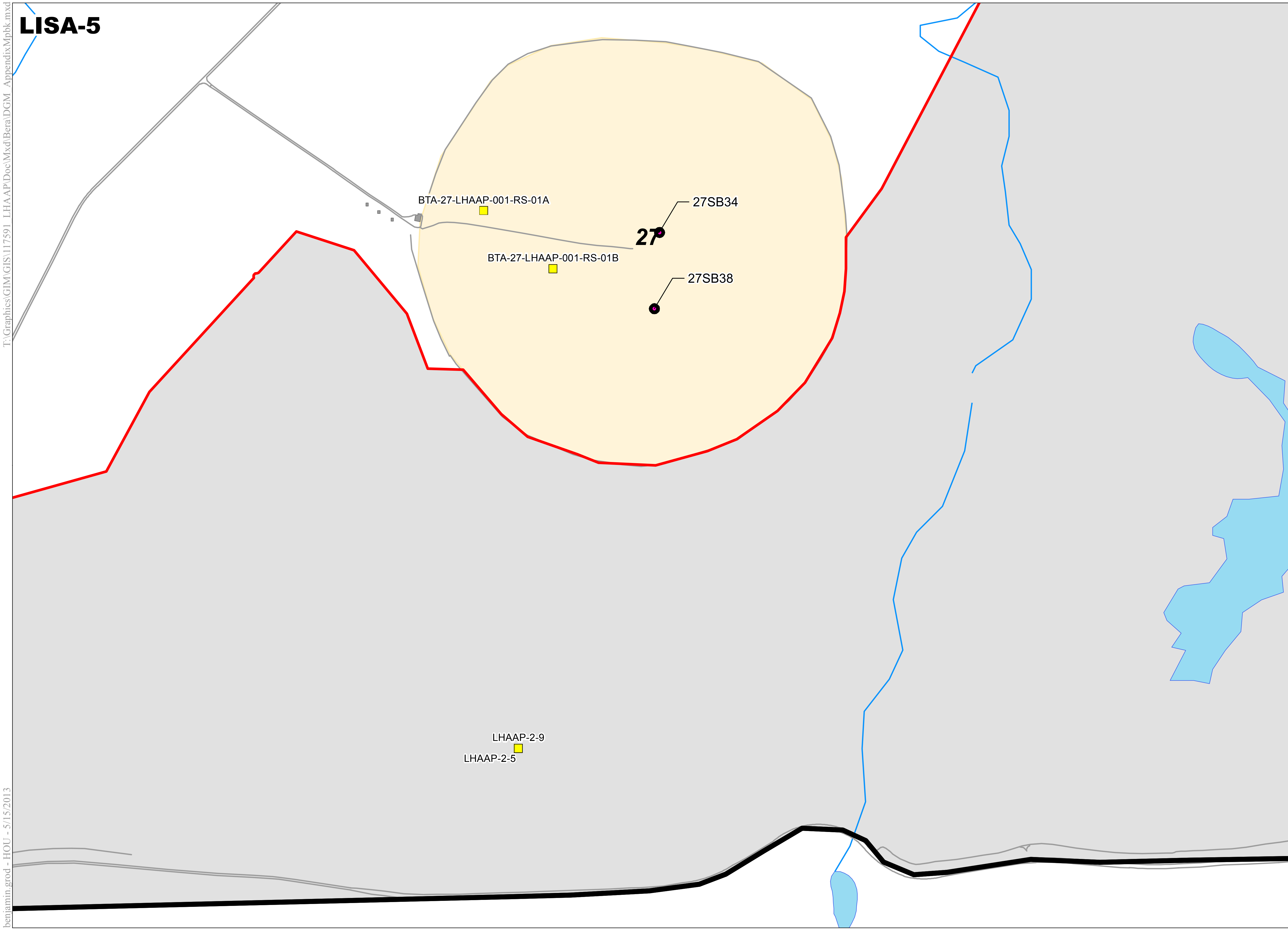
PROPOSED DATA GAPS SAMPLES FOR SOIL, LOW IMPACT SUB-AREA

LONGHORN ARMY AMMUNITION PLANT
KARNACK, TEXAS

T:\Graphics\GIM\GIS\117591 LHAAP\Doc\Mxd\Bera\DGM AppendixMppk.mxd

benjamin.grod - HOU - 5/15/2013

00188055



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

APPENDIX A - FIGURE 6
AREA LISA-5

PROPOSED DATA GAPS SAMPLES FOR SOIL, LOW IMPACT SUB-AREA

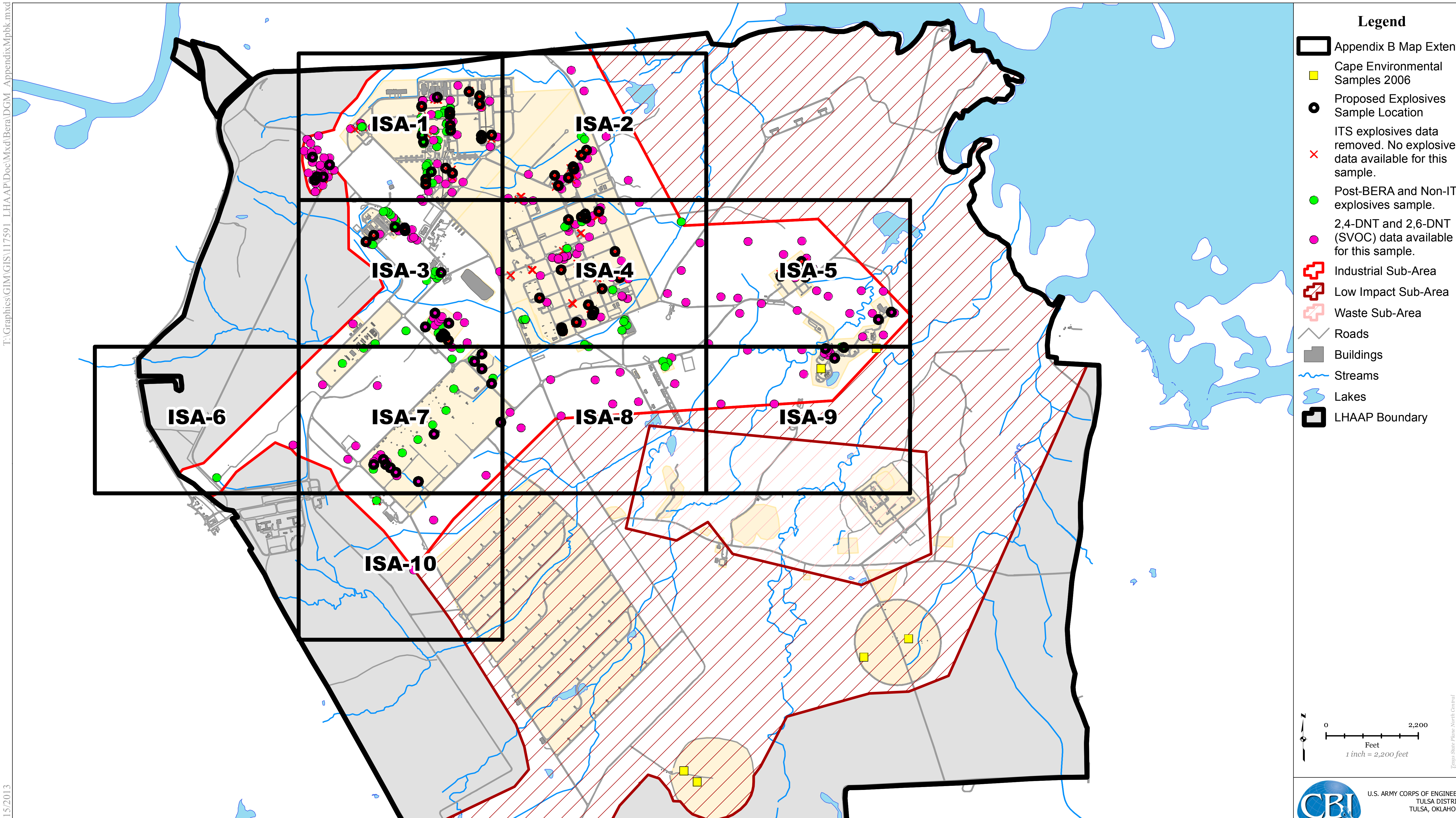
LONGHORN ARMY AMMUNITION PLANT
KARNACK, TEXAS

T:\Graphics\GIM\GIS\117591 LHAAP\Doc\Mxd\Bera\DGM AppendixMpbk.mxd

benjamin.grod - HOU - 5/15/2013

APPENDIX B

Large Scale Maps of Industrial Sub-Area Sample Locations

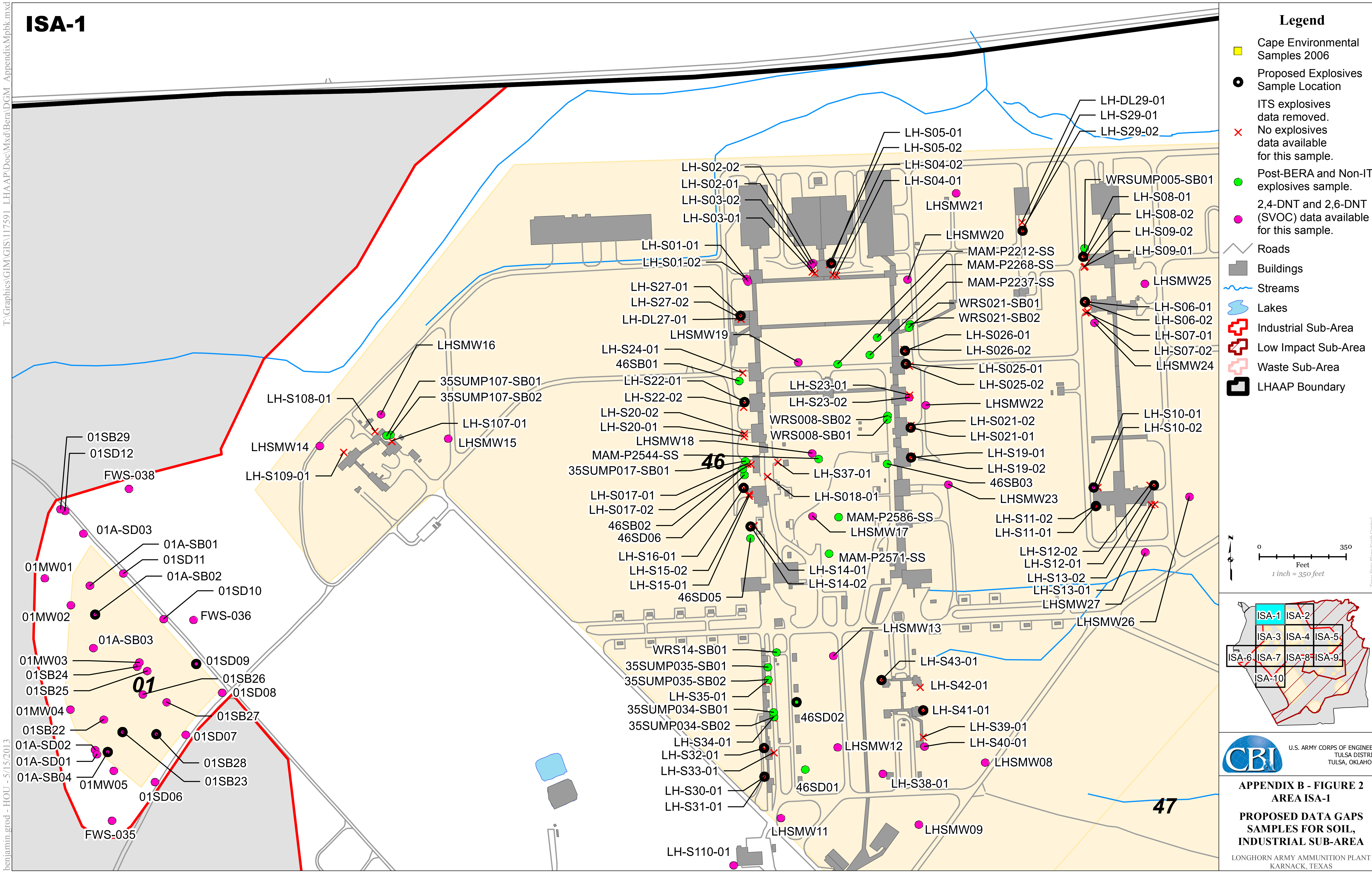


APPENDIX B
FIGURE 1
OVERVIEW MAP
PROPOSED DATA GAPS SAMPLES FOR SOIL, INDUSTRIAL SUB-AREA
LONGHORN ARMY AMMUNITION PLANT
KARNACK, TEXAS

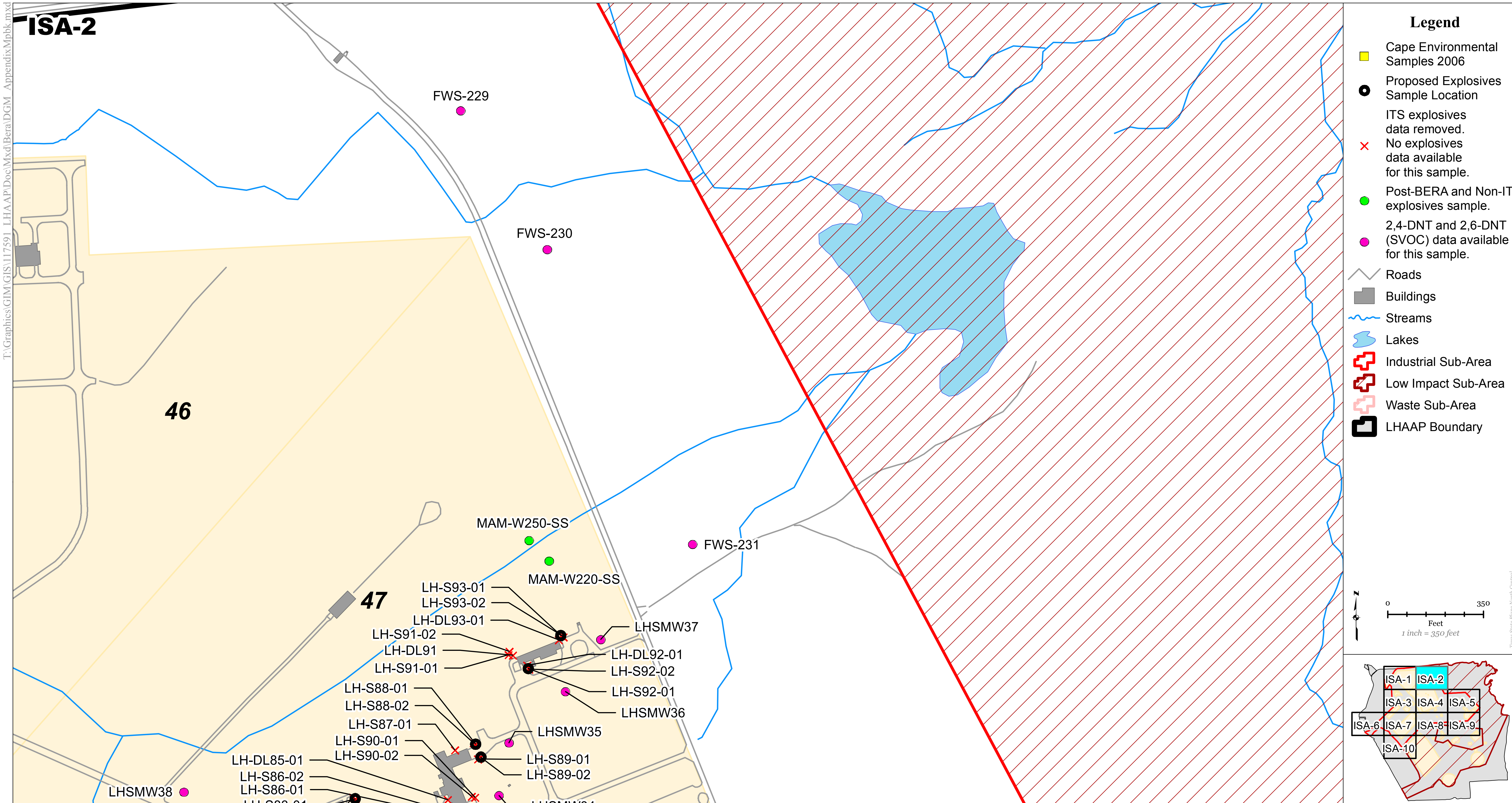
T:\Graphics\GIM\GIS\117591_LHAAP\Doc\Mxd\Bera\DGM_AppendixMpbk.mxd

benjamin.grod - HOU - 5/15/2013

00188058


ISA-1
Legend
Cape Environmental Samples 2006
Proposed Explosives Sample Location
ITS explosives data removed. No explosives data available for this sample.
Post-BERA and Non-ITS explosives sample.
2,4-DNT and 2,6-DNT (SVOC) data available for this sample.
Roads
Buildings
Streams
Lakes
Industrial Sub-Area
Low Impact Sub-Area
Waste Sub-Area
LHAAP Boundary
Feet
1 inch = 350 feet
ISA-1
ISA-2
ISA-3
ISA-4
ISA-5
ISA-6
ISA-7
ISA-8
ISA-9
ISA-10
46
47
01
LH-DL29-01
LH-S29-01
LH-S29-02
LH-S05-01
LH-S05-02
LH-S04-02
LH-S04-01
LH-S02-02
LH-S02-01
LH-S03-02
LH-S03-01
LHSMW21
LHSMW20
LH-S01-01
LH-S01-02
MAM-P2212-SS
MAM-P2268-SS
MAM-P2237-SS
WRSUMP005-SB01
LH-S08-01
LH-S08-02
LH-S09-02
LH-S09-01
LHSMW25
LH-S27-01
LH-S27-02
LH-DL27-01
LHSMW19
WRS021-SB01
WRS021-SB02
LH-S026-01
LH-S026-02
LH-S06-01
LH-S06-02
LH-S07-01
LH-S07-02
LHSMW24
LHSMW16
LH-S24-01
46SB01
LH-S025-01
LH-S025-02
35SUMP107-SB01
35SUMP107-SB02
LH-S108-01
LH-S22-01
LH-S22-02
LH-S23-01
LH-S23-02
LHSMW22
LH-S10-01
LH-S10-02
LH-S107-01
LH-S20-02
LH-S20-01
WRS008-SB02
WRS008-SB01
LH-S021-02
LH-S021-01
LHSMW15
LHSMW14
LHSMW18
MAM-P2544-SS
LH-S19-01
LH-S19-02
LH-S109-01
35SUMP017-SB01
LH-S37-01
46SB03
LHSMW23
LH-S017-01
LH-S017-02
LH-S018-01
46SB02
46SD06
MAM-P2586-SS
LHSMW17
LH-S11-02
LH-S11-01
LH-S16-01
LH-S15-02
LH-S15-01
MAM-P2571-SS
LH-S14-01
LH-S14-02
LH-S12-02
LH-S12-01
LH-S13-02
LH-S13-01
LHSMW27
46SD05
LHSMW13
LHSMW26
01SB29
01SD12
FWS-038
01A-SD03
01A-SB01
01SD11
01A-SB02
01MW01
01SD10
01MW02
FWS-036
01A-SB03
01MW03
01SD09
01SB24
01SB26
01SB25
01SD08
01MW04
01SB27
01SB22
01SD07
01A-SD02
01A-SD01
01SB28
01A-SB04
01SB23
01MW05
01SD06
FWS-035
WRS14-SB01
35SUMP035-SB01
35SUMP035-SB02
LH-S35-01
35SUMP034-SB01
35SUMP034-SB02
46SD02
LH-S43-01
LH-S42-01
LH-S41-01
LH-S39-01
LH-S40-01
LH-S34-01
LH-S32-01
LH-S33-01
LHSMW12
LHSMW08
46SD01
LH-S38-01
LH-S30-01
LH-S31-01
LHSMW11
LHSMW09
LH-S110-01
CBI
U.S. ARMY CORPS OF ENGINEERS
TULSA DISTRICT
TULSA, OKLAHOMA
APPENDIX B - FIGURE 2
AREA ISA-1
PROPOSED DATA GAPS
SAMPLES FOR SOIL,
INDUSTRIAL SUB-AREA
LONGHORN ARMY AMMUNITION PLANT
KARNACK, TEXAS
T:\Graphics\GIM\GIS\117591 LHAAP\Doc\Mxd\Bera\DGM_AppendixMpbk.mxd
benjamin.grod - HOU - 5/15/2013

00188059



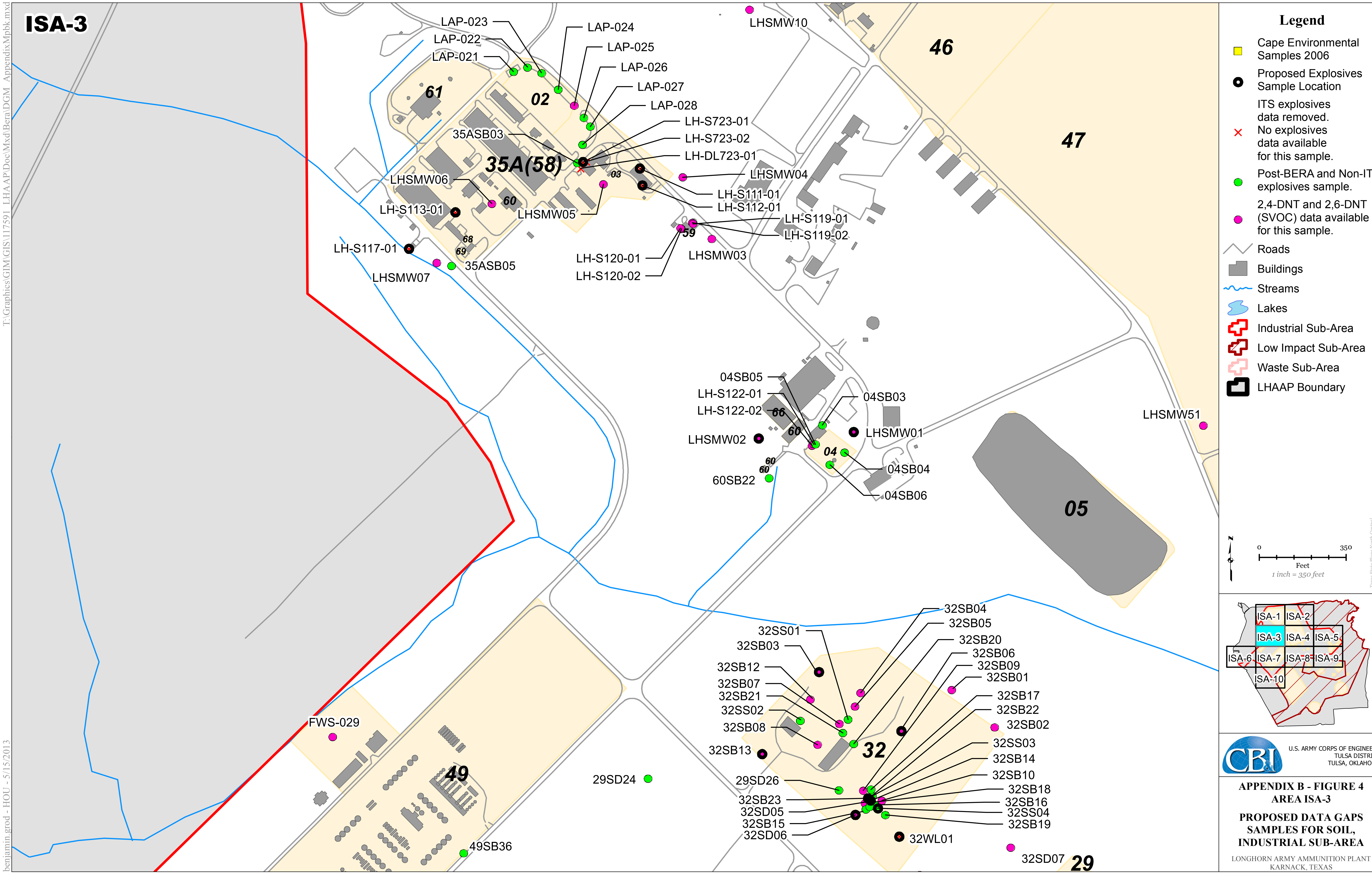
U.S. ARMY CORPS OF ENGINEERS
TULSA DISTRICT
TULSA, OKLAHOMA

APPENDIX B - FIGURE 3
AREA ISA-2

PROPOSED DATA GAPS SAMPLES FOR SOIL, INDUSTRIAL SUB-AREA

LONGHORN ARMY AMMUNITION PLANT
KARNACK, TEXAS

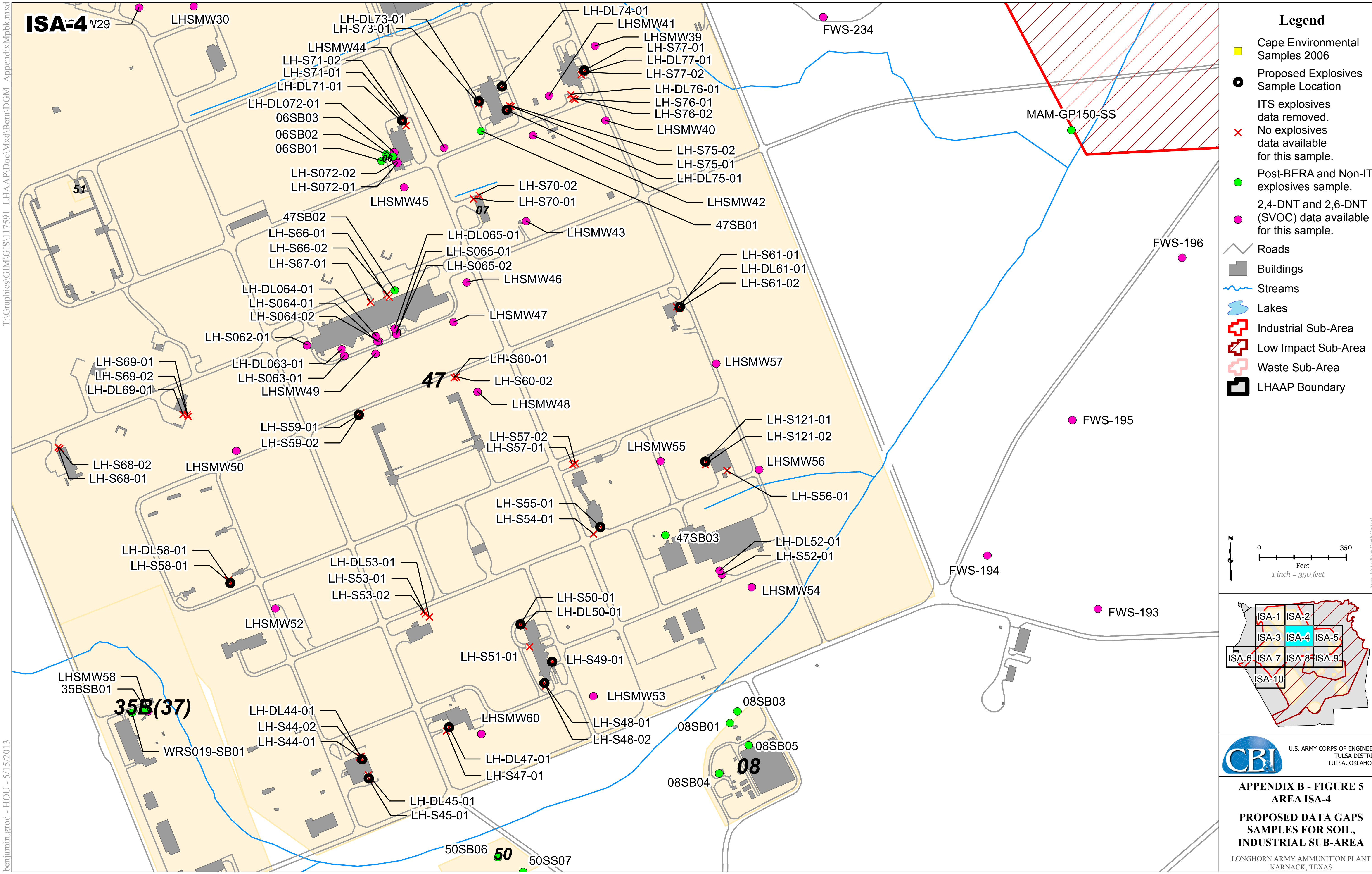
00188060



APPENDIX B - FIGURE 4
AREA ISA-3

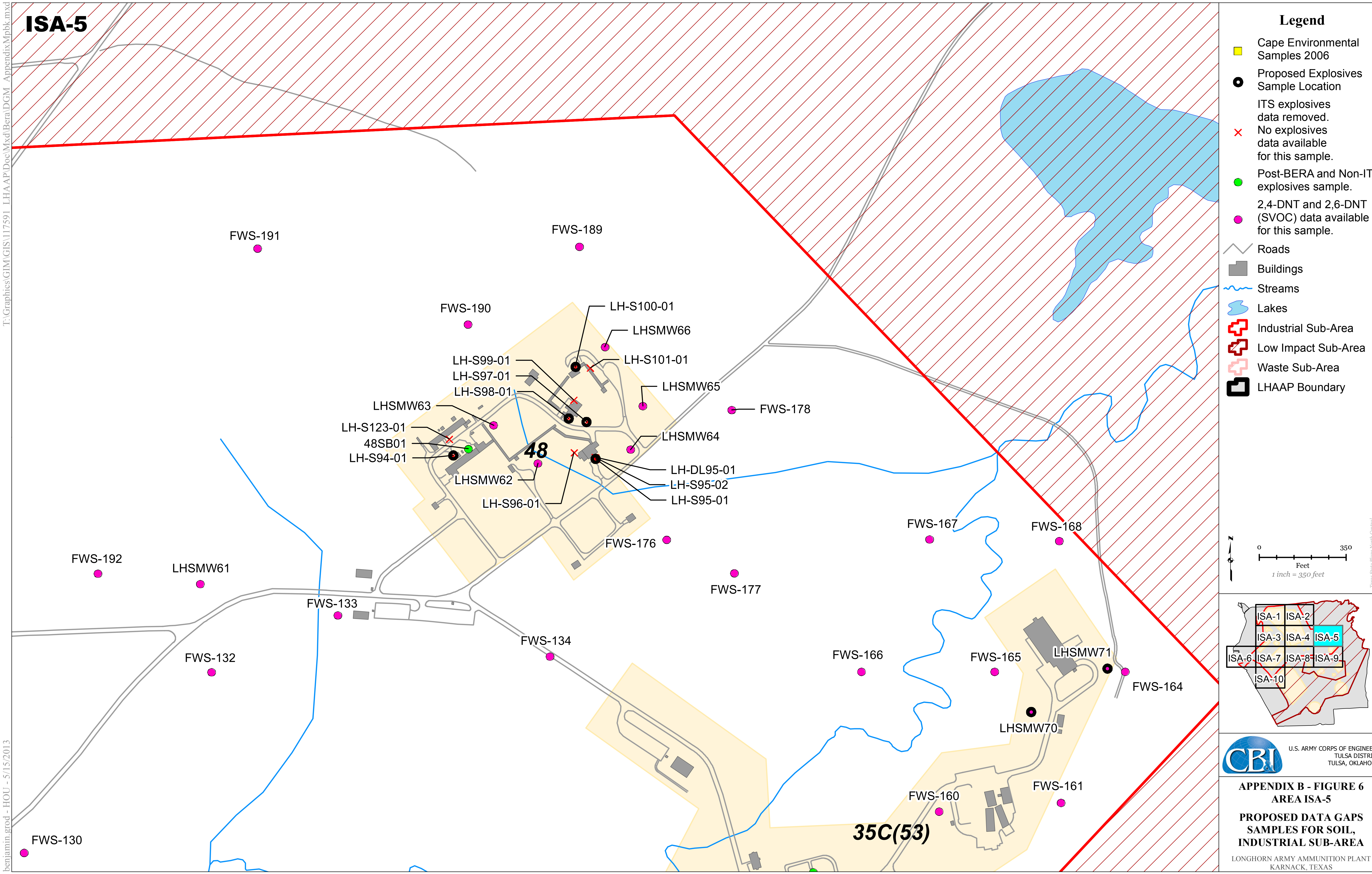
PROPOSED DATA GAPS SAMPLES FOR SOIL, INDUSTRIAL SUB-AREA

LONGHORN ARMY AMMUNITION PLANT
KARNACK, TEXAS



ISA-4
LHSMW30
LH-DL73-01
LH-S73-01
LH-DL74-01
LHSMW41
LHSMW39
LH-S77-01
LH-DL77-01
LH-S77-02
LH-DL76-01
LH-S76-01
LH-S76-02
LHSMW40
LH-S75-02
LH-S75-01
LH-DL75-01
LHSMW42
47SB01
LHSMW44
LH-S71-02
LH-S71-01
LH-DL71-01
LH-DL072-01
06SB03
06SB02
06SB01
06
LH-S072-02
LH-S072-01
LHSMW45
51
LH-S70-02
LH-S70-01
07
LHSMW43
47SB02
LH-S66-01
LH-S66-02
LH-S67-01
LH-DL065-01
LH-S065-01
LH-S065-02
LHSMW46
LH-DL064-01
LH-S064-01
LH-S064-02
LHSMW47
LH-S062-01
LH-S61-01
LH-DL61-01
LH-S61-02
LH-S69-01
LH-S69-02
LH-DL69-01
LH-DL063-01
LH-S063-01
LHSMW49
LH-S60-01
47
LH-S60-02
LHSMW48
LHSMW57
LH-S59-01
LH-S59-02
LH-S57-02
LH-S57-01
LHSMW55
LH-S121-01
LH-S121-02
LHSMW56
LH-S68-02
LH-S68-01
LHSMW50
LH-S56-01
LH-S55-01
LH-S54-01
47SB03
LH-DL52-01
LH-S52-01
LH-DL58-01
LH-S58-01
LH-DL53-01
LH-S53-01
LH-S53-02
LHSMW54
LH-S50-01
LH-DL50-01
LHSMW52
LH-S51-01
LH-S49-01
LHSMW58
35BSB01
35B(37)
LHSMW53
LH-S48-01
LH-S48-02
LH-DL44-01
LH-S44-02
LH-S44-01
LHSMW60
WRS019-SB01
LH-DL47-01
LH-S47-01
08SB03
08SB01
08SB05
08
08SB04
LH-DL45-01
LH-S45-01
50SB06
50
50SS07
FWS-234
MAM-GP150-SS
FWS-196
FWS-195
FWS-194
FWS-193
Legend
Cape Environmental Samples 2006
Proposed Explosives Sample Location
ITS explosives data removed. No explosives data available for this sample.
Post-BERA and Non-ITS explosives sample.
2,4-DNT and 2,6-DNT (SVOC) data available for this sample.
Roads
Buildings
Streams
Lakes
Industrial Sub-Area
Low Impact Sub-Area
Waste Sub-Area
LHAAP Boundary
0
350
Feet
1 inch = 350 feet
ISA-1
ISA-2
ISA-3
ISA-4
ISA-5
ISA-6
ISA-7
ISA-8
ISA-9
ISA-10
U.S. ARMY CORPS OF ENGINEERS
TULSA DISTRICT
TULSA, OKLAHOMA
APPENDIX B - FIGURE 5
AREA ISA-4
PROPOSED DATA GAPS
SAMPLES FOR SOIL,
INDUSTRIAL SUB-AREA
LONGHORN ARMY AMMUNITION PLANT
KARNACK, TEXAS
T:\Graphics\GIM\GIS\117591 LHAAP\Doc\Mxd\Bera\DGM_AppendixMpbk.mxd
benjamin.grod - HOU - 5/15/2013

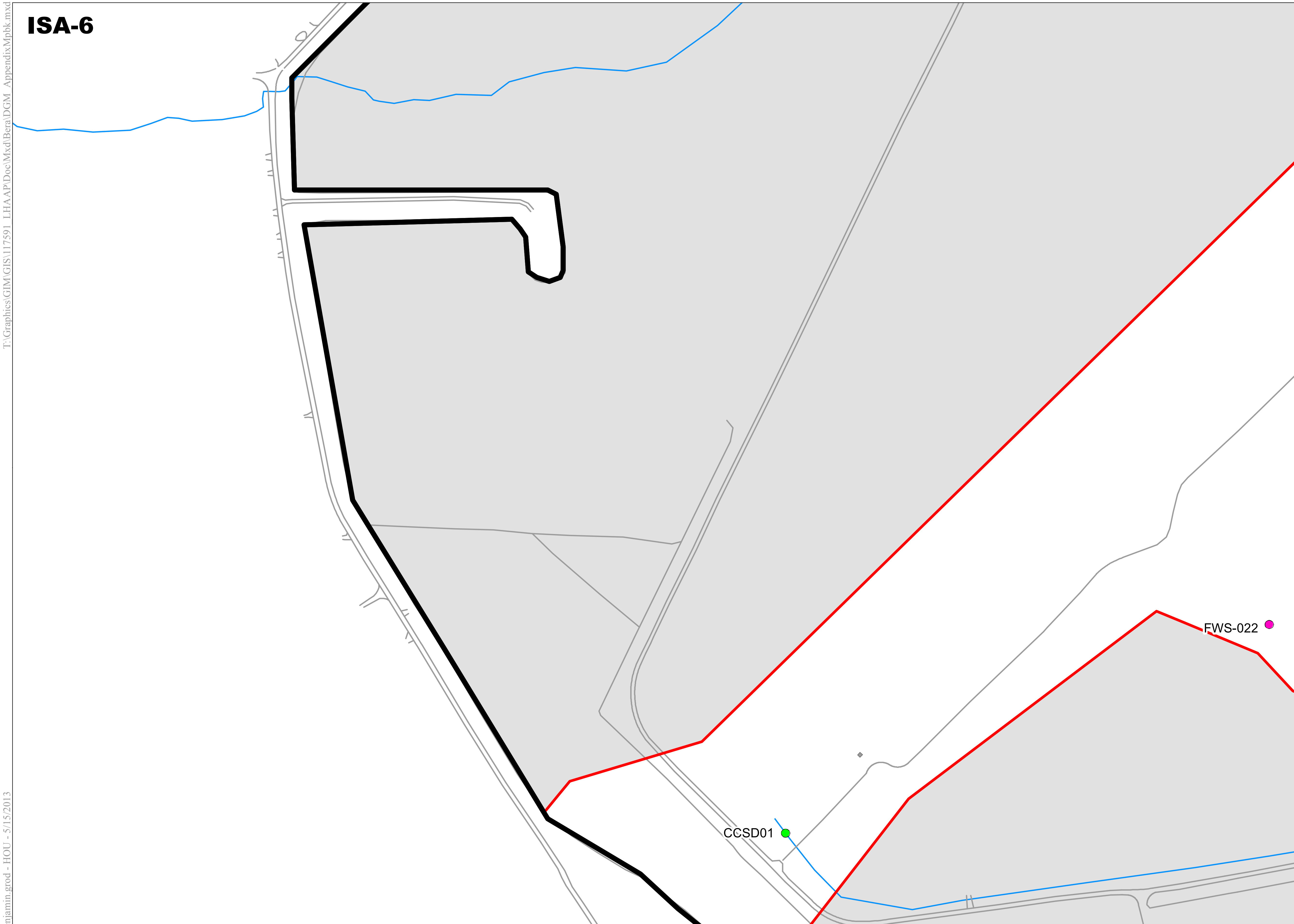
00188062



APPENDIX B - FIGURE 6
AREA ISA-5

PROPOSED DATA GAPS SAMPLES FOR SOIL, INDUSTRIAL SUB-AREA

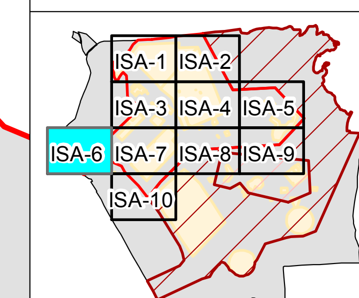
LONGHORN ARMY AMMUNITION PLANT
KARNACK, TEXAS



Legend

- Cape Environmental Samples 2006
- Proposed Explosives Sample Location
- ITS explosives data removed. No explosives data available for this sample.
- Post-BERA and Non-ITS explosives sample.
- 2,4-DNT and 2,6-DNT (SVOC) data available for this sample.
- Roads
- Buildings
- Streams
- Lakes
- Industrial Sub-Area
- Low Impact Sub-Area
- Waste Sub-Area
- LHAAP Boundary

0 350
Feet
1 inch = 350 feet
Texas State Plane North Central Feet



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

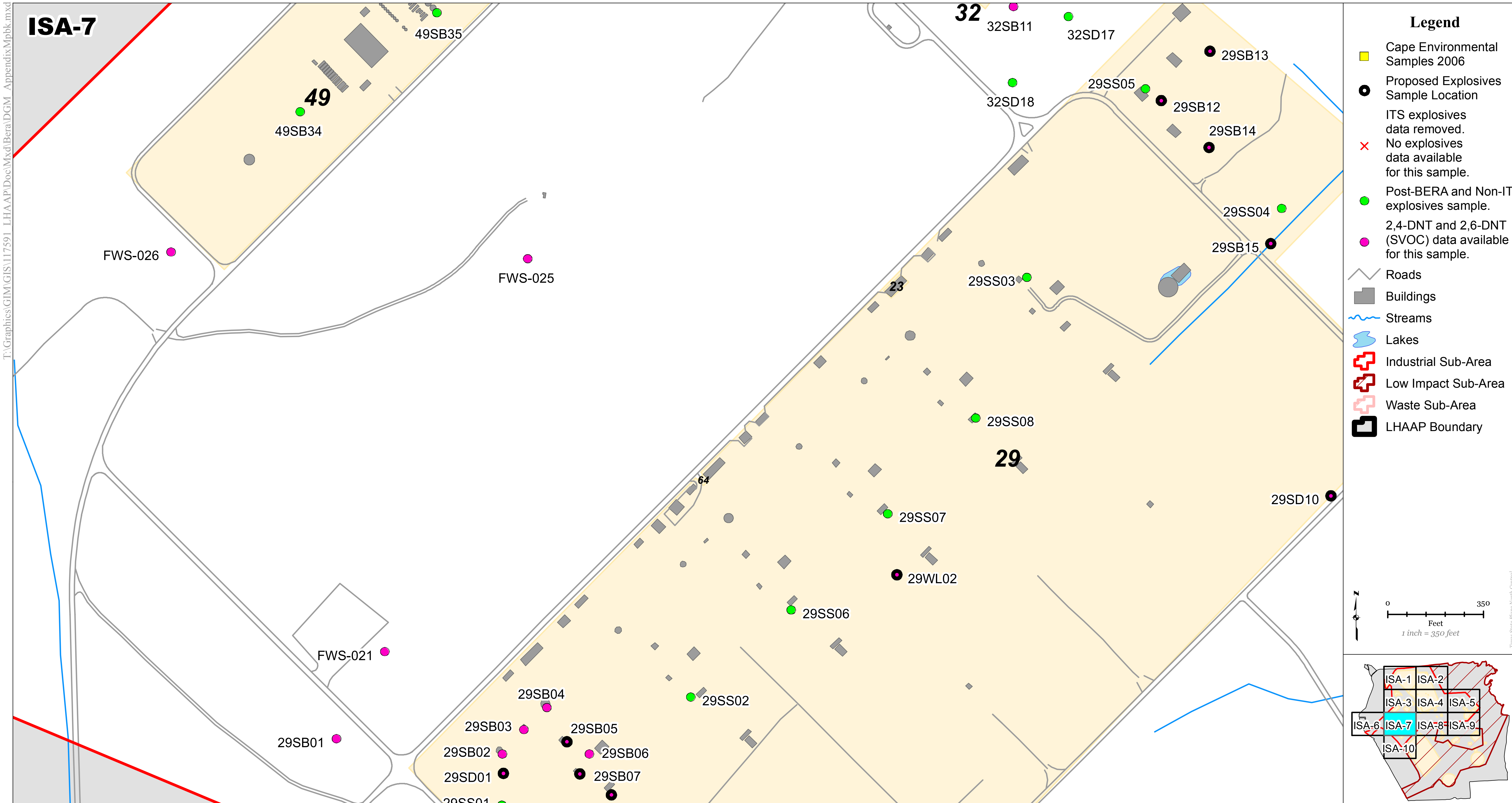
APPENDIX B - FIGURE 7
AREA ISA-6

PROPOSED DATA GAPS SAMPLES FOR SOIL, INDUSTRIAL SUB-AREA

LONGHORN ARMY AMMUNITION PLANT
KARNACK, TEXAS

T:\Graphics\GIM\GIS\117591_LHAAP\Doc\Mxd\Bera\DGM_AppendixMpbk.mxd

benjamin.grod - HOU - 5/15/2013

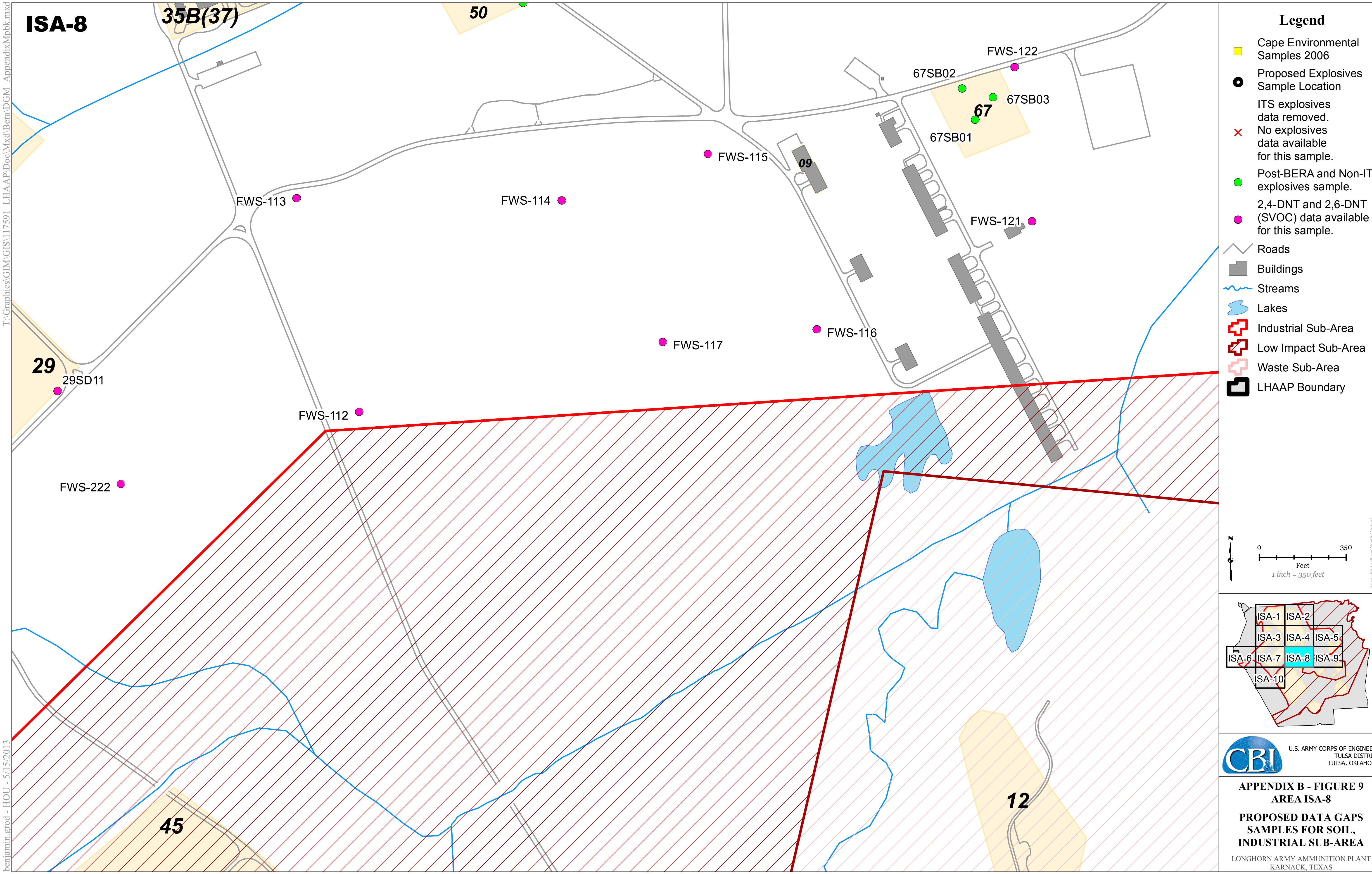


U.S. ARMY CORPS OF ENGINEERS
TULSA DISTRICT
TULSA, OKLAHOMA

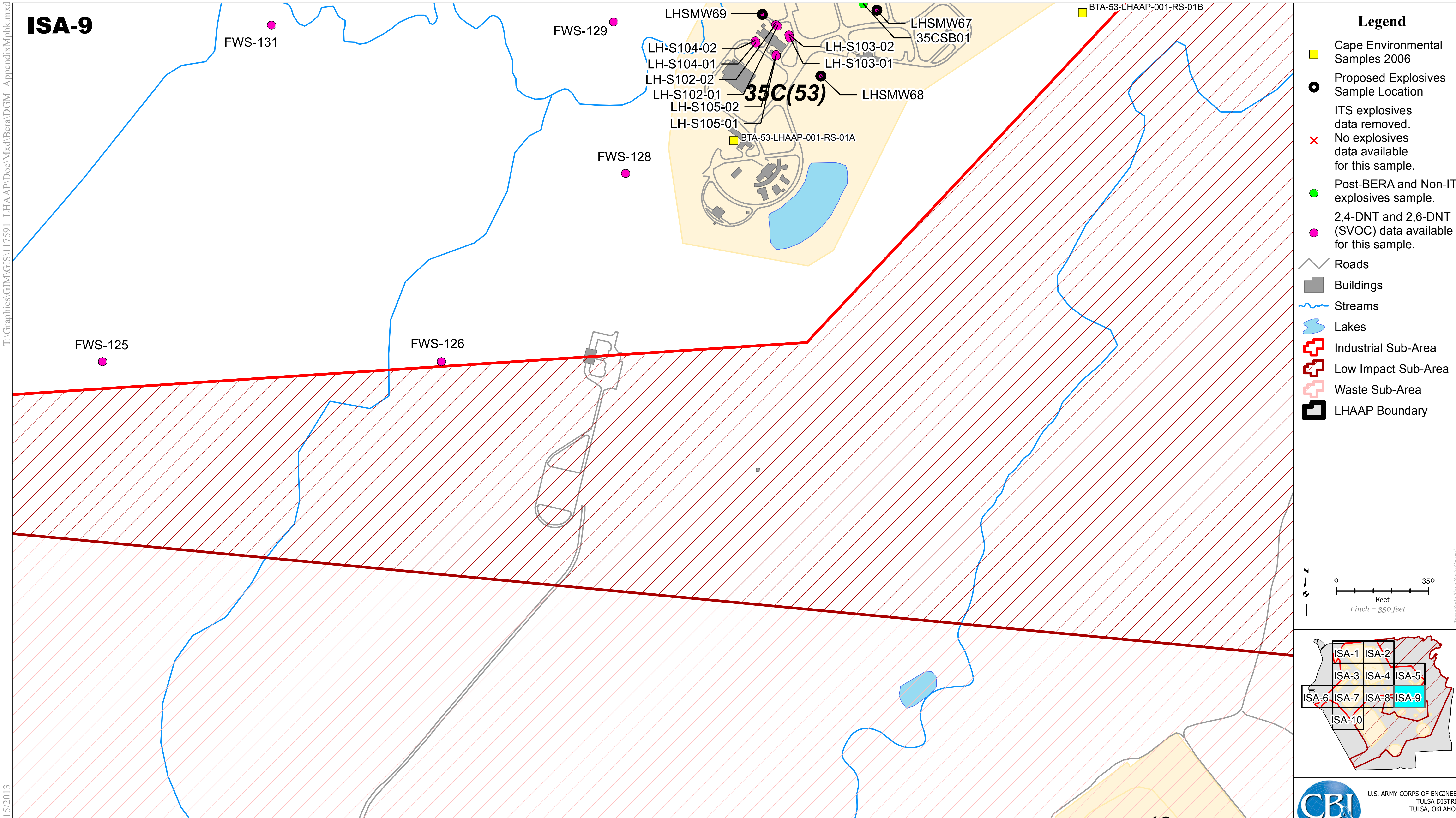
APPENDIX B - FIGURE 8
AREA ISA-7

PROPOSED DATA GAPS SAMPLES FOR SOIL, INDUSTRIAL SUB-AREA

LONGHORN ARMY AMMUNITION PLANT
KARNACK, TEXAS


ISA-8
35B(37)
50
67
09
29
45
12
FWS-122
67SB02
67SB03
67SB01
FWS-115
FWS-113
FWS-114
FWS-121
FWS-116
FWS-117
29SD11
FWS-112
FWS-222
Legend
Cape Environmental Samples 2006
Proposed Explosives Sample Location
ITS explosives data removed. No explosives data available for this sample.
Post-BERA and Non-ITS explosives sample.
2,4-DNT and 2,6-DNT (SVOC) data available for this sample.
Roads
Buildings
Streams
Lakes
Industrial Sub-Area
Low Impact Sub-Area
Waste Sub-Area
LHAAP Boundary
0
350
Feet
1 inch = 350 feet
ISA-1
ISA-2
ISA-3
ISA-4
ISA-5
ISA-6
ISA-7
ISA-8
ISA-9
ISA-10
U.S. ARMY CORPS OF ENGINEERS
TULSA DISTRICT
TULSA, OKLAHOMA
APPENDIX B - FIGURE 9
AREA ISA-8
PROPOSED DATA GAPS SAMPLES FOR SOIL, INDUSTRIAL SUB-AREA
LONGHORN ARMY AMMUNITION PLANT
KARNACK, TEXAS
T:\Graphics\GIM\GIS\117591 LHAAP\Doc\Mxd\Bera\DGM_AppendixMpbk.mxd
benjamin.grod - HOU - 5/15/2013

T:\Graphics\GIM\GIS\117591_LHAAP\Doc\Mxd\Bera\DGM_AppendixMpbk.mxd



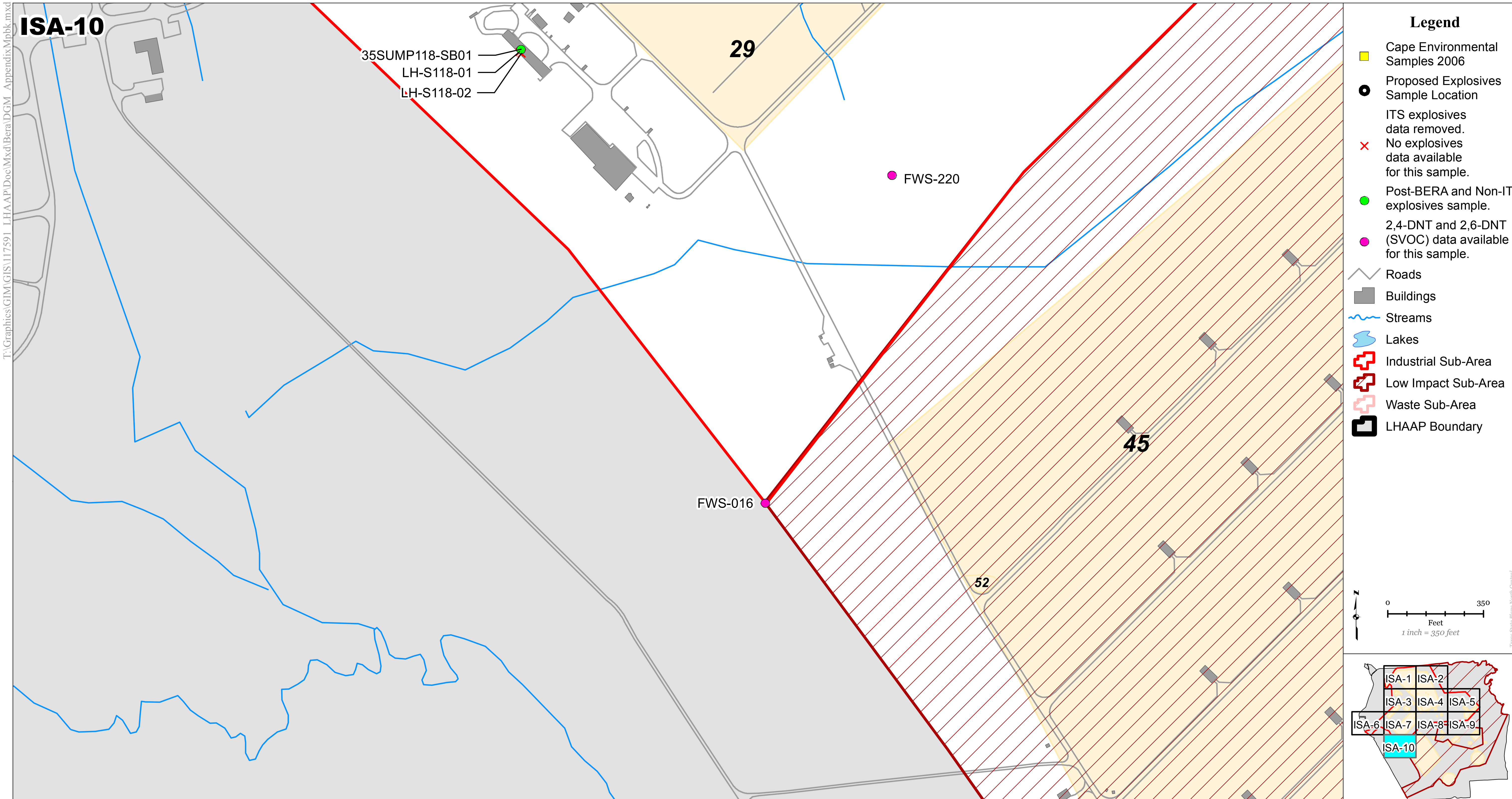
APPENDIX B - FIGURE 10
AREA ISA-9

PROPOSED DATA GAPS SAMPLES FOR SOIL, INDUSTRIAL SUB-AREA

LONGHORN ARMY AMMUNITION PLANT
KARNACK, TEXAS

benjamin.grod - HOU - 5/15/2013

00188067



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

APPENDIX B - FIGURE 11
AREA ISA-10

PROPOSED DATA GAPS SAMPLES FOR SOIL, INDUSTRIAL SUB-AREA

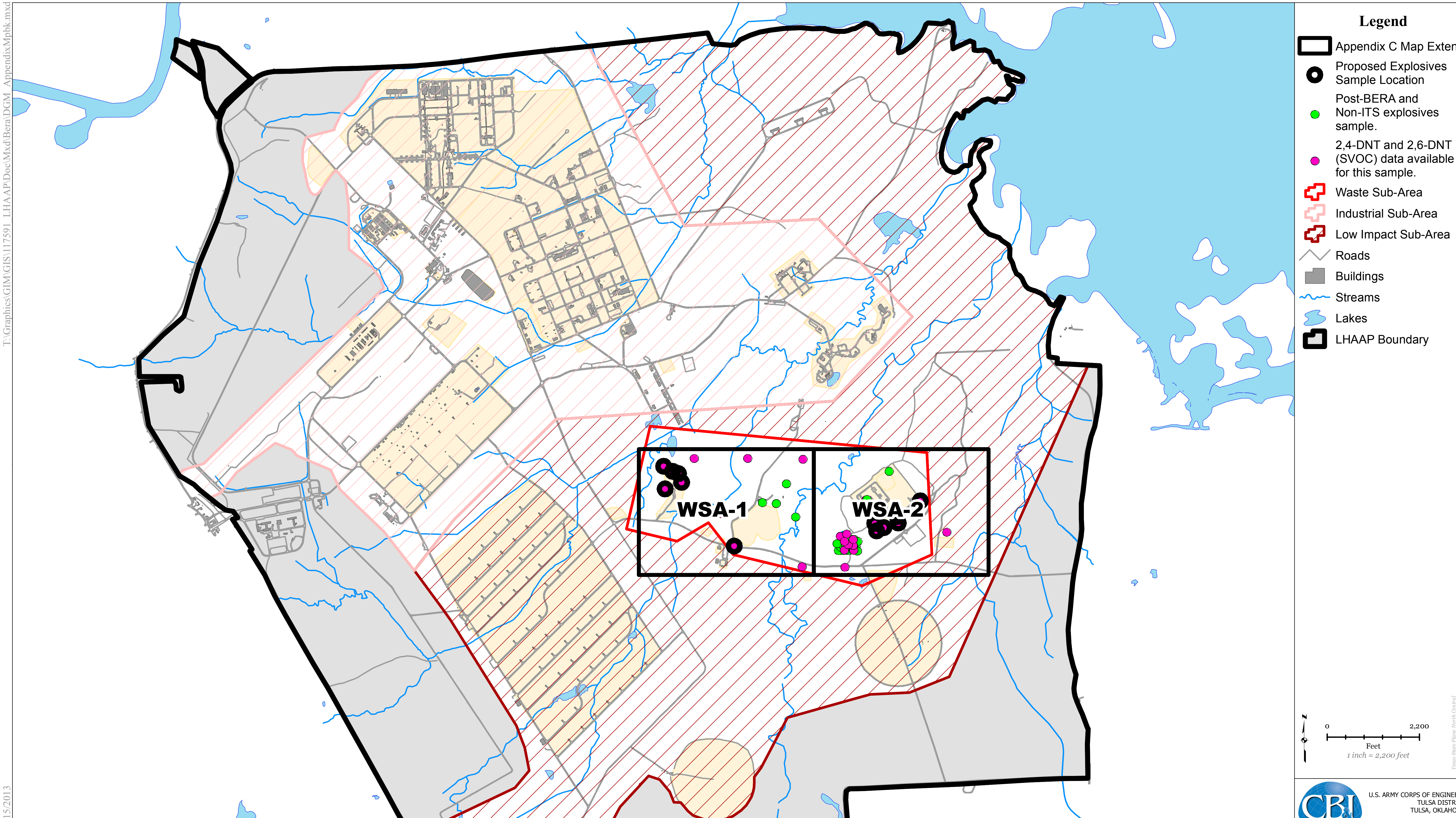
LONGHORN ARMY AMMUNITION PLANT
KARNACK, TEXAS

T:\Graphics\GIM\GIS\117591 LHAAP\Doc\Mxd\Bera\DGM AppendixMpbk.mxd

benjamin.grod - HOU - 5/15/2013

APPENDIX C

Large Scale Maps of Waste Sub-Area Sample Locations

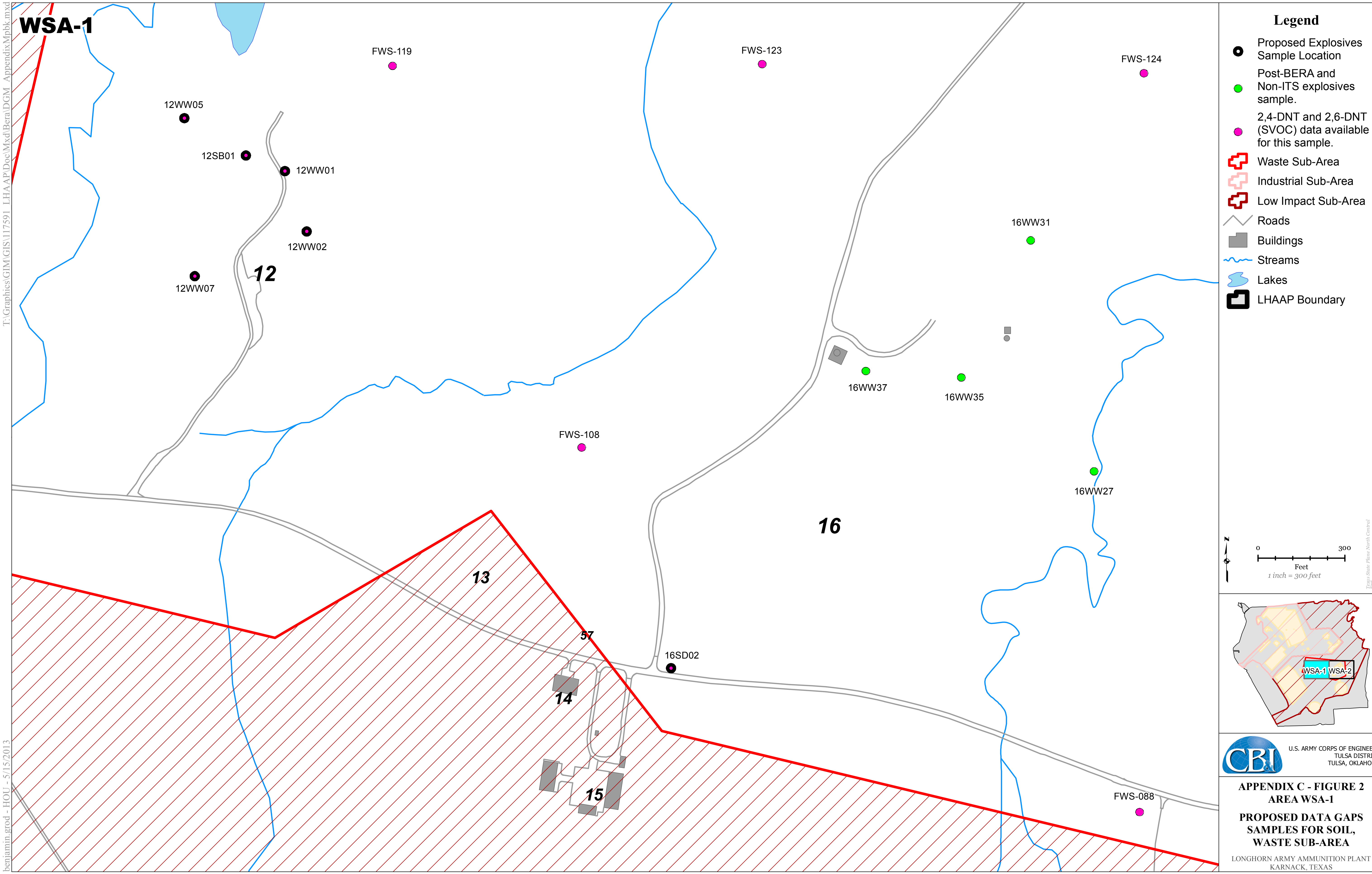


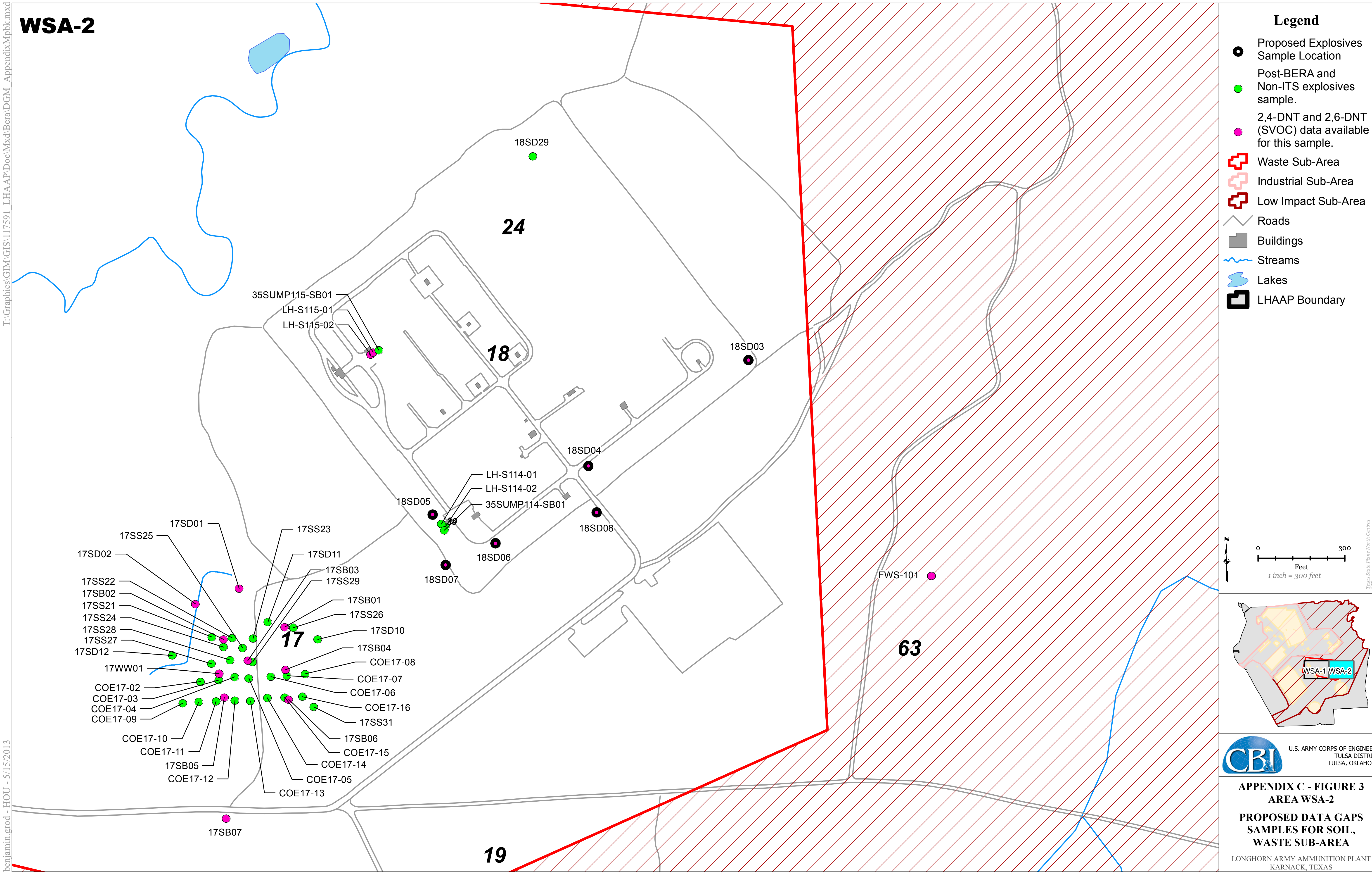
APPENDIX C
FIGURE 1
OVERVIEW MAP
PROPOSED DATA GAPS SAMPLES FOR SOIL, WASTE SUB-AREA
LONGHORN ARMY AMMUNITION PLANT
KARNACK, TEXAS

T:\Graphics\GIM\GIS\117591 LHAAP\Doc\Mxd\Bera\DGM AppendixMpbk.mxd

benjamin.grod - HOU - 5/15/2013

00188070


WSA-1
FWS-119
FWS-123
FWS-124
12WW05
12SB01
12WW01
12WW02
12WW07
12
FWS-108
16WW31
16WW37
16WW35
16WW27
16
13
57
14
15
16SD02
FWS-088
Legend
Proposed Explosives Sample Location
Post-BERA and Non-ITS explosives sample.
2,4-DNT and 2,6-DNT (SVOC) data available for this sample.
Waste Sub-Area
Industrial Sub-Area
Low Impact Sub-Area
Roads
Buildings
Streams
Lakes
LHAAP Boundary
0
300
Feet
1 inch = 300 feet
WSA-1
WSA-2
U.S. ARMY CORPS OF ENGINEERS
TULSA DISTRICT
TULSA, OKLAHOMA
APPENDIX C - FIGURE 2
AREA WSA-1
PROPOSED DATA GAPS SAMPLES FOR SOIL, WASTE SUB-AREA
LONGHORN ARMY AMMUNITION PLANT
KARNACK, TEXAS



APPENDIX C - FIGURE 3
AREA WSA-2
PROPOSED DATA GAPS SAMPLES FOR SOIL, WASTE SUB-AREA
LONGHORN ARMY AMMUNITION PLANT
KARNACK, TEXAS

00188072

DRAFT FINAL

DATA GAP MEMORANDUM FOR EXPLOSIVES IN SEDIMENT AND SURFACE WATER AT THE LONGHORN ARMY AMMUNITION PLANT, KARNACK, TX

Contract No. W912BV-10-D-2010

PREPARED FOR:

U.S. Army Corps of Engineers, Tulsa District
1645 South 101 East Avenue
Tulsa, OK 74128-4609

PREPARED BY:

AGEISS Inc.
1202 Bergen Parkway, Suite 310
Evergreen, CO 80439

CB&I
1401 Enclave Parkway, Suite 250
Houston, TX 77077

May 2013

TABLE OF CONTENTS

Section **Page**

LIST OF TABLES

Table **Page**

LIST OF FIGURES

Figure **Page**

LIST OF ATTACHMENTS

ABBREVIATION / ACRONYM LIST

AGEISS	AGEISS Inc.
BERA	baseline ecological risk assessment
CC	Central Creek
COC	chemical of concern
COPEC	constituent of potential ecological concern
DNT	dinitrotoluene
FOD	frequency of detection
GPC	Goose Prairie Creek
HB	Harrison Bayou
HMX	octogen
ITS-ENV	Intertek Testing Services Environmental Laboratories, Inc.
LHAAP	Longhorn Army Ammunition Plant
ND	non-detect
NT	nitrotoluene
RDX	cyclotrimethylenetrinitramine
SB	Saunders Branch
Shaw	Shaw Environmental and Infrastructure, Inc.
SVOC	semi-volatile organic compound
TCEQ	Texas Commission on Environmental Quality
TNB	trinitrobenzene
TNT	trinitrotoluene
USACE	United States Army Corps of Engineers
USEPA	United States Environmental Protection Agency

1.0 INTRODUCTION

This memorandum and its companion document, Data Gap Memorandum for Explosives in Soil (AGEISS 2013), summarize the information previously sent to LHAAP stakeholders in the February 2011 through March 2012 timeframe, present a recommendation for the collection of additional samples to address data gaps, and present appropriate figures indicating recommended sample locations and number of samples. A list of sediment and surface water chemical analytical samples collected at LHAAP is presented in **Attachment A**.

1.1 Background

In 2003, Shaw Environmental and Infrastructure (Shaw) (now CB&I) was tasked by the United States Army Corps of Engineers (USACE), Tulsa District, to perform an installation-wide baseline ecological risk assessment (BERA) at the Longhorn Army Ammunition Plant (LHAAP), located in Karnack, Texas. This BERA included Steps 3 through 8 of the 8-Step ecological risk assessment process; Steps 1 and 2 had been previously performed by Jacobs Engineering (Jacobs 2001a, Jacobs 2002, and Jacobs 2003). The BERA was finalized in November, 2007 (Shaw 2007).

The BERA included a synthesis of many environmental investigations that had previously been performed by other sub-contractors at the facility in prior years, and one of the first challenges for Shaw was to compile all relevant environmental data available for the facility. The primary dataset used to calculate potential risks to various representative receptors in the BERA was comprised of data from 1993 through 2003. These data are referred to herein as “the BERA dataset.” Additional data from samples collected between 2003 and the time when the BERA was finalized in 2007 were also evaluated in the BERA to ensure that more recent sampling information did not affect overall site conclusions. These data were referred to in the BERA and herein as the “post-BERA dataset.”

Explosives data are of primary concern at the LHAAP due to its history as an ammunition plant whose primary mission was to produce 2,4,6-trinitrotoluene (TNT) flake. Explosives data collected for the LHAAP investigation in the 1993 through 1995 timeframe that were analyzed by Intertek Testing Services Environmental Laboratories, Inc. (ITS-ENV) in Richardson, TX, were deemed unusable by the U.S. Environmental Protection Agency (USEPA) for environmental decision making (Jacobs 2001b). Although the determination that the ITS-ENV data were unusable was made prior to Shaw’s involvement on the project, the quality problems with the ITS-ENV explosives data were known when the BERA was initiated, and all data associated with ITS-ENV (as determined by the code “ITS” in the Laboratory Identification field of the electronic database) were eliminated from Shaw’s BERA dataset.

After the BERA was approved and finalized, a data review performed as part of the remediation design for LHAAP-17 revealed that a number of historical samples that were included in the BERA dataset had explosives data from the 1993-1995 timeframe, and it was suspected that these data likely originated from the ITS-ENV laboratory, even though the electronic database provided to Shaw by the Army did not carry unusable data qualifiers for these results. A review of the hard copy Phase I and II reports was performed, and it was confirmed that many of these data were from the ITS-ENV laboratory. Therefore, ITS-ENV data that were incorrectly or cryptically coded for their laboratory source appear to have been inadvertently retained in the dataset and used to quantify ecological risk in the BERA.

1.2 Prior Communications Regarding Data Gaps

Once it was discovered that the BERA dataset inadvertently included some ITS-ENV data, Shaw was asked to determine how the removal of these data affected the BERA conclusions. To address this question, Shaw performed an evaluation on the impact of the ITS-ENV data removal, including evaluations for each LHAAP watershed.

The four watersheds at LHAAP comprise the aquatic ecological exposure units of concern that were evaluated in the BERA and include Central Creek (CC), Goose Prairie Creek (GPC), Harrison Bayou (HB), and Saunders Branch (SB). Shaw prepared a series of memoranda for LHAAP stakeholders describing the potential impacts to the BERA conclusions resulting from the removal of the ITS-ENV from the BERA dataset, including responding to comments from both the Texas Commission on Environmental Quality (TCEQ) and USEPA Region 6. Transmittal of these emails, memos, and responses to comments occurred in the February 2011 through March 2012 timeframe, approximately, at which time both the TCEQ and USEPA requested the USACE to proceed with a formal proposal for addressing any data gaps in the LHAAP BERA resulting from the removal of the ITS-ENV data.

1.3 Addressing Identified Data Gaps

Once consensus is reached on the basic framework for addressing the data gaps, additional details will be provided in a formal Work Plan (including a Sample Analysis Plan, Health and Safety Plan, and other standard work plan components). After the Work Plan is approved and the additional samples described therein have been collected, a BERA Addendum Report will be issued that presents the results of the sampling (including re-calculated exposure point concentrations, revised food chain models, if needed, etc.) and a revised analysis of potential impacts to ecological receptors. A subset of the results from any new samples may also be used to perform a statistical comparison with the rejected ITS-ENV results. It is possible that results of this statistical test may show that individual explosive compounds do not have statistically significantly greater concentrations in the new data set compared with the rejected ITS-ENV data set. This finding would lend additional support to the conclusions previously presented in the BERA. Final conclusions and recommendations for explosives compounds in the four watersheds will also be presented in the BERA Addendum Report.

2.0 INITIAL EVALUATION

As presented in **Table 2-1** and summarized below, 82 of 162 sediment and 74 of 279 surface water explosives samples were eliminated (ITS-ENV samples, 1993-1995) (sample lists for surface water and sediment are presented in **Attachment A**, based on Section 6.0 tables in the BERA). The focus of this Data Gap Memorandum is to discuss, by watershed, whether the BERA conclusions remain valid for sediment and surface water following the elimination of the ITS-ENV data. The BERA addressed four watersheds (CC, GPC, HB, and SB) as facility-wide exposure areas (see **Figure 2-1**). The focus of the discussion is whether remaining sediment and/or surface water samples sufficiently characterized each watershed to support the conclusions previously presented in the BERA or if additional sediment and/or surface water sampling is needed.

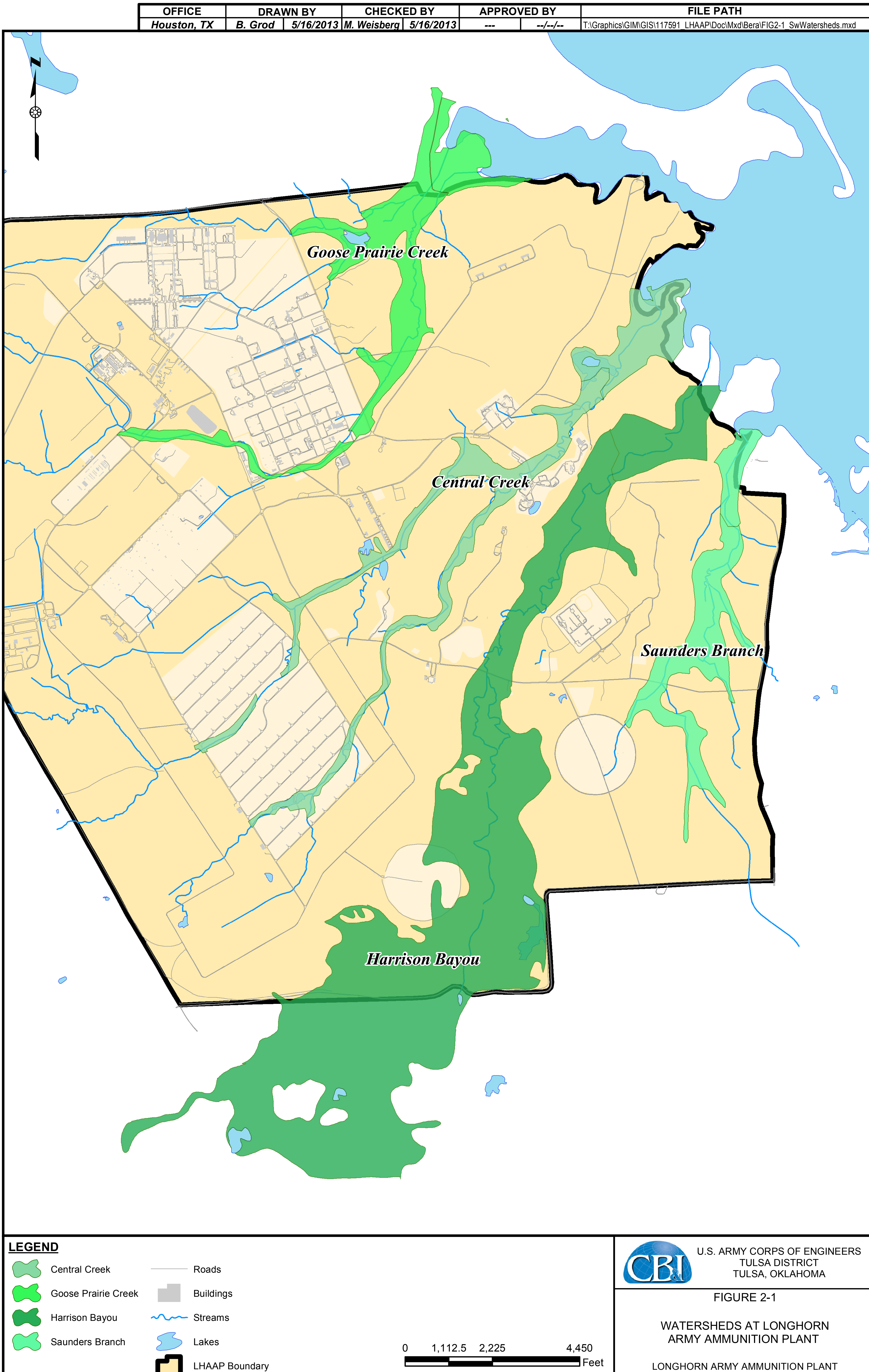
Although many of the ITS-ENV data were discarded, samples remaining after the ITS-ENV data are removed generally provide reasonable spatial coverage, and additional knowledge about the facility is now available that was not available at the time when the ITS-ENV samples were collected (1993-1995) or when the BERA was generated (2005-2007). The remediation of some explosives-contaminated areas has also occurred. Semi-volatile organic compound (SVOC) data that contain limited explosives results (i.e., 2,4-dinitrotoluene [DNT], 2,6-DNT, and nitrobenzene) from reputable labs and other lines of evidence are also available that provide information to support the decision regarding the number of replacement samples that may be needed.

Table 2-1. Summary of Explosives Data Used for ITS-ENV Sample Removal Evaluation

	Sediment Explosives				
Basin	Number of Samples Used in BERA[1]	Removed ITS-ENV 1993-1995 Samples[2]	Post-BERA Samples[3]	Number of Samples in Revised Dataset[4]	Removed BERA Samples Analyzed for Both SVOCs and Explosives[5]
CC	49	28	10	31	14
GPC	71	22	6	55	16
HB	32	26	1	7	13
SB	10	6	3	7	6
Total	162	82	20	100	49
	Surface Water Explosives				
Basin	**Number of Samples Used in BERA[1]**	**Removed ITS-ENV 1993-1995 Samples[2]**	**Post-BERA Samples[3]**	**Number of Samples in Revised Dataset[4]**	**Removed BERA Samples Analyzed for Both SVOCs and Explosives[5]**
CC	37	28	5	14	14
GPC	202	15	2	189	9
HB	36	27	1	10	11
SB	4	4	3	3	4
Total	279	74	11	216	38

Notes:
BERA = Baseline Ecological Risk Assessment; CC = Central Creek;
GPC = Goose Prairie Creek; HB = Harrison Bayou;
SB = Saunders Branch
SVOCs = semi-volatile organic compounds
[1] Number of samples used in the BERA includes ITS-ENV explosives data (1993-1995), but not Post-BERA data (2004).
[2] See Appendix A for the list of samples with ITS-ENV explosives data from 1993 through 1995.
[3] *Installation-Wide BERA*, LHAAP, Volume I: Step 3 Report, 2007, Post BERA-Samples collected in 2004, Appendix G.
[4] *Installation-Wide BERA* data (with all ITS data from 1993 through 1995 removed) and Post BERA-Samples.
[5] Samples collected during 1993-1995 that may have results for some explosives from SVOC analyses.

00188078


OFFICE
Houston, TX
DRAWN BY
B. Grod 5/16/2013
CHECKED BY
M. Weisberg 5/16/2013
APPROVED BY
--- --/--/--
FILE PATH
T:\Graphics\GIM\GIS\117591_LHAAP\Doc\Mxd\Bera\FIG2-1_SwWatersheds.mxd
Goose Prairie Creek
Central Creek
Saunders Branch
Harrison Bayou
LEGEND
Central Creek
Goose Prairie Creek
Harrison Bayou
Saunders Branch
Roads
Buildings
Streams
Lakes
LHAAP Boundary
0 1,112.5 2,225 4,450
Feet
U.S. ARMY CORPS OF ENGINEERS
TULSA DISTRICT
TULSA, OKLAHOMA
FIGURE 2-1
WATERSHEDS AT LONGHORN
ARMY AMMUNITION PLANT
LONGHORN ARMY AMMUNITION PLANT
KARNACK, TEXAS

3.0 EXPLOSIVES DATA GAPS EVALUATION FOR SURFACE WATER AND SEDIMENT

The evaluation of whether remaining sediment and surface water explosives data sufficiently characterize each watershed to support the conclusions previously presented in the BERA is discussed in this section. First, the amount of usable explosives data obtained during SVOC analyses was evaluated. Next, separate analyses examined the frequency of detection and spatial coverage of the remaining samples after exclusion of the 1993-1995 ITS-ENV data. The following explosives were detected in at least one surface water or sediment sample: 1,3,5-trinitrobenzene (TNB), 2,4,6-TNT, 2,4-DNT , 2,6-DNT, 2-A-4,6-DNT, 4-A-2,6-DNT, octagen (HMX), 2-nitrotoluene (NT), 3-NT, 4-NT, cyclotrimethylenetrinitramine **(**RDX), and Tetryl. The evaluation herein focuses on these 12 explosives.

It should also be noted that the USEPA Region 6 Fish Tissue Study performed for Caddo Lake (Section 2.2.4 in Shaw 2007) did not find explosive constituents (i.e., 2,4-DNT, 2,6,DNT, NT) in the SVOC results performed on the 213 fish that were collected. Thus, fishery resources for the major water body (Caddo Lake) receiving surface waters and sediment from LHAAP (via CC, GPC, HB, and SB) has not been impacted by 2,4-DNT, 2,6-DNT, or NT.

3.1 Frequency of Detection Evaluation

An evaluation was performed on a watershed by watershed basis to assess differences in the number of explosive constituents and their detection frequencies pre- and post-ITS-ENV sample removal. As the BERA used explosive constituent results obtained via SVOC and Explosive analytical methods, this evaluation excludes all 1993-1995 explosive constituent sample data regardless of analytical method. This resulted in a potential overestimate of the number of excluded samples. Post-BERA samples (Appendix G, *Installation-Wide LHAAP BERA*, Shaw 2007) were also included in this revised dataset. Results of the frequency of detection evaluation are presented in **Table 3-1** (sediment) and **Table 3-2** (surface water).

Ten sediment samples were used for the BERA in Saunders Branch. Six ITS-ENV samples were removed, but three post-BERA sediment samples were identified. All explosives were non-detect in BERA and post-BERA sediment samples at Saunders Branch. Four surface water samples were used for the BERA in Saunders Branch. All four ITS-ENV samples were removed, but three post-BERA surface water samples were identified. All explosives were non-detected in BERA and post-BERA surface water samples at Saunders Branch.

Thirty-two sediment samples were used for the BERA in Harrison Bayou. Twenty-six ITS-ENV samples were removed, and one post-BERA sediment sample was identified. All explosives were non-detect in BERA and post-BERA sediment samples at Harrison Bayou. Thirty-six surface water samples were used for the BERA in Harrison Bayou. Twenty-seven ITS-ENV samples were removed, and one post-BERA surface water sample was identified. All explosives were non-detect in BERA and post-BERA surface water samples at Harrison Bayou.

Forty-nine sediment samples were used for the BERA in Central Creek. Twenty-eight ITS-ENV samples were removed, but ten post-BERA sediment samples were identified. All explosives were non-detect in BERA and post-BERA sediment samples at Central Creek. Thirty-seven surface water samples were used for the BERA in Central Creek. Twenty-eight ITS-ENV samples were removed, but five post-BERA surface water samples were identified. 2-NT in surface water was detected (frequency of detection = 1/37) in the BERA, but not detected in the revised dataset (i.e., ITS-ENV data removed). 3-NT (1/14), HMX (2/14), and RDX (1/14) were detected in the Central Creek revised surface water dataset (with post-BERA samples) but not in the BERA itself.

Seventy-one sediment samples were used for the BERA in Goose Prairie Creek. Twenty-two ITS-ENV samples were removed, but six post-BERA sediment samples were identified. 2,4,6-TNT (3/71), 2-A-4,6-DNT (2/67), and 4-A-2,6-DNT (2/71) were infrequently detected in the BERA, but only 2,4,6-TNT (1/55) was detected in the revised dataset. Two hundred-two surface water samples were used for the BERA in Goose Prairie Creek. Fifteen ITS-ENV samples were removed, but two post-BERA surface water samples were identified. Eleven explosives were detected in the BERA surface water samples: 1,3,5-TNB (2/195), 2,4,6-TNT (13/195), 2,4-DNT (25/206), 2,6-DNT (11/205), 2-A-4,6-DNT (43/195), 4-A-2,6-DNT (47/195), HMX (11/196), 2-NT (3/195), 4-NT (4/195), RDX (17/195), and Tetryl (6/192). Eleven explosives were also detected in the revised dataset: 1,3,5-TNB (2/181), 2,4,6-TNT (13/181), 2,4-DNT (25/188), 2,6-DNT (11/186), 2-A-4,6-DNT (43/181), 4-A-2,6-DNT (44/180), HMX (11/182), 2-NT (3/180), 4-NT (4/180), RDX (17/181), and Tetryl (6/181).

3.2 SVOC Explosives Evaluation

The explosives analytical suite contains a list of 14 chemicals (1,3,5-trinitrobenzene, 1,3-dinitrobenzene, 2,4,6-TNT, 2,4-DNT, 2,6-DNT, 2-amino-4,6-DNT, 2-NT, 3-NT, 4-amino-2,6-DNT, 4-NT, HMX, nitrobenzene, RDX, and Tetryl), all of which should be considered when evaluating potential data gaps caused by the removal of the ITS-ENV data. However, 2,4-DNT, 2,6-DNT, and (sometimes) nitrobenzene were often analyzed as part of the SVOC analytical suite in surface water and sediment. Because SVOCs were analyzed by a reputable (non-ITS-ENV) laboratory, they can provide supplemental information regarding the presence or absence of these three explosives compounds—as well as indicators for releases of other explosives compounds – in samples where the explosives data were rejected. In addition, it should be noted that for explosives in sediments, the ecological screening levels for 2,4-DNT and 2,6-DNT are generally lower than other explosives. (i.e., they are more toxic). Therefore, valuable supplemental information is provided by these two SVOC explosive compounds, due to the fact that they are more toxic than almost all of the other explosives and as such would be the hazard drivers for the explosives compounds.

Using all the non-rejected surface water explosives constituent data for LHAAP, for all four watersheds combined, there were 2,834 numerical results (including explosives results and SVOC explosives results, but not double counting any results for the same sample), and out of this total there were 198 detects (7%). Most of these detections were in GPC. A total of 11 explosives were detected, including 2,4-DNT and 2,6-DNT (but not nitrobenzene).

2,4-DNT was analyzed in 242 samples, and detected in 28 samples (11.6%). In these 28 samples, one to five other explosives were also detected, depending on the sample. So, out of 14 possible explosive constituents, this means 7% to 36% of the other possible explosives were also detected. This suggests that the presence of 2,4-DNT in a sample was a predictor of the presence of other explosives (although not a predictor with a high level of certainty).

2,6-DNT was analyzed in 241 surface water samples, and detected in 11 samples (4.6%). In these 11 samples, three to six other explosives were also detected, depending on the sample. So, out of 14 possible explosive constituents, this means 20% to 43% of the other possible explosives were also detected. This suggests that the presence of 2,6-DNT in a sample was a likely predictor of the presence of other explosives.

Other explosives (i.e., non-2,4-DNT, non-2,6-DNT, and non-nitrobenzene) were analyzed in 235 (non-rejected) LHAAP surface water samples, and detected in 71 samples (30%). Of these 71 samples, 2,4-DNT and 2,6-DNT were not detected in 60 of them (nitrobenzene was not analyzed). This suggests that while 2,4-DNT and 2,6-DNT results may be used to predict the presence of other explosives in a surface water sample, the correlation (based on presence/absence data) is moderate. However, this evaluation does demonstrate that some usable explosives constituent data were available and were used from SVOC analyses in the LHAAP BERA. Therefore, this mitigates to some extent the data gap resulting from the loss of explosives data due to the rejection of 1993-1995 ITS-ENV data packages.

It should be noted that a similar evaluation of sediment SVOC and explosives constituent data was not performed, as explosives were detected at a much lower frequency in sediment compared with surface water sample results.

Table 3-1. Comparison of Detected Explosives in Sediment between the 2007 BERA Data Set and the Revised Data Set

Watershed	Detected Parameters	2007 BERA Step 3 Report[1]			Revised Data (1993 – 1995 ITS-ENV Data Excluded)[2]		
		FOD	Percent Detected	Comments	FOD[3]	Percent Detected	Comments
CC	None [4]	---	---	ND	---	---	ND
GPC	2,4,6-Trinitrotoluene	3 / 71	4.2%		1 / 55	1.8%	
	2-Amino-4,6-dinitrotoluene	2 / 67	3.0%		---	---	ND
	4-Amino-2,6-dinitrotoluene	2 / 71	2.8%		---	---	ND
HB	None	---	---	ND	---	---	ND
SB	None	---	---	ND	---	---	ND

Notes:
BERA = Baseline Ecological Risk Assessment
FOD = Frequency of Detection
ND = non-detect
CC = Central Creek
GPC = Goose Prairie Creek
HB = Harrison Bayou
SB = Saunders Branch
[1] *Installation-Wide BERA*, LHAAP, Volume I: Step 3 Report, 2007, Section 6 COPEC selection tables.
[2] *Installation-Wide BERA* data (with all ITS-ENV data from 1993 through 1995 removed), and Post BERA-Samples collected in 2004, Appendix G.
[3] Does not include field duplicates.
[4] All samples were non-detect.

Table 3-2. Comparison of Detected Explosives in Surface Water between the 2007 BERA Data Set and the Revised Data Set

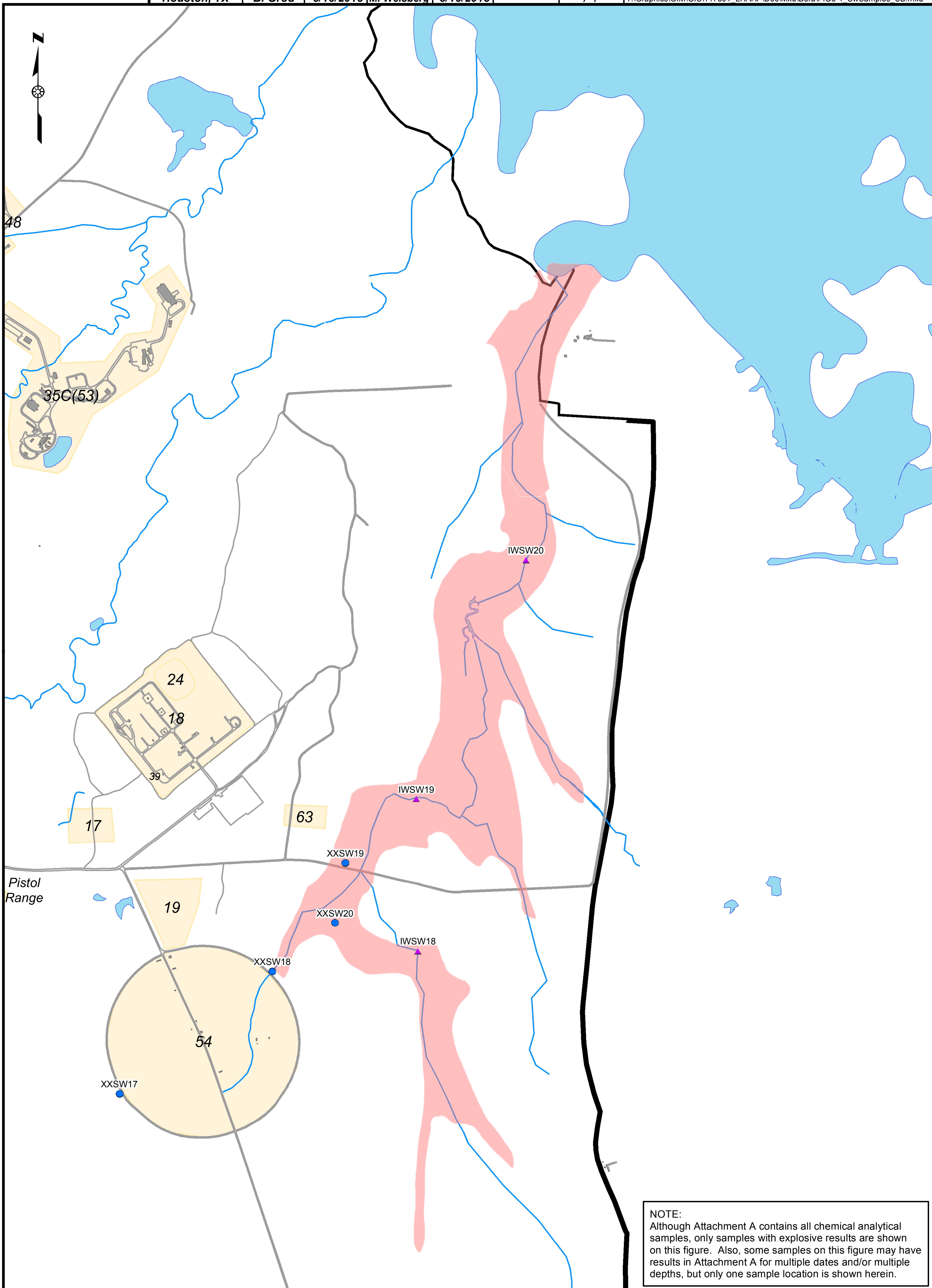
Watershed	Detected Parameters	2007 BERA Step 3 Report[1]					Revised Data (1993 – 1995 ITS-ENV Data Excluded)[2]				
		FOD			Percent Detected	Comments	FOD[3]			Percent Detected	Comments
CC	2-Nitrotoluene	1	/	37	2.7%			---		---	ND
	3-Nitrotoluene		---		---	ND	1	/	14	7.1%	
	HMX		---		---	ND	2	/	14	14.3%	
	RDX		---		---	ND	1	/	14	7.1%	
GPC	1,3,5-Trinitrobenzene	2	/	195	1.0%		2	/	181	1.1%	
	2,4,6-Trinitrotoluene	13	/	195	6.7%		13	/	181	7.2%	
	2,4-Dinitrotoluene	25	/	206	12.1%		25	/	188	13.3%	
	2,6-Dinitrotoluene	11	/	205	5.4%		11	/	186	5.9%	
	2-Amino-4,6-dinitrotoluene	43	/	195	22.1%		43	/	181	23.8%	
	4-Amino-2,6-dinitrotoluene	47	/	195	24.1%		44	/	180	24.4%	
	HMX	11	/	196	5.6%		11	/	182	6.0%	
	2-Nitrotoluene	3	/	195	1.5%		3	/	180	1.7%	
	4-Nitrotoluene	4	/	195	2.1%		4	/	180	2.2%	
	RDX	17	/	195	8.7%		17	/	181	9.4%	
	Tetryl	6	/	192	3.1%		6	/	181	3.3%	
HB	None [4]		---		---	ND		---		---	ND
SB	None		---		---	ND		---		---	ND

Notes:
BERA = Baseline Ecological Risk Assessment
FOD = Frequency of Detection
ND = all explosives were non-detects
CC = Central Creek
GPC = Goose Prairie Creek
HB = Harrison Bayou
SB = Saunders Branch
[1] *Installation-Wide BERA*, LHAAP, Volume I: Step 3 Report, 2007, Section 6 COPEC selection tables.
[2] *Installation-Wide BERA* data (with all ITS-ENV data from 1993 through 1995 removed), and Post BERA-Samples collected in 2004, Appendix G.
[3] Does not include field duplicates.
[4] All samples were non-detect.

3.3 Sample Distribution and Spatial Coverage

An evaluation was performed on a watershed by watershed basis to assess the spatial coverage of sediment and surface water samples throughout each watershed. Although removal of some ITS-ENV samples resulted in a majority of samples (more than 50%) being removed for surface water and sediment in HB, and surface water in CC, (**Table 2-1**), when removed BERA samples with SVOC explosive constituent results were added back in, these three data groupings had slightly more than 50% of their samples retained. A visual examination of the sample locations shown on **Figure 3-1** through **Figure 3-8** demonstrates there is reasonable coverage of samples with usable explosive constituent data spatially distributed throughout each watershed, with the exception of HB. Only seven sediment samples are available in the revised data set for HB (**Table 2-1**). USEPA's ProUCL statistical software and Guidance (USEPA 2010) states that 8 to 10 samples are generally recommended for estimation of exposure point concentrations for use in risk assessments.

OFFICE	DRAWN BY		CHECKED BY		APPROVED BY		FILE PATH
Houston, TX	*B. Grod*	*5/16/2013*	*M. Weisberg*	*5/16/2013*	---	--/--/--	T:\Graphics\GIM\GIS\117591_LHAAP\Doc\Mxd\Bera\FIG3-1_SwSamples_SB.mxd



NOTE:
Although Attachment A contains all chemical analytical samples, only samples with explosive results are shown on this figure. Also, some samples on this figure may have results in Attachment A for multiple dates and/or multiple depths, but only one sample location is shown herein.

LEGEND

- × ITS explosives data removed. No explosives data available for this sample.
- + Non-ITS explosives sample.
- ● ITS explosives data removed. Limited (2,4-DNT and 2,6-DNT) explosives data available for this sample.
- ● 2,4-DNT and 2,6-DNT (SVOC) data available for this sample.
- ▲ Post-BERA Samples.
- Watershed
- Roads
- Buildings
- Streams
- Lakes
- LHAAP Boundary

0 500 1,000 2,000 Feet

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

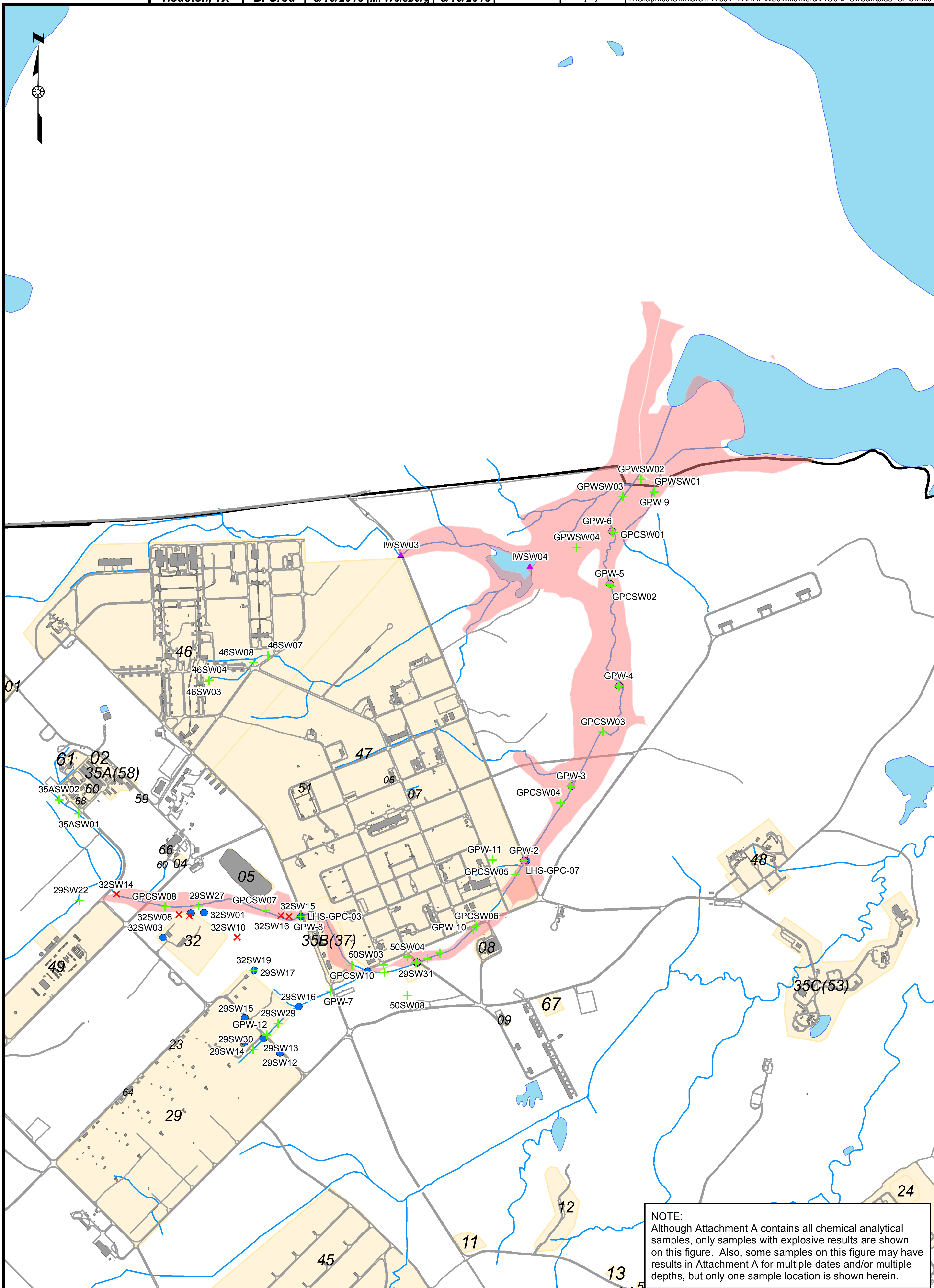
FIGURE 3-1

SURFACE WATER SAMPLES
SAUNDERS BRANCH WATERSHED

LONGHORN ARMY AMMUNITION PLANT
KARNACK, TEXAS

00188086

OFFICE	DRAWN BY		CHECKED BY		APPROVED BY		FILE PATH
Houston, TX	B. Grod	5/16/2013	M. Weisberg	5/16/2013	---	--/--/--	T:\Graphics\GIM\GIS\117591_LHAAP\Doc\Mxd\Bera\FIG3-2_SwSamples_GPC.mxd



NOTE:
Although Attachment A contains all chemical analytical samples, only samples with explosive results are shown on this figure. Also, some samples on this figure may have results in Attachment A for multiple dates and/or multiple depths, but only one sample location is shown herein.

LEGEND

- ITS explosives data removed. No explosives data available for this sample.
- Non-ITS explosives sample.
- 2,4-DNT and 2,6-DNT (SVOC) data available for this sample.
- ITS explosives data removed. Limited (2,4-DNT and 2,6-DNT) explosives data available for this sample.
- Post-BERA Samples.
- Watershed
- Roads
- Buildings
- Streams
- Lakes
- LHAAP Boundary

0 650 1,300 2,600 Feet

CB&I

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

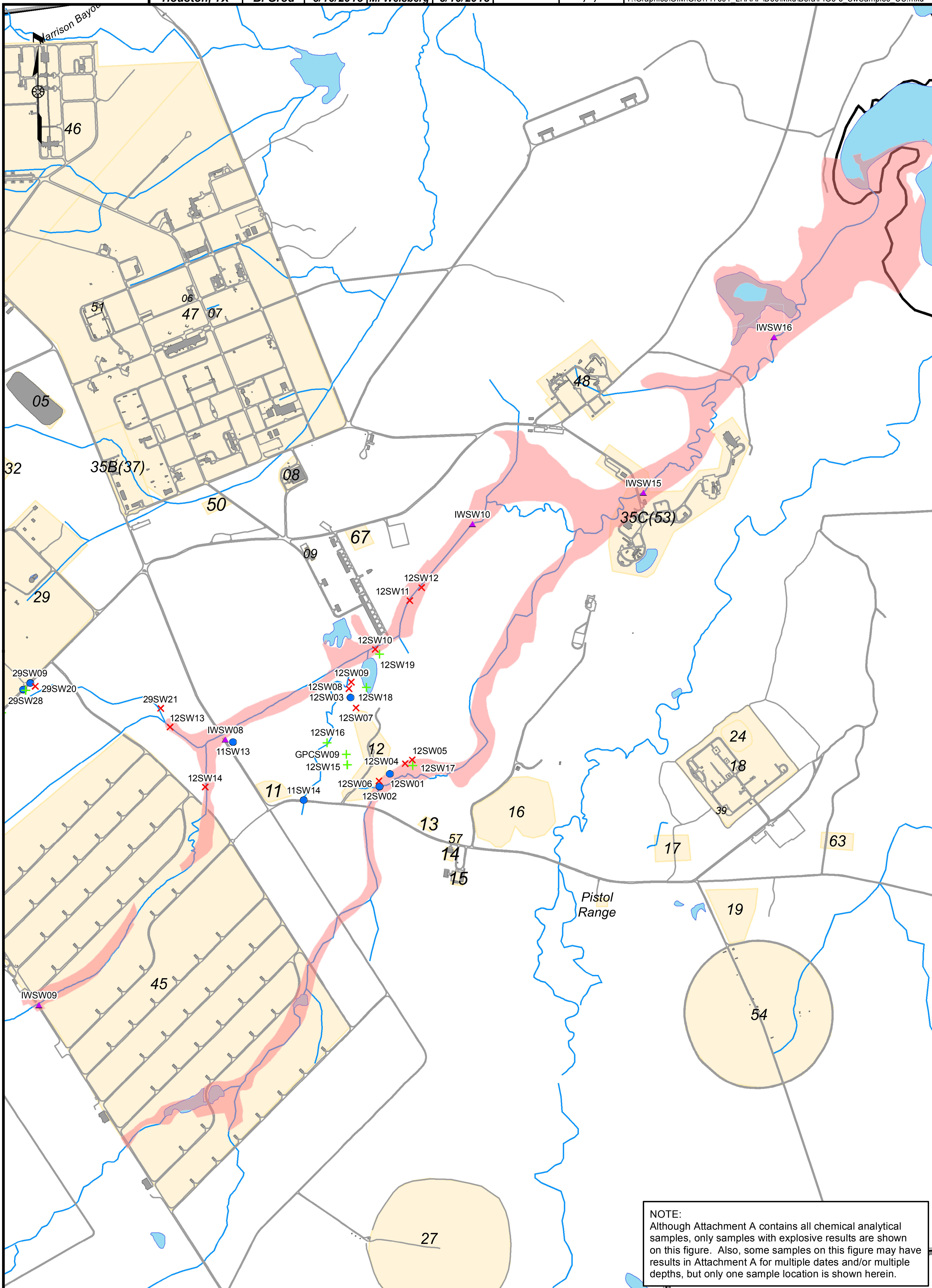
FIGURE 3-2

SURFACE WATER SAMPLES
GOOSE PRAIRIE CREEK WATERSHED

LONGHORN ARMY AMMUNITION PLANT
KARNACK, TEXAS

00188087

OFFICE	DRAWN BY		CHECKED BY		APPROVED BY		FILE PATH
Houston, TX	B. Grod	5/16/2013	M. Weisberg	5/16/2013	- - -	--/--/--	T:\Graphics\GIM\GIS\117591_LHAAP\Doc\Mxd\Bera\FIG3-3_SwSamples_CC.mxd



NOTE:
Although Attachment A contains all chemical analytical samples, only samples with explosive results are shown on this figure. Also, some samples on this figure may have results in Attachment A for multiple dates and/or multiple depths, but only one sample location is shown herein.

LEGEND

- × ITS explosives data removed. No explosives data available for this sample.
- + Non-ITS explosives sample.
- ● 2,4-DNT and 2,6-DNT (SVOC) data available for this sample.
- ● ITS explosives data removed. Limited (2,4-DNT and 2,6-DNT) explosives data available for this sample.
- ▲ Post-BERA Samples.
- Watershed
- Roads
- Buildings
- Streams
- Lakes
- LHAAP Boundary

0 650 1,300 2,600 Feet

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

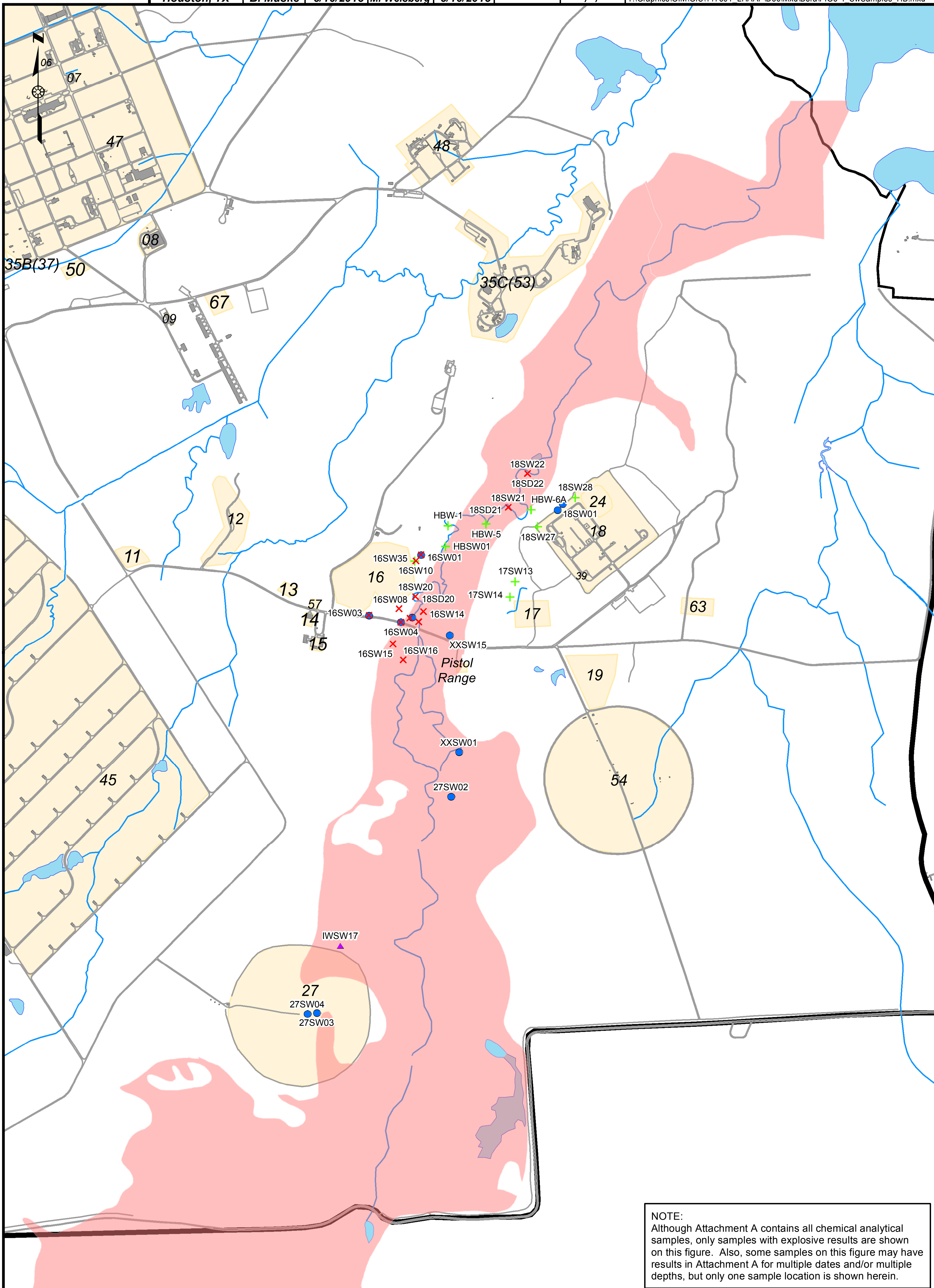
FIGURE 3-3

SURFACE WATER SAMPLES
CENTRAL CREEK WATERSHED

LONGHORN ARMY AMMUNITION PLANT
KARNACK, TEXAS

00188088

OFFICE	DRAWN BY		CHECKED BY		APPROVED BY		FILE PATH
Houston, TX	B. Muske	5/16/2013	M. Weisberg	5/16/2013	---	--/--/--	T:\Graphics\GIM\GIS\117591_LHAAP\Doc\Mxd\Bera\FIG3-4_SwSamples_HB.mxd



NOTE:
Although Attachment A contains all chemical analytical samples, only samples with explosive results are shown on this figure. Also, some samples on this figure may have results in Attachment A for multiple dates and/or multiple depths, but only one sample location is shown herein.

LEGEND

- ITS explosives data removed. No explosives data available for this sample.
- Non-ITS explosives sample.
- 2,4-DNT and 2,6-DNT (SVOC) data available for this sample.
- ITS explosives data removed. Limited (2,4-DNT and 2,6-DNT) explosives data available for this sample.
- Post-BERA Samples.
- Watershed
- Roads
- Buildings
- Streams
- Lakes
- LHAAP Boundary

0 650 1,300 2,600 Feet

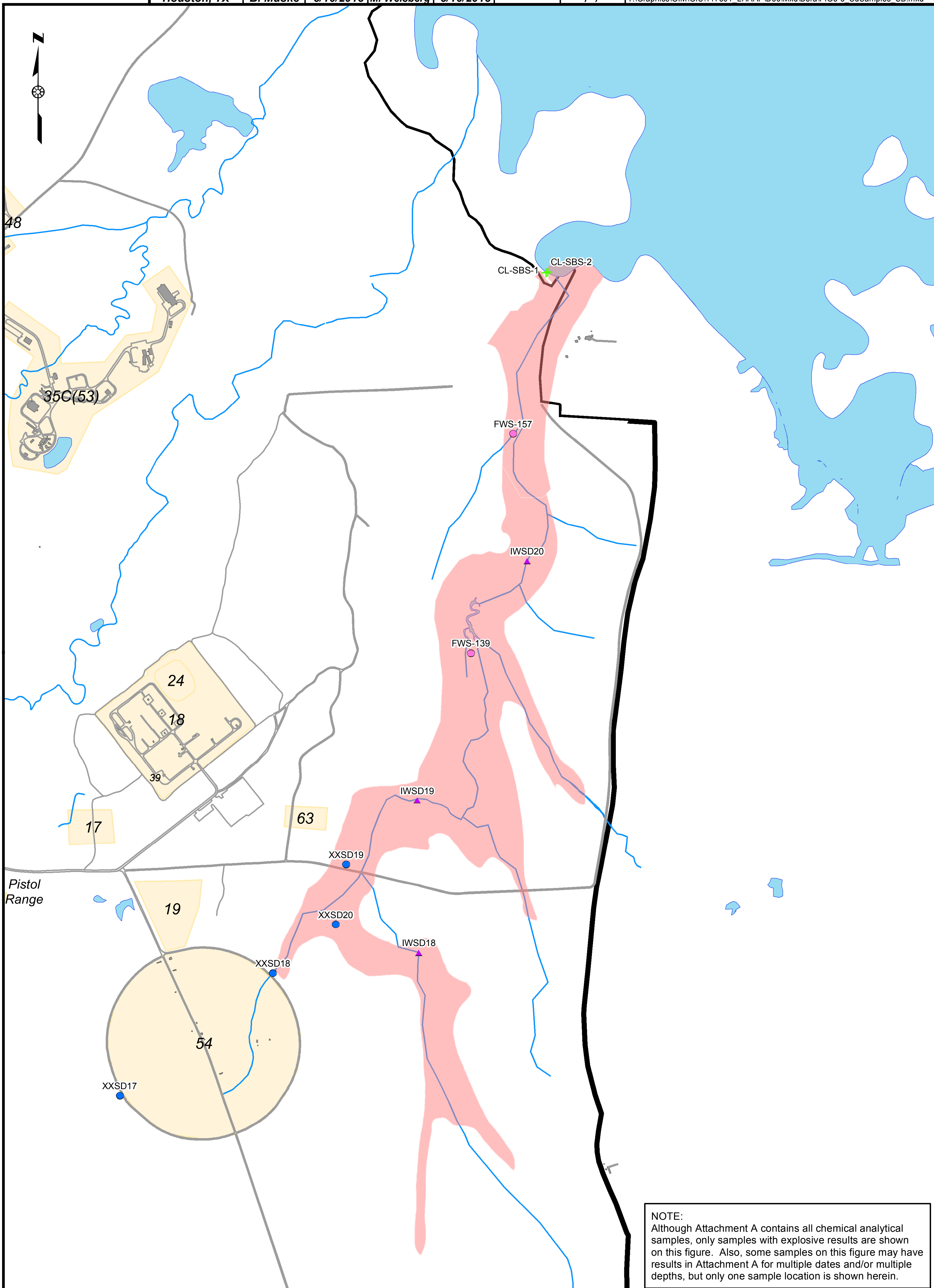
U.S. ARMY CORPS OF ENGINEERS
TULSA DISTRICT
TULSA, OKLAHOMA

FIGURE 3-4

SURFACE WATER SAMPLES
HARRISON BAYOU WATERSHED

LONGHORN ARMY AMMUNITION PLANT
KARNACK, TEXAS

OFFICE	DRAWN BY		CHECKED BY		APPROVED BY		FILE PATH
Houston, TX	B. Muske	5/16/2013	M. Weisberg	5/16/2013	---	--/--/--	T:\Graphics\GIM\GIS\117591_LHAAP\Doc\Mxd\Bera\FIG3-5_SdSamples_SB.mxd



NOTE:
Although Attachment A contains all chemical analytical samples, only samples with explosive results are shown on this figure. Also, some samples on this figure may have results in Attachment A for multiple dates and/or multiple depths, but only one sample location is shown herein.

LEGEND

- × ITS explosives data removed. No explosives data available for this sample.
- + Non-ITS explosives sample.
- ● 2,4-DNT and 2,6-DNT (SVOC) data available for this sample.
- ● ITS explosives data removed. Limited (2,4-DNT and 2,6-DNT) explosives data available for this sample.
- ▲ Post-BERA Samples.
- Watershed
- Roads
- Buildings
- Streams
- Lakes
- LHAAP Boundary

0 500 1,000 2,000 Feet

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

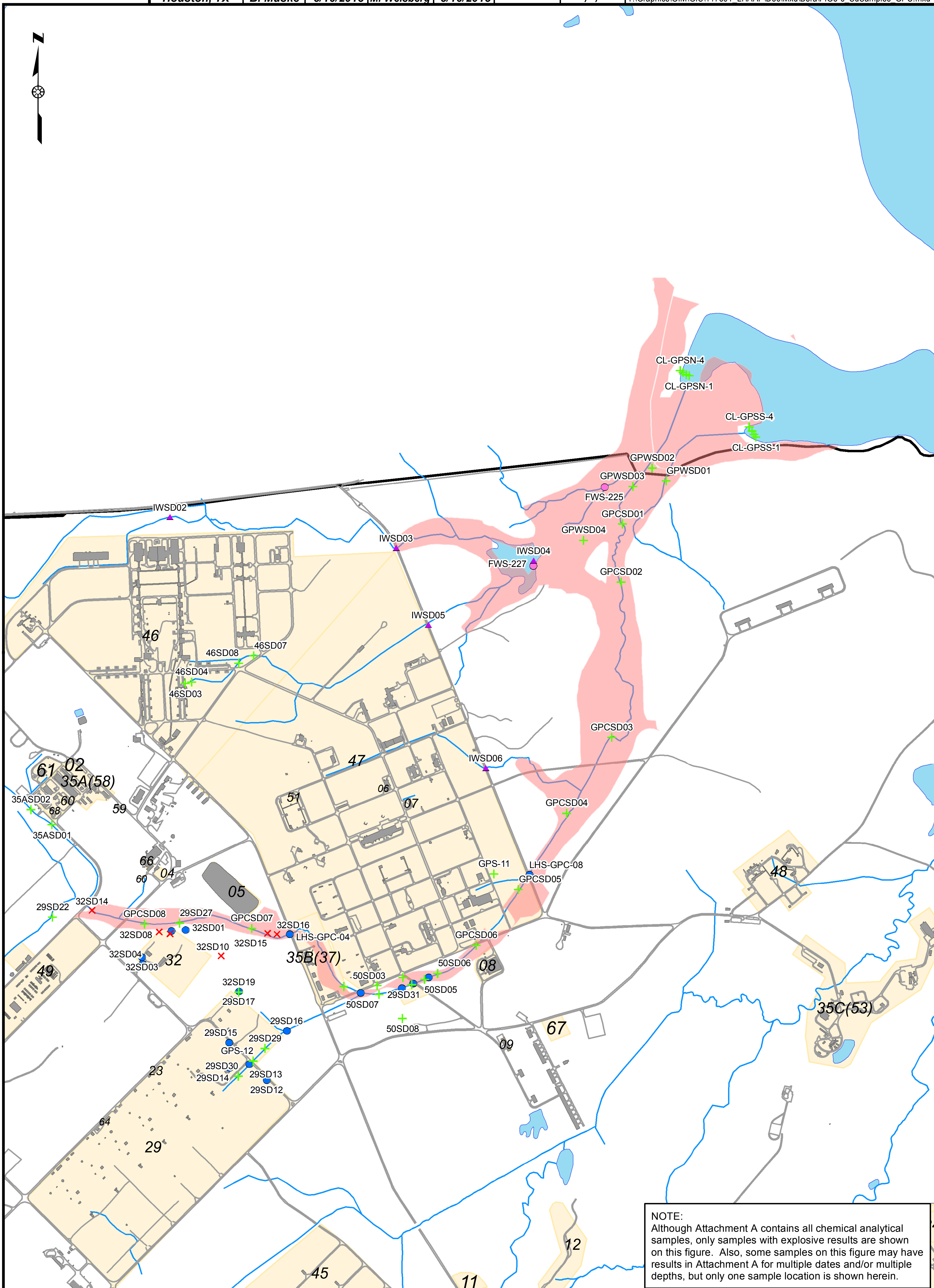
FIGURE 3-5

SEDIMENT SAMPLES
SAUNDERS BRANCH WATERSHED

LONGHORN ARMY AMMUNITION PLANT
KARNACK, TEXAS

00188090

OFFICE	DRAWN BY		CHECKED BY		APPROVED BY		FILE PATH
Houston, TX	B. Muske	5/16/2013	M. Weisberg	5/16/2013	---	--/--/--	T:\Graphics\GIM\GIS\117591_LHAAP\Doc\Mxd\Bera\FIG3-6_SdSamples_GPC.mxd



NOTE:
Although Attachment A contains all chemical analytical samples, only samples with explosive results are shown on this figure. Also, some samples on this figure may have results in Attachment A for multiple dates and/or multiple depths, but only one sample location is shown herein.

LEGEND

- × ITS explosives data removed. No explosives data available for this sample.
- + Non-ITS explosives sample.
- ● 2,4-DNT and 2,6-DNT (SVOC) data available for this sample.
- ● ITS explosives data removed. Limited (2,4-DNT and 2,6-DNT) explosives data available for this sample.
- ▲ Post-BERA Samples.
- Watershed
- Roads
- Buildings
- Streams
- Lakes
- LHAAP Boundary

0 650 1,300 2,600 Feet

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

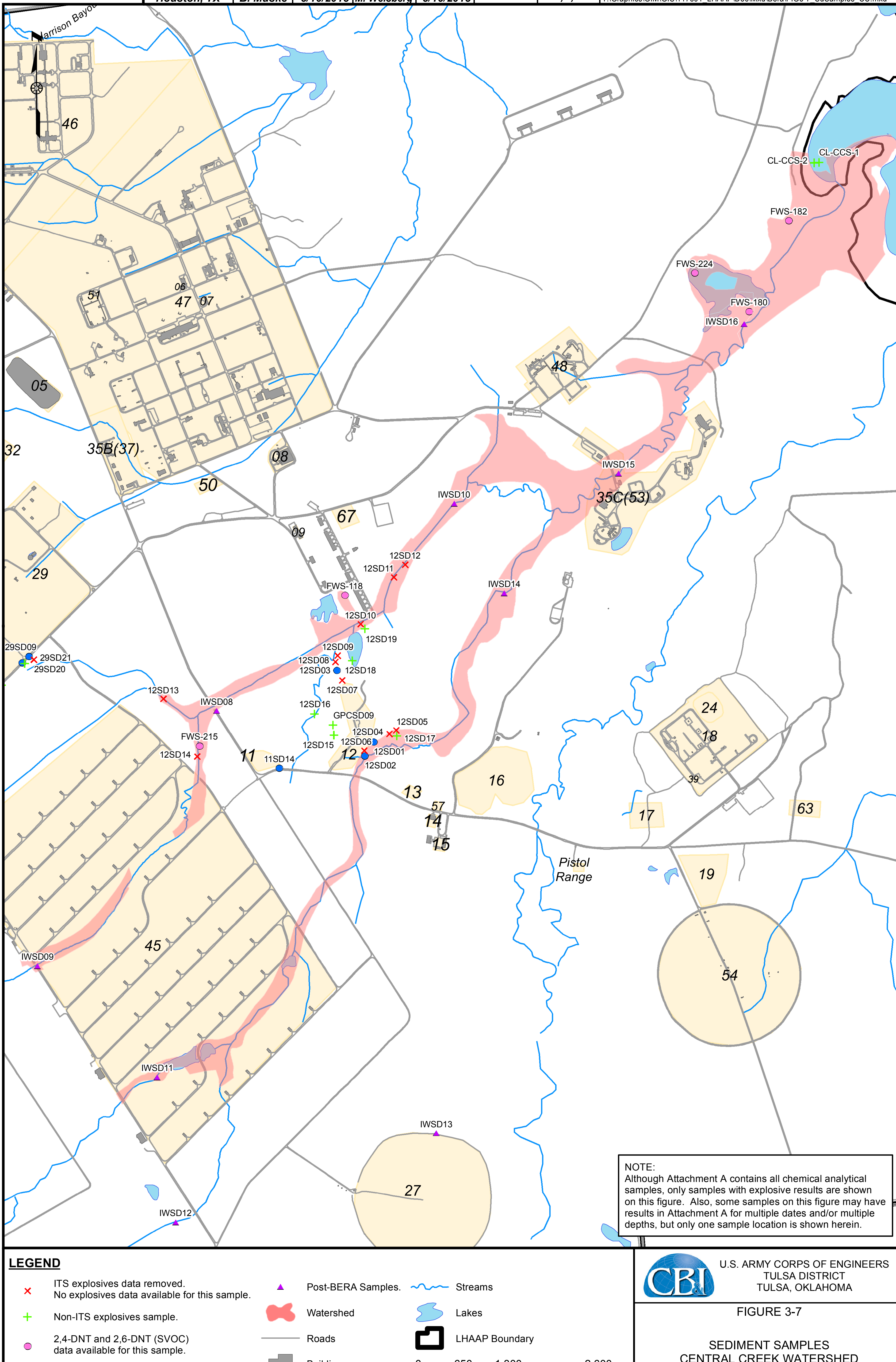
FIGURE 3-6

SEDIMENT SAMPLES
GOOSE PRAIRIE CREEK WATERSHED

LONGHORN ARMY AMMUNITION PLANT
KARNACK, TEXAS

00188091

OFFICE	DRAWN BY		CHECKED BY		APPROVED BY		FILE PATH
Houston, TX	B. Muske	5/16/2013	M. Weisberg	5/16/2013	- - -	--/--/--	T:\Graphics\GIM\GIS\117591_LHAAP\Doc\Mxd\Bera\FIG3-7_SdSamples_CC.mxd



NOTE:
Although Attachment A contains all chemical analytical samples, only samples with explosive results are shown on this figure. Also, some samples on this figure may have results in Attachment A for multiple dates and/or multiple depths, but only one sample location is shown herein.

LEGEND

- ✕ ITS explosives data removed. No explosives data available for this sample.
- + Non-ITS explosives sample.
- ● (pink) 2,4-DNT and 2,6-DNT (SVOC) data available for this sample.
- ● (blue) ITS explosives data removed. Limited (2,4-DNT and 2,6-DNT) explosives data available for this sample.
- ▲ Post-BERA Samples.
- Watershed
- Roads
- Buildings
- Streams
- Lakes
- LHAAP Boundary

0 650 1,300 2,600 Feet

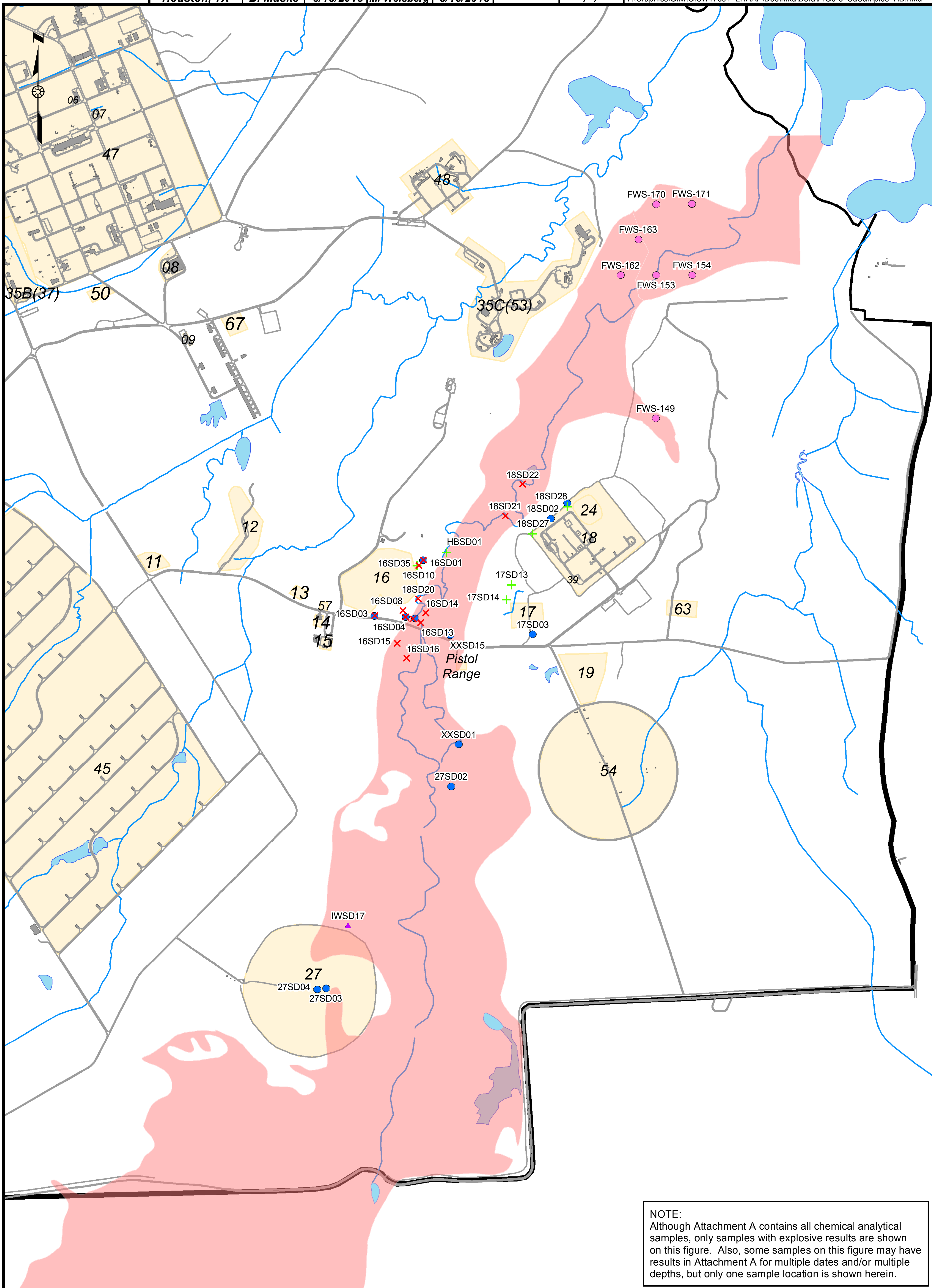
U.S. ARMY CORPS OF ENGINEERS
TULSA DISTRICT
TULSA, OKLAHOMA

FIGURE 3-7

SEDIMENT SAMPLES
CENTRAL CREEK WATERSHED

LONGHORN ARMY AMMUNITION PLANT
KARNACK, TEXAS

OFFICE	DRAWN BY		CHECKED BY		APPROVED BY		FILE PATH
Houston, TX	B. Muske	5/16/2013	M. Weisberg	5/16/2013	---	--/--/--	T:\Graphics\GIM\GIS\117591_LHAAP\Doc\Mxd\Bera\FIG3-8_SdSamples_HB.mxd



NOTE:
Although Attachment A contains all chemical analytical samples, only samples with explosive results are shown on this figure. Also, some samples on this figure may have results in Attachment A for multiple dates and/or multiple depths, but only one sample location is shown herein.

LEGEND

- × ITS explosives data removed. No explosives data available for this sample.
- + Non-ITS explosives sample.
- ● 2,4-DNT and 2,6-DNT (SVOC) data available for this sample.
- ● ITS explosives data removed. Limited (2,4-DNT and 2,6-DNT) explosives data available for this sample.
- ▲ Post-BERA Samples.
- Watershed
- Roads
- Buildings
- Streams
- Lakes
- LHAAP Boundary

0 650 1,300 2,600 Feet

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

FIGURE 3-8

SEDIMENT SAMPLES
HARRISON BAYOU WATERSHED

LONGHORN ARMY AMMUNITION PLANT
KARNACK, TEXAS

4.0 CONCLUSIONS AND RECOMMENDATIONS

4.1 Saunders Branch

Explosives data for six sediment and four surface water samples were eliminated; however, three additional post-BERA sediment and surface water samples were collected. Also, all of the eliminated results had SVOC explosives data (i.e., 2,4-DNT and 2,6-DNT). The revised dataset includes adequate sediment and surface water spatial coverage, and all explosives data were non-detect. In addition, this watershed is on the eastern-most portion of the Facility and drains many non-impacted terrestrial areas, so explosives contamination is not believed to be a major concern for SB. Therefore, no additional sediment and surface water sampling is recommended for Saunders Branch.

4.2 Harrison Bayou

Explosives data for 26 sediment and 27 surface water samples were eliminated and one additional post-BERA sample was collected for each media type. Also, 11 and 13 of these eliminated sample results for surface water and sediment, respectively, had SVOC explosives data (i.e., 2,4-DNT and 2,6-DNT). Even though a large number of samples were removed, sediment and surface water spatial coverage is generally still adequate. Although all explosives data were non-detect in both the BERA and the revised dataset, there is some uncertainty related to this finding, due to the loss of a considerable amount of explosives data. In addition, USEPA's ProUCL statistical software and Guidance (USEPA, 2010) states that 8 to 10 samples are generally recommended for estimation of exposure point concentrations for use in risk assessments, and only seven sediment samples remain with full explosives results (**Table 2-1**). Therefore it is recommended that eight additional sediment samples be collected for Harrison Bayou to increase the number of sediment samples to 15 and to provide enhanced spatial coverage. As field crews will be collecting these sediment samples, the additional effort to collect surface water samples will be relatively minor; therefore, five surface water samples will be collected from a subset of these proposed sediment sample locations, assuming water is present. These recommended surface water sample locations are presented in **Figure 4-1**.

4.3 Central Creek

Explosives data for 28 sediment and 28 surface water samples were eliminated; however, 10 additional sediment and five additional surface water post-BERA samples were collected. Also, all 14 of these eliminated sample results for both surface water and sediment had SVOC explosives data (i.e., 2,4-DNT and 2,6-DNT). The revised dataset includes adequate sediment and surface water spatial coverage, and explosives were infrequently detected in both media. Therefore, no additional sediment and surface water sampling is recommended for Central Creek.

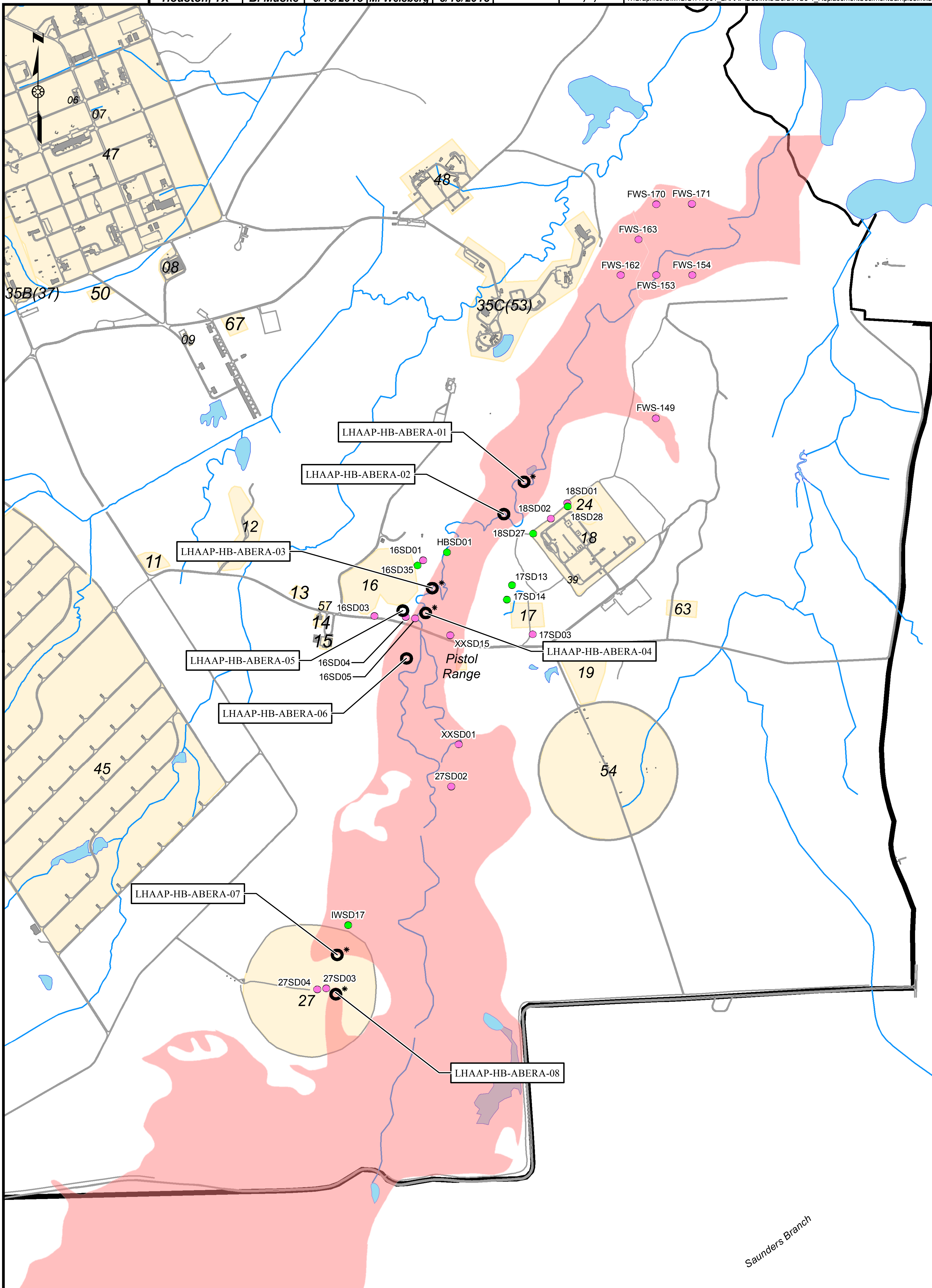
4.4 Goose Prairie Creek

Goose Prairie Creek had the lowest percentage of sediment and surface water samples eliminated, and it had the most samples available in both the BERA and the revised dataset. Explosives data for 22 sediment and 15 surface water samples were eliminated; however, six additional sediment and two surface water post-BERA samples were collected. Also, nine and 16 of these eliminated sample results had SVOC explosives data (i.e., 2,4-DNT and 2,6-DNT) for surface water and sediment, respectively. The revised dataset includes adequate sediment and surface water spatial coverage. In addition, some explosives were non-detect, or were generally infrequently detected in both media, and the frequency of detections was very similar between the BERA and the revised datasets. Therefore, no additional sediment and surface water sampling is recommended for Goose Prairie Creek.

Based on this evaluation of surface water and sediment data, BERA conclusions appear to remain valid for sediment and surface water for GPC, CC, and SB following the elimination of the ITS-ENV data. However, due to the loss of considerable sediment data for HB, the collection of eight additional sediment samples is recommended, so that a total of 15 sediment sample results may be used to recalculate exposure point concentrations of explosives, if explosives are selected as COPECs in this data set. These recommended sediment sample locations are presented in **Figure 4-1**. As field crews will be collecting these sediment samples, the additional effort to collect surface water samples will be relatively minor; therefore, five surface water samples will be collected from a subset of these proposed sediment sample locations, assuming water is present. These recommended surface water sample locations are presented in **Figure 4-1**.

00188095

OFFICE	DRAWN BY		CHECKED BY		APPROVED BY		FILE PATH
Houston, TX	B. Muske	5/16/2013	M. Weisberg	5/16/2013	---	--/--/--	T:\Graphics\GIM\GIS\117591_LHAAP\Doc\Mxd\Bera\FIG3-1_ReplacementSedimentSamples.mxd



LEGEND

- Proposed Explosives Sediment Sample Location
- Proposed Explosives Surface Water Sample Location (if water present)
- Post-BERA and Non-ITS explosives Sample
- 2,4-DNT and 2,6-DNT (SVOC) data available for this sample
- Watershed
- Roads
- Buildings
- Streams
- Lakes
- LHAAP Boundary

0 650 1,300 2,600 Feet

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

FIGURE 4-1

REPLACEMENT SEDIMENT AND SURFACE WATER SAMPLES IN THE HARRISON BAYOU WATERSHED

LONGHORN ARMY AMMUNITION PLANT
KARNACK, TEXAS

5.0 REFERENCES

AGEISS, 2013, Data Gap Memorandum for Explosives in Soil at the Longhorn Army Ammunition Plant, Karnack, Texas, Denver, CO.

Jacobs, 2001a, Final Ecological Risk Assessment, A Supplement to the Remedial Investigation Report Site 16 Landfill, Longhorn Army Ammunition Plant, Karnack, Texas, Oak Ridge, TN.

Jacobs, 2001b, Final Remedial Investigation Report for the Group 2 Sites, Longhorn Army Ammunition Plant, Karnack, Texas, Oak Ridge, TN, April.

Jacobs, 2002, Final Baseline Human Health and Ecological Risk Assessment Report for the Group 2 Sites, Longhorn Army Ammunition Plant, Karnack, Texas, Oak Ridge, TN.

Jacobs, 2003, Final Baseline Human Health and Ecological Risk Assessment Report for the Group 4 Sites, Longhorn Army Ammunition Plant, Karnack, Texas, Oak Ridge, TN.

Shaw, 2007, Final Installation-Wide Baseline Ecological Risk Assessment, Longhorn Army Ammunition Plant, Karnack, Texas, Houston, Texas, November.

U.S. Environmental Protection Agency (USEPA). 2010. ProUCL Version 4.1.00 User Guide. Draft Final. EPA/600/R-07/038. May 2010.

ATTACHMENT A

Samples in Surface Water and Sediment

Attachment A
Samples in Surface Water and Sediment

Location	Sample Number	Date	Analyses	Matrix	LHAAP BERA Source	Basin	Explosives?	1993-1995?	SVOCs analyzed?	Map Symbol
12SD01	12SD01	04/22/93	Explosives, General Chemistry, Metals, SVOC, VOC	SD	Table 6-10	CC	Yes	Yes	Yes	Blue Circle
12SD02	12SD02	04/22/93	Explosives, General Chemistry, Metals, SVOC, VOC	SD	Table 6-10	CC	Yes	Yes	Yes	Blue Circle
12SD03	12SD03(0-0.5)	05/03/93	Explosives, General Chemistry, Metals, SVOC, VOC	SD	Table 6-10	CC	Yes	Yes	Yes	Blue Circle
12SD04	12SD04(000.0)	02/18/95	Explosives, Metals, VOC	SD	Table 6-10	CC	Yes	Yes		Red X
12SD05	12SD05(000.0)	02/18/95	Explosives, Metals, VOC	SD	Table 6-10	CC	Yes	Yes		Red X
12SD06	12SD06(000.0)	02/18/95	Explosives, Metals, VOC	SD	Table 6-10	CC	Yes	Yes		Red X
12SD07	12SD07(000.0)	02/18/95	Explosives, Metals, VOC	SD	Table 6-10	CC	Yes	Yes		Red X
12SD08	12SD08(000.0)	02/18/95	Explosives, Metals, VOC	SD	Table 6-10	CC	Yes	Yes		Red X
12SD08	12SD08(000.0)QC	02/18/95	Explosives, Metals, VOC	SD	Table 6-10	CC	Yes	Yes		Red X
12SD09	12SD09(000.0)	02/18/95	Explosives, Metals, VOC	SD	Table 6-10	CC	Yes	Yes		Red X
12SD10	12SD10 (000.0)	03/15/95	Explosives, Metals, VOC	SD	Table 6-10	CC	Yes	Yes		Red X
12SD11	12SD11 (000.0)	03/15/95	Explosives, Metals, VOC	SD	Table 6-10	CC	Yes	Yes		Red X
12SD12	12SD12 (000.0)	03/15/95	Explosives, Metals, VOC	SD	Table 6-10	CC	Yes	Yes		Red X
12SD13	12SD13(000.0)	03/01/95	Explosives, Metals, VOC	SD	Table 6-10	CC	Yes	Yes		Red X
12SD14	12SD14(000.0)	03/02/95	Explosives, Metals, VOC	SD	Table 6-10	CC	Yes	Yes		Red X
12SD15	12SD15	10/06/98	Dioxins/Furans, Explosives, Metals, Pest/PCB, SVOC, VOC	SD	Table 6-10	CC	Yes		Yes	Green +
12SD15	12SD15QC	10/06/98	Dioxins/Furans, Explosives, Metals, Pest/PCB, SVOC, VOC	SD	Table 6-10	CC	Yes		Yes	Green +
12SD16	12SD16	10/06/98	Explosives, Metals, VOC	SD	Table 6-10	CC	Yes			Green +
12SD17	12SD17	10/06/98	Dioxins/Furans, Explosives, Metals, Pest/PCB, SVOC, VOC	SD	Table 6-10	CC	Yes		Yes	Green +
12SD18	12SD18	10/06/98	Explosives, Metals, VOC	SD	Table 6-10	CC	Yes			Green +
12SD19	12SD19	10/07/98	Dioxins/Furans, Explosives, Metals, Pest/PCB, SVOC, VOC	SD	Table 6-10	CC	Yes		Yes	Green +
12SW01	12SW01	04/18/93	VOC	SD	Table 6-10	CC		Yes		
29SD02	29SD02(0.5)	04/29/93	Explosives, General Chemistry, Metals, SVOC, VOC	SD	Table 6-10	CC	Yes	Yes	Yes	Blue Circle
29SD03	29SD03(0.5)	04/29/93	Explosives, General Chemistry, Metals, SVOC, VOC	SD	Table 6-10	CC	Yes	Yes	Yes	Blue Circle
29SD04	29SD04(0.5)	04/29/93	Explosives, General Chemistry, Metals, SVOC, VOC	SD	Table 6-10	CC	Yes	Yes	Yes	Blue Circle
29SD05	29SD05(0.5)	04/29/93	Explosives, General Chemistry, Metals, SVOC, VOC	SD	Table 6-10	CC	Yes	Yes	Yes	Blue Circle
29SD06	29SD06(0.5)	04/28/93	Explosives, General Chemistry, Metals, SVOC, VOC	SD	Table 6-10	CC	Yes	Yes	Yes	Blue Circle
29SD07	29SD07(0.5)	04/28/93	Explosives, General Chemistry, Metals, SVOC, VOC	SD	Table 6-10	CC	Yes	Yes	Yes	Blue Circle
29SD08	29SD08(0-0.5)	04/28/93	Explosives, General Chemistry, Metals, SVOC, VOC	SD	Table 6-10	CC	Yes	Yes	Yes	Blue Circle
29SD08	29SD08(0-0.5)QC	04/28/93	Explosives, General Chemistry, Metals, SVOC, VOC	SD	Table 6-10	CC	Yes	Yes	Yes	Blue Circle
29SD09	29SD09(0-0.5)	04/28/93	Explosives, General Chemistry, Metals, SVOC, VOC	SD	Table 6-10	CC	Yes	Yes	Yes	Blue Circle
29SD18	29SD18(0-0.5)	05/03/93	Explosives, General Chemistry, Metals, SVOC, VOC	SD	Table 6-10	CC	Yes	Yes	Yes	Blue Circle
29SD19	29SD19 (000.0)	02/22/95	Explosives, Metals	SD	Table 6-10	CC	Yes	Yes		Red X
29SD20	29SD20(000.0)	03/01/95	Explosives, Metals	SD	Table 6-10	CC	Yes	Yes		Red X
29SD21	29SD21 (000.0)	02/22/95	Explosives, Metals	SD	Table 6-10	CC	Yes	Yes		Red X
29SD23	29SD23	10/06/98	Dioxins/Furans, Explosives, Metals, Pest/PCB, SVOC, VOC	SD	Table 6-10	CC	Yes		Yes	Green +
29SD23	29SD23QC	10/06/98	Dioxins/Furans, Explosives, Metals, Pest/PCB, SVOC, VOC	SD	Table 6-10	CC	Yes		Yes	Green +
29SD25	29SD25	10/06/98	Explosives, Metals, VOC	SD	Table 6-10	CC	Yes			Green +
29SD28	29SD28	10/06/98	Explosives, Metals, VOC	SD	Table 6-10	CC	Yes			Green +
11SD14	C940823-11SD14-N00	08/23/94	Explosives, General Chemistry, Metals, SVOC, VOC	SD	Table 6-10	CC	Yes	Yes	Yes	Blue Circle
11SD14	C940823-11SD14-QC00	08/23/94	Explosives, General Chemistry, Metals, SVOC, VOC	SD	Table 6-10	CC	Yes	Yes	Yes	Blue Circle
CL-CCS-1	CL-CCS-1 (1)	10/19/00	Explosives, General Chemistry, Metals, Perchlorate, Pesticides, SVOC, VOC	SD	Table 6-10	CC	Yes		Yes	Green +
CL-CCS-1	CL-CCS-1 (2)	10/19/00	Explosives, General Chemistry, Metals, Perchlorate, Pesticides, SVOC, VOC	SD	Table 6-10	CC	Yes		Yes	Green +
CL-CCS-1	CL-CCS-1(1)	10/19/00	Dioxins/Furans, General Chemistry	SD	Table 6-10	CC				
CL-CCS-2	CL-CCS-2 (1)	10/19/00	Explosives, General Chemistry, Metals, Perchlorate, Pesticides, SVOC, VOC	SD	Table 6-10	CC	Yes		Yes	Green +
CL-CCS-2	CL-CCS-2 (1)QC	10/19/00	Explosives, General Chemistry, Metals, Perchlorate, Pesticides, SVOC, VOC	SD	Table 6-10	CC	Yes		Yes	Green +
CL-CCS-2	CL-CCS-2 (2)	10/19/00	Explosives, General Chemistry, Metals, Perchlorate, Pesticides, SVOC, VOC	SD	Table 6-10	CC	Yes		Yes	Green +
CL-HBS-1	CL-HBS-1 (1)	10/18/00	Explosives, General Chemistry, Metals, Perchlorate, Pesticides, SVOC, VOC	SD	Table 6-10	CC	Yes		Yes	Green +
CL-HBS-1	CL-HBS-1 (2)	10/18/00	Explosives, General Chemistry, Metals, Perchlorate, Pesticides, SVOC, VOC	SD	Table 6-10	CC	Yes		Yes	Green +
CL-HBS-2	CL-HBS-2 (1)	10/18/00	Explosives, General Chemistry, Metals, Perchlorate, Pesticides, SVOC, VOC	SD	Table 6-10	CC	Yes		Yes	Green +
CL-HBS-2	CL-HBS-2 (2)	10/18/00	Explosives, General Chemistry, Metals, Perchlorate, Pesticides, SVOC, VOC	SD	Table 6-10	CC	Yes		Yes	Green +
CL-HBS-2	CL-HBS-2(1)	10/18/00	Dioxins/Furans, General Chemistry	SD	Table 6-10	CC				
CL-HBS-2	CL-HBS-2(1)QC	10/18/00	Dioxins/Furans, General Chemistry	SD	Table 6-10	CC				
CL-HBS-3	CL-HBS-3 (1)	10/18/00	Explosives, General Chemistry, Metals, Perchlorate, Pesticides, SVOC, VOC	SD	Table 6-10	CC	Yes		Yes	Green +
CL-HBS-3	CL-HBS-3 (1)QC	10/18/00	Explosives, General Chemistry, Metals, Perchlorate, Pesticides, SVOC, VOC	SD	Table 6-10	CC	Yes		Yes	Green +
CL-HBS-3	CL-HBS-3 (2)	10/18/00	Explosives, General Chemistry, Metals, Perchlorate, Pesticides, SVOC, VOC	SD	Table 6-10	CC	Yes		Yes	Green +
CL-HBS-4	CL-HBS-4 (1)	10/18/00	Explosives, General Chemistry, Metals, Perchlorate, Pesticides, SVOC, VOC	SD	Table 6-10	CC	Yes		Yes	Green +
CL-HBS-4	CL-HBS-4 (2)	10/18/00	Explosives, General Chemistry, Metals, Perchlorate, Pesticides, SVOC, VOC	SD	Table 6-10	CC	Yes		Yes	Green +
CL-HBS-4	CL-HBS-4(1)	10/18/00	Dioxins/Furans, General Chemistry	SD	Table 6-10	CC				
FWS-118	CLNWR118	09/09/03	Dioxins/Furans, Metals, Pesticides, SVOC	SD	Table 6-10	CC			Yes	Pink Circle
FWS-180	CLNWR180	09/09/03	Metals, Pesticides, SVOC	SD	Table 6-10	CC			Yes	Pink Circle
FWS-182	CLNWR182	09/09/03	Metals, Pesticides, SVOC	SD	Table 6-10	CC			Yes	Pink Circle
FWS-215	CLNWR215	09/09/03	Metals, Pesticides, SVOC	SD	Table 6-10	CC			Yes	Pink Circle
FWS-224	CLNWR224	09/09/03	Metals, Pesticides, SVOC	SD	Table 6-10	CC			Yes	Pink Circle
GPCSD09	GPCSD09-981111	11/11/98	Explosives, General Chemistry, Metals, SVOC, VOC	SD	Table 6-10	CC	Yes		Yes	Green +
GPCSD09	GPCSD09-981203	12/03/98	Pest/PCB	SD	Table 6-10	CC				
IWSD07	IWSD07	09/17/04	Metals, Perchlorate, Explosives	SD	App. G_Table G-1	CC	Yes			Purple Triangle
IWSD08	IWSD08	09/17/04	Metals, Perchlorate, Explosives	SD	App. G_Table G-1	CC	Yes			Purple Triangle
IWSD09	IWSD09	09/17/04	Metals, Perchlorate, Explosives	SD	App. G_Table G-1	CC	Yes			Purple Triangle
IWSD10	IWSD10	09/17/04	Metals, Perchlorate, Explosives	SD	App. G_Table G-1	CC	Yes			Purple Triangle
IWSD11	IWSD11	09/16/04	Metals, Perchlorate, Explosives	SD	App. G_Table G-1	CC	Yes			Purple Triangle
IWSD12	IWSD12	09/16/04	Metals, Perchlorate, Explosives	SD	App. G_Table G-1	CC	Yes			Purple Triangle
IWSD13	IWSD13	09/16/04	Metals, Perchlorate, Explosives	SD	App. G_Table G-1	CC	Yes			Purple Triangle
IWSD14	IWSD14	09/16/04	Metals, Perchlorate, Explosives	SD	App. G_Table G-1	CC	Yes			Purple Triangle
IWSD14-QC	IWSD14-QC	09/16/04	Metals, Perchlorate, Explosives	SD	App. G_Table G-1	CC	Yes			Purple Triangle
IWSD15	IWSD15	09/17/04	Metals, Perchlorate, Explosives, SVOCs, Pesticides, Herbicides, PCBs, Dioxins/Furans	SD	App. G_Table G-1	CC	Yes			Purple Triangle
IWSD16	IWSD16	09/17/04	Metals, Perchlorate, Explosives	SD	App. G_Table G-1	CC	Yes			Purple Triangle
11SD14	LH11-SD14	03/31/93	Explosives, General Chemistry, Metals, SVOC, VOC	SD	Table 6-10	CC	Yes	Yes	Yes	Blue Circle

Attachment A
Samples in Surface Water and Sediment

Location	Sample Number	Date	Analyses	Matrix	LHAAP BERA Source	Basin	Explosives?	1993-1995?	SVOCs analyzed?	Map Symbol
29SD12	29SD12(0-0.5)	04/27/93	Explosives, General Chemistry, Metals, SVOC, VOC	SD	Table 6-8	GPC	Yes	Yes	Yes	**Blue Circle**
29SD13	29SD13(0-0.5)	04/27/93	Explosives, General Chemistry, Metals, SVOC, VOC	SD	Table 6-8	GPC	Yes	Yes	Yes	**Blue Circle**
29SD13	29SD13(0-0.5)QC	04/27/93	Explosives, General Chemistry, Metals, SVOC, VOC	SD	Table 6-8	GPC	Yes	Yes	Yes	**Blue Circle**
29SD14	29SD14(0.5)	04/30/93	Explosives, General Chemistry, Metals, SVOC, VOC	SD	Table 6-8	GPC	Yes	Yes	Yes	**Blue Circle**
29SD15	29SD15(0-0.5)	04/27/93	Explosives, General Chemistry, Metals, SVOC, VOC	SD	Table 6-8	GPC	Yes	Yes	Yes	**Blue Circle**
29SD16	29SD16(0-0.5)	04/27/93	Explosives, General Chemistry, Metals, SVOC, VOC	SD	Table 6-8	GPC	Yes	Yes	Yes	**Blue Circle**
29SD17	29SD17(0.5)	04/30/93	Explosives, General Chemistry, Metals, SVOC, VOC	SD	Table 6-8	GPC	Yes	Yes	Yes	**Blue Circle**
29SD22	29SD22	10/07/98	Explosives, Metals, VOC	SD	Table 6-8	GPC	Yes			**Green +**
29SD27	29SD27	10/08/98	Dioxins/Furans, Explosives, Metals, Pest/PCB, SVOC, VOC	SD	Table 6-8	GPC	Yes		Yes	**Green +**
29SD29	29SD29	10/06/98	Explosives, Metals, VOC	SD	Table 6-8	GPC	Yes			**Green +**
29SD30	29SD30	10/07/98	Dioxins/Furans, Explosives, Metals, Pest/PCB, SVOC, VOC	SD	Table 6-8	GPC	Yes		Yes	**Green +**
29SD31	29SD31	10/07/98	Explosives, Metals, VOC	SD	Table 6-8	GPC	Yes			**Green +**
32SD01	32SD01(0.5)	04/30/93	Explosives, General Chemistry, Metals, SVOC, VOC	SD	Table 6-8	GPC	Yes	Yes	Yes	**Blue Circle**
32SD01	32SD01(0.5)QC	04/30/93	General Chemistry, Metals, SVOC, VOC	SD	Table 6-8	GPC		Yes	Yes	**Blue Circle**
32SD02	32SD02(0.5)	04/30/93	Explosives, General Chemistry, Metals, SVOC, VOC	SD	Table 6-8	GPC	Yes	Yes	Yes	**Blue Circle**
32SD03	32SD03(0.5)	04/30/93	Explosives, General Chemistry, Metals, SVOC, VOC	SD	Table 6-8	GPC	Yes	Yes	Yes	**Blue Circle**
32SD04	32SD04(0.5)	04/30/93	Explosives, General Chemistry, Metals, SVOC, VOC	SD	Table 6-8	GPC	Yes	Yes	Yes	**Blue Circle**
32SD08	32SD08(000.0)	04/12/95	Explosives, Metals	SD	Table 6-8	GPC	Yes	Yes		**Red X**
32SD09	32SD09(000.0)	04/12/95	Explosives, Metals	SD	Table 6-8	GPC	Yes	Yes		**Red X**
32SD10	32SD10(000.0)	02/20/95	Explosives, Metals	SD	Table 6-8	GPC	Yes	Yes		**Red X**
32SD14	32SD14(000.0)	02/19/95	Explosives, Metals	SD	Table 6-8	GPC	Yes	Yes		**Red X**
32SD15	32SD15(000.0)	02/19/95	Explosives, Metals	SD	Table 6-8	GPC	Yes	Yes		**Red X**
32SD16	32SD16(000.0)	02/19/95	Explosives, Metals	SD	Table 6-8	GPC	Yes	Yes		**Red X**
32SD19	32SD19-981008	10/08/98	Dioxins/Furans, Explosives, Metals, Pest/PCB, SVOC, VOC	SD	Table 6-8	GPC	Yes		Yes	**Green +**
35ASD01	35ASD01-981109	11/09/98	Dioxins/Furans, Explosives, General Chemistry, Metals, Pest/PCB, SVOC, VOC	SD	Table 6-8	GPC	Yes		Yes	**Green +**
35ASD01	35ASD01-981203	12/03/98	Pest/PCB	SD	Table 6-8	GPC				
35ASD02	35ASD02-981109	11/09/98	Explosives, General Chemistry, Metals, SVOC, VOC	SD	Table 6-8	GPC	Yes		Yes	**Green +**
35ASD02	35ASD02-981203	12/03/98	Pest/PCB	SD	Table 6-8	GPC				
46SD03	46SD03-981110	11/10/98	Explosives, General Chemistry, Metals, SVOC, VOC	SD	Table 6-8	GPC	Yes		Yes	**Green +**
46SD03	46SD03-981203	12/03/98	Pest/PCB	SD	Table 6-8	GPC				
46SD04	46SD04-981110	11/10/98	Explosives, General Chemistry, Metals, SVOC, VOC	SD	Table 6-8	GPC	Yes		Yes	**Green +**
46SD04	46SD04-981207	12/07/98	Pest/PCB	SD	Table 6-8	GPC				
46SD07	46SD07-981110	11/10/98	Explosives, General Chemistry, Metals, SVOC, VOC	SD	Table 6-8	GPC	Yes		Yes	**Green +**
46SD07	46SD07-981203	12/03/98	Pest/PCB	SD	Table 6-8	GPC				
46SD08	46SD08-981110	11/10/98	Explosives, General Chemistry, Metals, SVOC, VOC	SD	Table 6-8	GPC	Yes		Yes	**Green +**
46SD08	46SD08-981203	12/03/98	Pest/PCB	SD	Table 6-8	GPC				
50SD03	50SD03-981112	11/12/98	Explosives, General Chemistry, Metals, SVOC, VOC	SD	Table 6-8	GPC	Yes		Yes	**Green +**
50SD04	50SD04-981111	11/11/98	Explosives, General Chemistry, Metals, SVOC, VOC	SD	Table 6-8	GPC	Yes		Yes	**Green +**
50SD05	50SD05-981111	11/11/98	Explosives, General Chemistry, Metals, SVOC, VOC	SD	Table 6-8	GPC	Yes		Yes	**Green +**
50SD06	50SD06-981110	11/10/98	Explosives, General Chemistry, Metals, Pest/PCB, SVOC, VOC	SD	Table 6-8	GPC	Yes		Yes	**Green +**
50SD06	50SD06-981111	11/11/98	Dioxins/Furans	SD	Table 6-8	GPC				
50SD07	50SD07-981111	11/11/98	Explosives, General Chemistry, Metals, SVOC, VOC	SD	Table 6-8	GPC	Yes		Yes	**Green +**
50SD08	50SD08-981111	11/11/98	Dioxins/Furans, Explosives, General Chemistry, Metals, Pest/PCB, SVOC, VOC	SD	Table 6-8	GPC	Yes		Yes	**Green +**
60SD01	60SD01-981110	11/10/98	Pesticides	SD	Table 6-8	GPC				
60SD02	60SD02-981110	11/10/98	Pesticides	SD	Table 6-8	GPC				
60SD02	60SD02QC	11/10/98	Pesticides	SD	Table 6-8	GPC				
50SD06	C-50SD06QC-981110	11/10/98	Explosives, General Chemistry, Metals, Pest/PCB, SVOC, VOC	SD	Table 6-8	GPC	Yes		Yes	**Green +**
50SD06	C-50SD06QC-981111	11/11/98	Dioxins/Furans	SD	Table 6-8	GPC				
CL-GPSN-1	CL-GPSN-1 (1)	08/10/00	Explosives, General Chemistry, Metals, Pesticides, SVOC, VOC	SD	Table 6-8	GPC	Yes		Yes	**Green +**
CL-GPSN-1	CL-GPSN-1 (2)	08/10/00	Explosives, General Chemistry, Metals, Pesticides, SVOC, VOC	SD	Table 6-8	GPC	Yes		Yes	**Green +**
CL-GPSN-1	CL-GPSN-1(1)	08/10/00	General Chemistry, Perchlorate	SD	Table 6-8	GPC				
CL-GPSN-1	CL-GPSN-1(2)	08/10/00	General Chemistry, Perchlorate	SD	Table 6-8	GPC				
CL-GPSN-2	CL-GPSN-2 (1)	08/10/00	Explosives, General Chemistry, Metals, Pesticides, SVOC, VOC	SD	Table 6-8	GPC	Yes		Yes	**Green +**
CL-GPSN-2	CL-GPSN-2 (2)	08/10/00	Explosives, General Chemistry, Metals, Pesticides, SVOC, VOC	SD	Table 6-8	GPC	Yes		Yes	**Green +**
CL-GPSN-2	CL-GPSN-2(1)	08/10/00	General Chemistry, Perchlorate	SD	Table 6-8	GPC				
CL-GPSN-2	CL-GPSN-2(2)	08/10/00	General Chemistry, Perchlorate	SD	Table 6-8	GPC				
CL-GPSN-3	CL-GPSN-3 (1)	08/10/00	Explosives, General Chemistry, Metals, Pesticides, SVOC, VOC	SD	Table 6-8	GPC	Yes		Yes	**Green +**
CL-GPSN-3	CL-GPSN-3 (2)	08/10/00	Explosives, General Chemistry, Metals, Pesticides, SVOC, VOC	SD	Table 6-8	GPC	Yes		Yes	**Green +**
CL-GPSN-3	CL-GPSN-3 (2) QC	08/10/00	Explosives, General Chemistry, Metals, Pesticides, SVOC, VOC	SD	Table 6-8	GPC	Yes		Yes	**Green +**
CL-GPSN-3	CL-GPSN-3(1)	08/10/00	General Chemistry, Perchlorate	SD	Table 6-8	GPC				
CL-GPSN-3	CL-GPSN-3(2)	08/10/00	General Chemistry, Perchlorate	SD	Table 6-8	GPC				
CL-GPSN-3	CL-GPSN-3(2) QC	08/10/00	General Chemistry, Perchlorate	SD	Table 6-8	GPC				
CL-GPSN-4	CL-GPSN-4 (1)	08/10/00	Explosives, General Chemistry, Metals, Pesticides, SVOC, VOC	SD	Table 6-8	GPC	Yes		Yes	**Green +**
CL-GPSN-4	CL-GPSN-4 (2)	08/10/00	Explosives, General Chemistry, Metals, Pesticides, SVOC, VOC	SD	Table 6-8	GPC	Yes		Yes	**Green +**
CL-GPSN-4	CL-GPSN-4(1)	08/10/00	General Chemistry, Perchlorate	SD	Table 6-8	GPC				
CL-GPSN-4	CL-GPSN-4(2)	08/10/00	General Chemistry, Perchlorate	SD	Table 6-8	GPC				
CL-GPSS-1	CL-GPSS-1 (1)	08/09/00	Explosives, General Chemistry, Metals, Pesticides, SVOC, VOC	SD	Table 6-8	GPC	Yes		Yes	**Green +**
CL-GPSS-1	CL-GPSS-1 (2)	08/09/00	Explosives, General Chemistry, Metals, Pesticides, SVOC, VOC	SD	Table 6-8	GPC	Yes		Yes	**Green +**
CL-GPSS-1	CL-GPSS-1(1)	08/09/00	General Chemistry, Perchlorate	SD	Table 6-8	GPC				
CL-GPSS-1	CL-GPSS-1(2)	08/09/00	General Chemistry, Perchlorate	SD	Table 6-8	GPC				
CL-GPSS-2	CL-GPSS-2 (1)	08/09/00	Explosives, General Chemistry, Metals, Pesticides, SVOC, VOC	SD	Table 6-8	GPC	Yes		Yes	**Green +**
CL-GPSS-2	CL-GPSS-2 (1) QC	08/09/00	Explosives, General Chemistry, Metals, Pesticides, SVOC, VOC	SD	Table 6-8	GPC	Yes		Yes	**Green +**
CL-GPSS-2	CL-GPSS-2 (2)	08/09/00	Explosives, General Chemistry, Metals, Pesticides, SVOC, VOC	SD	Table 6-8	GPC	Yes		Yes	**Green +**
CL-GPSS-2	CL-GPSS-2(1)	08/09/00	General Chemistry, Perchlorate	SD	Table 6-8	GPC				
CL-GPSS-2	CL-GPSS-2(1)QC	08/09/00	General Chemistry, Perchlorate	SD	Table 6-8	GPC				
CL-GPSS-2	CL-GPSS-2(2)	08/09/00	General Chemistry, Perchlorate	SD	Table 6-8	GPC				
CL-GPSS-3	CL-GPSS-3 (1)	08/09/00	Explosives, General Chemistry, Metals, Pesticides, SVOC, VOC	SD	Table 6-8	GPC	Yes		Yes	**Green +**
CL-GPSS-3	CL-GPSS-3 (2)	08/09/00	Explosives, General Chemistry, Metals, Pesticides, SVOC, VOC	SD	Table 6-8	GPC	Yes		Yes	**Green +**

Attachment A
Samples in Surface Water and Sediment

Location	Sample Number	Date	Analyses	Matrix	LHAAP BERA Source	Basin	Explosives?	1993-1995?	SVOCs analyzed?	Map Symbol
CL-GPSS-3	CL-GPSS-3(1)	08/09/00	General Chemistry, Perchlorate	SD	Table 6-8	GPC				
CL-GPSS-3	CL-GPSS-3(2)	08/09/00	General Chemistry, Perchlorate	SD	Table 6-8	GPC				
CL-GPSS-4	CL-GPSS-4 (1)	08/09/00	Explosives, General Chemistry, Metals, Pesticides, SVOC, VOC	SD	Table 6-8	GPC	Yes		Yes	Green +
CL-GPSS-4	CL-GPSS-4 (2)	08/09/00	Explosives, General Chemistry, Metals, Pesticides, SVOC, VOC	SD	Table 6-8	GPC	Yes		Yes	Green +
CL-GPSS-4	CL-GPSS-4(1)	08/09/00	General Chemistry, Perchlorate	SD	Table 6-8	GPC				
CL-GPSS-4	CL-GPSS-4(2)	08/09/00	General Chemistry, Perchlorate	SD	Table 6-8	GPC				
FWS-225	CLNWR225	09/09/03	Metals, Pesticides, SVOC	SD	Table 6-8	GPC			Yes	Pink Circle
FWS-227	CLNWR227	09/09/03	Metals, Pesticides, SVOC	SD	Table 6-8	GPC			Yes	Pink Circle
GPCSD01	GPCSD01-981118	11/18/98	Explosives, General Chemistry, Metals, SVOC, VOC	SD	Table 6-8	GPC	Yes		Yes	Green +
GPCSD01	GPCSD01-981202	12/02/98	Pest/PCB	SD	Table 6-8	GPC				
GPCSD02	GPCSD02-981118	11/18/98	Explosives, General Chemistry, Metals, SVOC, VOC	SD	Table 6-8	GPC	Yes		Yes	Green +
GPCSD02	GPCSD02-981202	12/02/98	Pest/PCB	SD	Table 6-8	GPC				
GPCSD03	GPCSD03	11/17/98	Dioxins/Furans, Explosives, Metals, Pest/PCB, SVOC, VOC	SD	Table 6-8	GPC	Yes		Yes	Green +
GPCSD04	GPCSD04-981116	11/16/98	Explosives, General Chemistry, Metals, SVOC, VOC	SD	Table 6-8	GPC	Yes		Yes	Green +
GPCSD04	GPCSD04-981202	12/02/98	Pest/PCB	SD	Table 6-8	GPC				
GPCSD05	GPCSD05-981116	11/16/98	Explosives, General Chemistry, Metals, SVOC, VOC	SD	Table 6-8	GPC	Yes		Yes	Green +
GPCSD05	GPCSD05-981202	12/02/98	Pest/PCB	SD	Table 6-8	GPC				
GPCSD06	GPCSD06	11/16/98	Dioxins/Furans, Explosives, General Chemistry, Metals, Pest/PCB, SVOC, VOC	SD	Table 6-8	GPC	Yes		Yes	Green +
GPCSD06	GPCSD06QC	11/16/98	Dioxins/Furans, Explosives, General Chemistry, Metals, Pest/PCB, SVOC, VOC	SD	Table 6-8	GPC	Yes		Yes	Green +
GPCSD07	GPCSD07-981116	11/16/98	Explosives, General Chemistry, Metals, SVOC, VOC	SD	Table 6-8	GPC	Yes		Yes	Green +
GPCSD07	GPCSD07-981203	12/03/98	Pest/PCB	SD	Table 6-8	GPC				
GPCSD08	GPCSD08	11/11/98	Dioxins/Furans, Explosives, General Chemistry, Metals, Pest/PCB, SVOC, VOC	SD	Table 6-8	GPC	Yes		Yes	Green +
GPCSD10	GPCSD10-981111	11/11/98	Explosives, General Chemistry, Metals, SVOC, VOC	SD	Table 6-8	GPC	Yes		Yes	Green +
GPCSD10	GPCSD10-981203	12/03/98	Pest/PCB	SD	Table 6-8	GPC				
GPS-1	GPS-1	08/07/96	VOC	SD	Table 6-8	GPC				
GPS-11	GPS-11	09/04/97	Explosives, VOC	SD	Table 6-8	GPC	Yes			Green +
GPS-12	GPS-12	09/04/97	Explosives, VOC	SD	Table 6-8	GPC	Yes			Green +
GPS-2	GPS-2	08/07/96	VOC	SD	Table 6-8	GPC				
GPS-3	GPS-3	08/07/96	VOC	SD	Table 6-8	GPC				
GPS-4	GPS-4	08/07/96	VOC	SD	Table 6-8	GPC				
GPS-5	GPS-5	08/08/96	VOC	SD	Table 6-8	GPC				
GPS-6	GPS-6	08/08/96	VOC	SD	Table 6-8	GPC				
GPWSD01	GPWSD01	11/19/98	Dioxins/Furans, Explosives, General Chemistry, Metals, Pest/PCB, SVOC, VOC	SD	Table 6-8	GPC	Yes		Yes	Green +
GPWSD01	GPWSD01QC	11/19/98	Dioxins/Furans, Explosives, General Chemistry, Metals, Pest/PCB, SVOC, VOC	SD	Table 6-8	GPC	Yes		Yes	Green +
GPWSD02	GPWSD02-981201	12/01/98	Explosives, General Chemistry, Metals, SVOC, VOC	SD	Table 6-8	GPC	Yes		Yes	Green +
GPWSD02	GPWSD02-981202	12/02/98	Pest/PCB	SD	Table 6-8	GPC				
GPWSD03	GPWSD03-981201	12/01/98	Explosives, General Chemistry, Metals, SVOC, VOC	SD	Table 6-8	GPC	Yes		Yes	Green +
GPWSD03	GPWSD03-981202	12/02/98	Pest/PCB	SD	Table 6-8	GPC				
GPWSD04	GPWSD04-981120	11/20/98	Dioxins/Furans, Explosives, General Chemistry, Metals, Pest/PCB, SVOC, VOC	SD	Table 6-8	GPC	Yes		Yes	Green +
IWSD01	IWSD01	09/17/04	Metals, Perchlorate, Explosives	SD	App. G_Table G-1	GPC	Yes			Purple Triangle
IWSD02	IWSD02	09/16/04	Metals, Perchlorate, Explosives	SD	App. G_Table G-1	GPC	Yes			Purple Triangle
IWSD03	IWSD03	09/16/04	Metals, Perchlorate, Explosives	SD	App. G_Table G-1	GPC	Yes			Purple Triangle
IWSD03-QC	IWSD03-QC	09/16/04	Metals, Perchlorate, Explosives	SD	App. G_Table G-1	GPC	Yes			Purple Triangle
IWSD04	IWSD04	09/16/04	Metals, Perchlorate, Explosives, SVOCs, Pesticides, Herbicides, PCBs, Dioxins/Furans	SD	App. G_Table G-1	GPC	Yes			Purple Triangle
IWSD05	IWSD05	09/16/04	Metals, Perchlorate, Explosives	SD	App. G_Table G-1	GPC	Yes			Purple Triangle
IWSD06	IWSD06	09/16/04	Metals, Perchlorate, Explosives	SD	App. G_Table G-1	GPC	Yes			Purple Triangle
50SD01	LH50SD01(0-1)	11/29/95	Explosives, Metals, SVOC, VOC	SD	Table 6-8	GPC	Yes	Yes	Yes	Blue Circle
50SD01	LH50SD01(0-1)QC	11/29/95	Explosives, Metals, SVOC, VOC	SD	Table 6-8	GPC	Yes	Yes	Yes	Blue Circle
50SD02	LH50SD02(0-1)	11/29/95	Explosives, Metals, SVOC, VOC	SD	Table 6-8	GPC	Yes	Yes	Yes	Blue Circle
LHS-GPC-02	LHS-GPC-02	01/12/95	Explosives, Metals, SVOC, VOC	SD	Table 6-8	GPC	Yes	Yes	Yes	Blue Circle
LHS-GPC-04	LHS-GPC-04	01/12/95	Explosives, Metals, SVOC, VOC	SD	Table 6-8	GPC	Yes	Yes	Yes	Blue Circle
LHS-GPC-06	LHS-GPC-06	01/12/95	Explosives, Metals, SVOC, VOC	SD	Table 6-8	GPC	Yes	Yes	Yes	Blue Circle
LHS-GPC-08	LHS-GPC-08	01/12/95	Explosives, Metals, SVOC, VOC	SD	Table 6-8	GPC	Yes	Yes	Yes	Blue Circle
16SD01	16SD01 (000.0)	02/21/95	Explosives, Metals, VOC	SD	Table 6-6	HB	Yes	Yes		Red X
16SD01	16SD01(0-0.5)	05/02/93	Explosives, General Chemistry, Metals, SVOC, VOC	SD	Table 6-6	HB	Yes	Yes	Yes	Blue Circle
16SD03	16SD03(000.0)	02/20/95	Explosives, Metals, VOC	SD	Table 6-6	HB	Yes	Yes		Red X
16SD03	16SD03(0-1)	04/14/93	Explosives, General Chemistry, Metals, SVOC, VOC	SD	Table 6-6	HB	Yes	Yes	Yes	Blue Circle
16SD04	16SD04 (000.0)	02/21/95	Explosives, Metals, VOC	SD	Table 6-6	HB	Yes	Yes		Red X
16SD04	16SD04(0-1)	04/14/93	Explosives, General Chemistry, Metals, SVOC, VOC	SD	Table 6-6	HB	Yes	Yes	Yes	Blue Circle
16SD05	16SD05(0-0.5)	05/02/93	Explosives, General Chemistry, Metals, SVOC, VOC	SD	Table 6-6	HB	Yes	Yes	Yes	Blue Circle
16SD05	16SD05(0-0.5)QC	05/02/93	Explosives, General Chemistry, Metals, SVOC, VOC	SD	Table 6-6	HB	Yes	Yes	Yes	Blue Circle
16SD08	16SD08 (000.0)	02/21/95	Explosives, Metals, VOC	SD	Table 6-6	HB	Yes	Yes		Red X
16SD10	16SD10 (000.0)	02/21/95	Explosives, Metals, VOC	SD	Table 6-6	HB	Yes	Yes		Red X
16SD12	16SD12 (000.0)	02/21/95	Explosives, Metals, VOC	SD	Table 6-6	HB	Yes	Yes		Red X
16SD13	16SD13 (000.0)	02/21/95	Explosives, Metals, VOC	SD	Table 6-6	HB	Yes	Yes		Red X
16SD14	16SD14 (000.0)	02/21/95	Explosives, Metals, VOC	SD	Table 6-6	HB	Yes	Yes		Red X
16SD14	16SD14 QC (000.	02/21/95	Explosives, Metals, VOC	SD	Table 6-6	HB	Yes	Yes		Red X
16SD15	16SD15(000.0)	03/16/95	Explosives, Metals, VOC	SD	Table 6-6	HB	Yes	Yes		Red X
16SD16	16SD16 (000.0)	03/16/95	Explosives, Metals, VOC	SD	Table 6-6	HB	Yes	Yes		Red X
16SD35	16SD35	10/29/97	Dioxins/Furans, Explosives, Metals, Pest/PCB, VOC	SD	Table 6-6	HB	Yes			Green +
17SD03	17SD03	04/21/93	Explosives, General Chemistry, Metals, SVOC, VOC	SD	Table 6-6	HB	Yes	Yes	Yes	Blue Circle
17SD13	17SD13	09/17/98	Explosives, Metals, VOC	SD	Table 6-6	HB	Yes			Green +
17SD14	17SD14	09/17/98	Dioxins/Furans, Explosives, Metals, Pest/PCB, SVOC, VOC	SD	Table 6-6	HB	Yes		Yes	Green +
18SD01	18SD01(0-0.5)	05/02/93	Explosives, General Chemistry, Metals, SVOC, VOC	SD	Table 6-6	HB	Yes	Yes	Yes	Blue Circle
18SD01	18SD01(0-0.5)QC	05/02/93	Explosives, General Chemistry, Metals, SVOC, VOC	SD	Table 6-6	HB	Yes	Yes	Yes	Blue Circle
18SD02	18SD02(0-0.5)	05/02/93	Explosives, General Chemistry, Metals, SVOC, VOC	SD	Table 6-6	HB	Yes	Yes	Yes	Blue Circle
18SD12	18SD12(000.0)	02/18/95	Metals, VOC	SD	Table 6-6	HB		Yes		
18SD13	18SD13(000.0)	02/18/95	Metals, VOC	SD	Table 6-6	HB		Yes		

Attachment A
Samples in Surface Water and Sediment

Location	Sample Number	Date	Analyses	Matrix	LHAAP BERA Source	Basin	Explosives?	1993-1995?	SVOCs analyzed?	Map Symbol
18SD13	18SD13(000.0)QC	02/18/95	Metals, VOC	SD	Table 6-6	HB		Yes		
18SD14	18SD14 (000.0)	02/21/95	Metals, VOC	SD	Table 6-6	HB		Yes		
18SD15	18SD15 (000.0)	02/21/95	Metals, VOC	SD	Table 6-6	HB		Yes		
18SD20	18SD20 (000.0)	02/22/95	Metals, VOC	SD	Table 6-6	HB		Yes		
18SD20	18SD20(000.0)	06/15/95	Explosives	SD	Table 6-6	HB	Yes	Yes		Red X
18SD22	18SD22 (000.0)	03/16/95	Metals, VOC	SD	Table 6-6	HB		Yes		
18SD22	18SD22(000.0)	06/15/95	Explosives	SD	Table 6-6	HB	Yes	Yes		Red X
18SD23	18SD23 (000.0)	03/16/95	Metals, VOC	SD	Table 6-6	HB		Yes		
18SD24	18SD24 (000.0)	03/15/95	Metals, VOC	SD	Table 6-6	HB		Yes		
18SD25	18SD25(000.0)	02/20/95	Metals, VOC	SD	Table 6-6	HB		Yes		
18SD26	18SD26(000.0)	02/20/95	Metals, VOC	SD	Table 6-6	HB		Yes		
18SD27	18SD27	10/07/98	Dioxins/Furans, Explosives, Metals, Pest/PCB, SVOC, VOC	SD	Table 6-6	HB	Yes		Yes	Green +
18SD27	18SD27QC	10/07/98	Dioxins/Furans, Explosives, Metals, Pest/PCB, SVOC, VOC	SD	Table 6-6	HB	Yes		Yes	Green +
18SD28	18SD28	11/12/98	Dioxins/Furans, Explosives, Metals, Pest/PCB, SVOC, VOC	SD	Table 6-6	HB	Yes		Yes	Green +
18SW21	18SW21 (000.0)	02/22/95	Metals, VOC	SD	Table 6-6	HB		Yes		
18SD21	C-18SD21(000.0)-9502	02/22/95	Metals, VOC	SD	Table 6-6	HB		Yes		
18SD21	C-18SD21(000.0)-9506	06/15/95	Explosives	SD	Table 6-6	HB	Yes	Yes		Red X
27SD02	C940823-27SD02-N00	08/23/94	Metals	SD	Table 6-6	HB		Yes		
XXSD15	C940823-XXSD15-N00	08/23/94	Explosives, General Chemistry, Metals, SVOC, VOC	SD	Table 6-6	HB	Yes	Yes	Yes	Blue Circle
FWS-149	CLNWR149	09/09/03	Dioxins/Furans, Metals, Pesticides, SVOC	SD	Table 6-6	HB			Yes	Pink Circle
FWS-153	CLNWR153	09/09/03	Metals, Pesticides, SVOC	SD	Table 6-6	HB			Yes	Pink Circle
FWS-154	CLNWR154	09/09/03	Metals, Pesticides, SVOC	SD	Table 6-6	HB			Yes	Pink Circle
FWS-162	CLNWR162	09/09/03	Metals, Pesticides, SVOC	SD	Table 6-6	HB			Yes	Pink Circle
FWS-163	CLNWR163	09/09/03	Metals, Pesticides, SVOC	SD	Table 6-6	HB			Yes	Pink Circle
FWS-170	CLNWR170	09/09/03	Metals, Pesticides, SVOC	SD	Table 6-6	HB			Yes	Pink Circle
FWS-171	CLNWR171	09/09/03	Metals, Pesticides, SVOC	SD	Table 6-6	HB			Yes	Pink Circle
HBS-1	HBS-1 S5 0193-10	08/31/95	General Chemistry, VOC	SD	Table 6-6	HB		Yes		
HBS-1	HBS-1-960612	06/12/96	VOC	SD	Table 6-6	HB				
HBS-1	HBS-1-960807	08/07/96	VOC	SD	Table 6-6	HB				
HBS-1	HBS-1-QC	08/07/96	VOC	SD	Table 6-6	HB				
HBS-2	HBS-2 S5 0193-12	08/31/95	General Chemistry, VOC	SD	Table 6-6	HB		Yes		
HBS-3	HBS-3 S5 0193-14	08/31/95	General Chemistry, VOC	SD	Table 6-6	HB		Yes		
HBS-4	HBS-4 S5 0193-16	08/31/95	General Chemistry, VOC	SD	Table 6-6	HB		Yes		
HBS-5	HBS-5-950911	09/11/95	VOC	SD	Table 6-6	HB		Yes		
HBS-5	HBS-5-960612	06/12/96	VOC	SD	Table 6-6	HB				
HBS-5	HBS-5-960807	08/07/96	VOC	SD	Table 6-6	HB				
HBS-6	HBS-6-950911	09/11/95	VOC	SD	Table 6-6	HB		Yes		
HBS-6A	HBS-6A-960807	08/07/96	VOC	SD	Table 6-6	HB				
HBS-7	HBS-7-950911	09/11/95	VOC	SD	Table 6-6	HB		Yes		
HBS-8	HBS-8-950911	09/11/95	VOC	SD	Table 6-6	HB		Yes		
HBS-9	HBS-9-950911	09/11/95	VOC	SD	Table 6-6	HB		Yes		
HBW-1	HBW-1-SED	08/10/00	Perchlorate	SD	Table 6-6	HB				
HBW-5	HBW-5-SED	08/10/00	Perchlorate	SD	Table 6-6	HB				
HBW-6	HBW-6-SED	08/10/00	Perchlorate	SD	Table 6-6	HB				
IWSD17	IWSD17	09/16/04	Metals, Perchlorate, Explosives	SD	App. G_Table G-1	HB	Yes			Purple Triangle
27SD02	LH27-SD02	03/30/93	Explosives, General Chemistry, Metals, SVOC, VOC	SD	Table 6-6	HB	Yes	Yes	Yes	Blue Circle
27SD03	LH27-SD03	03/30/93	Explosives, General Chemistry, Metals, SVOC, VOC	SD	Table 6-6	HB	Yes	Yes	Yes	Blue Circle
27SD04	LH27-SD04	03/30/93	Explosives, General Chemistry, Metals, SVOC, VOC	SD	Table 6-6	HB	Yes	Yes	Yes	Blue Circle
XXSD01	LHXX-SD01	03/30/93	Explosives, General Chemistry, Metals, SVOC, VOC	SD	Table 6-6	HB	Yes	Yes	Yes	Blue Circle
XXSD15	LHXX-SD15	03/31/93	Explosives, General Chemistry, Metals, SVOC, VOC	SD	Table 6-6	HB	Yes	Yes	Yes	Blue Circle
XXSD15	LHXX-SD15-QC	03/31/93	Explosives, General Chemistry, Metals, SVOC, VOC	SD	Table 6-6	HB	Yes	Yes	Yes	Blue Circle
HBSD01	P3HBSD01	09/17/98	Dioxins/Furans, Explosives, General Chemistry, Metals, Pest/PCB, SVOC, VOC	SD	Table 6-6	HB	Yes		Yes	Green +
18SD16	18SD16 (000.0)	02/21/95	Metals, VOC	SD	Table 6-12	SB		Yes		
18SD16	18SD16 QC (000.	02/21/95	Metals, VOC	SD	Table 6-12	SB		Yes		
18SD17	18SD17(000.0)	03/05/95	Metals, VOC	SD	Table 6-12	SB		Yes		
18SD18	18SD18(000.0)	03/05/95	Metals, VOC	SD	Table 6-12	SB		Yes		
18SD19	18SD19(000.0)	03/05/95	Metals, VOC	SD	Table 6-12	SB		Yes		
XXSD19	C930319-XXSD19-N00	03/19/93	Explosives, General Chemistry, Metals, SVOC, VOC	SD	Table 6-12	SB	Yes	Yes	Yes	Blue Circle
XXSD18	C930330-XXSD18-N00	03/30/93	Explosives, General Chemistry, Metals, SVOC, VOC	SD	Table 6-12	SB	Yes	Yes	Yes	Blue Circle
XXSD17	C940822-XXSD17-N00	08/22/94	Metals	SD	Table 6-12	SB		Yes		
FWS-139	CLNWR139	09/09/03	Metals, Pest, SVOC	SD	Table 6-12	SB			Yes	Pink Circle
FWS-157	CLNWR157	09/09/03	Dioxins/Furans, Metals, Pest, SVOC	SD	Table 6-12	SB			Yes	Pink Circle
CL-SBS-1	CL-SBS-1 (1)	10/19/00	Explosives, General Chemistry, Metals, Perchlorate, Pest, SVOC, VOC	SD	Table 6-12	SB	Yes		Yes	Green +
CL-SBS-1	CL-SBS-1 (2)	10/19/00	Explosives, General Chemistry, Metals, Perchlorate, Pest, SVOC, VOC	SD	Table 6-12	SB	Yes		Yes	Green +
CL-SBS-2	CL-SBS-2 (1)	10/19/00	Explosives, General Chemistry, Metals, Perchlorate, Pest, SVOC, VOC	SD	Table 6-12	SB	Yes		Yes	Green +
CL-SBS-2	CL-SBS-2 (2)	10/19/00	Explosives, General Chemistry, Metals, Perchlorate, Pest, SVOC, VOC	SD	Table 6-12	SB	Yes		Yes	Green +
CL-SBS-2	CL-SBS-2(1)	10/19/00	Dioxins/Furans, General Chemistry	SD	Table 6-12	SB				
IWSD18	IWSD18	09/15/04	Metals, Perchlorate, Explosives	SD	App. G_Table G-1	SB	Yes			Purple Triangle
IWSD19	IWSD19	09/15/04	Metals, Perchlorate, Explosives	SD	App. G_Table G-1	SB	Yes			Purple Triangle
IWSD20	IWSD20	09/15/04	Metals, Perchlorate, Explosives	SD	App. G_Table G-1	SB	Yes			Purple Triangle
XXSD17	LHXX-SD17	03/31/93	Explosives, General Chemistry, Metals, SVOC, VOC	SD	Table 6-12	SB	Yes	Yes	Yes	Blue Circle
XXSD18	LHXX-SD18	03/31/93	Explosives, General Chemistry, Metals, SVOC, VOC	SD	Table 6-12	SB	Yes	Yes	Yes	Blue Circle
XXSD19	LHXX-SD19	03/31/93	Explosives, General Chemistry, Metals, SVOC, VOC	SD	Table 6-12	SB	Yes	Yes	Yes	Blue Circle
XXSD20	LHXX-SD20	04/01/93	Explosives, General Chemistry, Metals, SVOC, VOC	SD	Table 6-12	SB	Yes	Yes	Yes	Blue Circle
12SW02	12SW02	05/04/93	Explosives, General Chemistry, Metals, SVOC, VOC	SW	Table 6-9	CC	Yes	Yes	Yes	Blue Circle
12SW03	12SW03	05/18/93	Explosives, General Chemistry, Metals, SVOC, VOC	SW	Table 6-9	CC	Yes	Yes	Yes	Blue Circle
12SW04	12SW04(WATER)	02/18/95	Explosives, Metals, VOC	SW	Table 6-9	CC	Yes	Yes		Red X
12SW05	12SW05(WATER)	02/18/95	Explosives, Metals, VOC	SW	Table 6-9	CC	Yes	Yes		Red X

00188102

Attachment A
Samples in Surface Water and Sediment

Location	Sample Number	Date	Analyses	Matrix	LHAAP BERA Source	Basin	Explosives?	1993-1995?	SVOCs analyzed?	Map Symbol
12SW06	12SW06(WATER)	02/18/95	Explosives, Metals, VOC	SW	Table 6-9	CC	Yes	Yes		Red X
12SW07	12SW07(WATER)	02/18/95	Explosives, Metals, VOC	SW	Table 6-9	CC	Yes	Yes		Red X
12SW08	12SW08(WATER)	02/18/95	Explosives, Metals, VOC	SW	Table 6-9	CC	Yes	Yes		Red X
12SW08	12SW08(WATER)QC	02/18/95	Explosives, Metals, VOC	SW	Table 6-9	CC	Yes	Yes		Red X
12SW09	12SW09(WATER)	02/18/95	Explosives, Metals, VOC	SW	Table 6-9	CC	Yes	Yes		Red X
12SW10	12SW10(WATER)	03/15/95	Explosives, Metals, VOC	SW	Table 6-9	CC	Yes	Yes		Red X
12SW11	12SW11(WATER)	03/15/95	Explosives, Metals, VOC	SW	Table 6-9	CC	Yes	Yes		Red X
12SW12	12SW12(WATER)	03/15/95	Explosives, Metals, VOC	SW	Table 6-9	CC	Yes	Yes		Red X
12SW13	12SW13(WATER)	03/01/95	Explosives, Metals, VOC	SW	Table 6-9	CC	Yes	Yes		Red X
12SW14	12SW14(WATER)	03/02/95	Explosives, Metals, VOC	SW	Table 6-9	CC	Yes	Yes		Red X
12SW15	12SW15	10/06/98	Dioxins/Furans, Explosives, General Chemistry, Metals, Pest/PCB, SVOC, VOC	SW	Table 6-9	CC	Yes		Yes	Green +
12SW15	12SW15QC	10/06/98	Dioxins/Furans, Explosives, General Chemistry, Metals, Pest/PCB, SVOC, VOC	SW	Table 6-9	CC	Yes		Yes	Green +
12SW16	12SW16	10/06/98	Explosives, General Chemistry, Metals, VOC	SW	Table 6-9	CC	Yes			Green +
12SW17	12SW17A	10/06/98	Dioxins/Furans, Explosives, General Chemistry, Metals, Pest/PCB, SVOC, VOC	SW	Table 6-9	CC	Yes		Yes	Green +
12SW18	12SW18	10/06/98	Explosives, General Chemistry, Metals, VOC	SW	Table 6-9	CC	Yes			Green +
12SW19	12SW19	10/07/98	Dioxins/Furans, Explosives, General Chemistry, Metals, Pest/PCB, SVOC, VOC	SW	Table 6-9	CC	Yes		Yes	Green +
29SW02	29SW02	05/25/93	Explosives, General Chemistry, Metals, SVOC, VOC	SW	Table 6-9	CC	Yes	Yes	Yes	Blue Circle
29SW03	29SW03	05/19/93	Explosives, General Chemistry, Metals, SVOC, VOC	SW	Table 6-9	CC	Yes	Yes	Yes	Blue Circle
29SW04	29SW04	05/19/93	Explosives, General Chemistry, Metals, SVOC, VOC	SW	Table 6-9	CC	Yes	Yes	Yes	Blue Circle
29SW05	29SW05	05/13/93	Explosives, General Chemistry, Metals, SVOC, VOC	SW	Table 6-9	CC	Yes	Yes	Yes	Blue Circle
29SW06	29SW06	05/20/93	Explosives, General Chemistry, Metals, SVOC, VOC	SW	Table 6-9	CC	Yes	Yes	Yes	Blue Circle
29SW07	29SW07	05/13/93	Explosives, General Chemistry, Metals, SVOC, VOC	SW	Table 6-9	CC	Yes	Yes	Yes	Blue Circle
29SW08	29SW08	05/12/93	Explosives, General Chemistry, Metals, SVOC, VOC	SW	Table 6-9	CC	Yes	Yes	Yes	Blue Circle
29SW09	29SW09	05/12/93	Explosives, General Chemistry, Metals, SVOC, VOC	SW	Table 6-9	CC	Yes	Yes	Yes	Blue Circle
29SW09	29SW09-QC	05/12/93	Explosives, General Chemistry, Metals, SVOC, VOC	SW	Table 6-9	CC	Yes	Yes	Yes	Blue Circle
29SW18	29SW18	05/03/93	Explosives, General Chemistry, Metals, SVOC, VOC	SW	Table 6-9	CC	Yes	Yes	Yes	Blue Circle
29SW19	29SW19(WATER)	02/22/95	Explosives, Metals	SW	Table 6-9	CC	Yes	Yes		Red X
29SW20	29SW20(WATER)	03/01/95	Explosives, Metals	SW	Table 6-9	CC	Yes	Yes		Red X
29SW21	29SW21(WATER)	02/22/95	Explosives, Metals	SW	Table 6-9	CC	Yes	Yes		Red X
29SW23	29SW23	10/06/98	Dioxins/Furans, Explosives, General Chemistry, Metals, Pest/PCB, SVOC, VOC	SW	Table 6-9	CC	Yes		Yes	Green +
29SW23	29SW23QC	10/06/98	Dioxins/Furans, Explosives, General Chemistry, Metals, Pest/PCB, SVOC, VOC	SW	Table 6-9	CC	Yes		Yes	Green +
29SW25	29SW25	10/06/98	Explosives, General Chemistry, Metals, VOC	SW	Table 6-9	CC	Yes			Green +
29SW28	29SW28	10/06/98	Explosives, General Chemistry, Metals, VOC	SW	Table 6-9	CC	Yes			Green +
12SW01	C-12SW01-930518	05/18/93	Explosives, General Chemistry, Metals, SVOC, VOC	SW	Table 6-9	CC	Yes	Yes	Yes	Blue Circle
GPCSW09	GPCSW09-981111	11/11/98	Explosives, General Chemistry, Metals, SVOC, VOC	SW	Table 6-9	CC	Yes		Yes	Green +
GPCSW09	GPCSW09-981203	12/03/98	Pest/PCB	SW	Table 6-9	CC				
IWSW08	IWSW08	09/17/04	Metals, Perchlorate, Explosives	SW	App. G_Table G-1	CC	Yes			Purple Triangle
IWSW09	IWSW09	09/17/04	Metals, Perchlorate, Explosives	SW	App. G_Table G-1	CC	Yes			Purple Triangle
IWSW10	IWSW10	09/17/04	Metals, Perchlorate, Explosives	SW	App. G_Table G-1	CC	Yes			Purple Triangle
IWSW15	IWSW15	09/17/04	Metals, Perchlorate, Explosives, SVOCs, Pesticides, Herbicides, PCBs, Dioxins/Furans	SW	App. G_Table G-1	CC	Yes			Purple Triangle
IWSW16	IWSW16	09/17/04	Metals, Perchlorate, Explosives	SW	App. G_Table G-1	CC	Yes			Purple Triangle
11SW13	LH11-SW13	03/31/93	Explosives, General Chemistry, Metals, SVOC, VOC	SW	Table 6-9	CC	Yes	Yes	Yes	Blue Circle
11SW14	LH11-SW14	03/31/93	Explosives, General Chemistry, Metals, SVOC, VOC	SW	Table 6-9	CC	Yes	Yes	Yes	Blue Circle
29SW12	29SW12	05/12/93	Explosives, General Chemistry, Metals, SVOC, VOC	SW	Table 6-7	GPC	Yes	Yes	Yes	Blue Circle
29SW12	29SW12-QC	05/12/93	General Chemistry, Metals, SVOC, VOC	SW	Table 6-7	GPC		Yes	Yes	Blue Circle
29SW13	29SW13	05/03/93	Explosives, General Chemistry, Metals, SVOC, VOC	SW	Table 6-7	GPC	Yes	Yes	Yes	Blue Circle
29SW13	29SW13-QC	05/03/93	General Chemistry, Metals, SVOC, VOC	SW	Table 6-7	GPC		Yes	Yes	Blue Circle
29SW14	29SW14	05/25/93	Explosives, General Chemistry, Metals, SVOC, VOC	SW	Table 6-7	GPC	Yes	Yes	Yes	Blue Circle
29SW15	29SW15	05/03/93	Explosives, General Chemistry, Metals, SVOC, VOC	SW	Table 6-7	GPC	Yes	Yes	Yes	Blue Circle
29SW16	29SW16	05/13/93	Explosives, General Chemistry, Metals, SVOC, VOC	SW	Table 6-7	GPC	Yes	Yes	Yes	Blue Circle
29SW17	29SW17	05/04/93	Explosives, General Chemistry, Metals, SVOC, VOC	SW	Table 6-7	GPC	Yes	Yes	Yes	Blue Circle
29SW17	29SW17-QC	05/04/93	Explosives, General Chemistry, Metals, SVOC, VOC	SW	Table 6-7	GPC	Yes	Yes	Yes	Blue Circle
29SW22	29SW22	10/07/98	Explosives, General Chemistry, Metals, VOC	SW	Table 6-7	GPC	Yes			Green +
29SW27	29SW27	10/08/98	Dioxins/Furans, Explosives, General Chemistry, Metals, Pest/PCB, SVOC, VOC	SW	Table 6-7	GPC	Yes		Yes	Green +
29SW29	29SW29	10/06/98	Explosives, General Chemistry, Metals, VOC	SW	Table 6-7	GPC	Yes			Green +
29SW30	29SW30	10/07/98	Dioxins/Furans, Explosives, General Chemistry, Metals, Pest/PCB, SVOC, VOC	SW	Table 6-7	GPC	Yes		Yes	Green +
29SW31	29SW31	10/07/98	Explosives, General Chemistry, Metals, VOC	SW	Table 6-7	GPC	Yes			Green +
32SW01	32SW01-930525	05/25/93	Explosives, General Chemistry, Metals, SVOC, VOC	SW	Table 6-7	GPC	Yes	Yes	Yes	Blue Circle
32SW02	32SW02-930506	05/06/93	Explosives, General Chemistry, Metals, SVOC, VOC	SW	Table 6-7	GPC	Yes	Yes	Yes	Blue Circle
32SW03	32SW03-930512	05/12/93	Explosives, General Chemistry, Metals, SVOC, VOC	SW	Table 6-7	GPC	Yes	Yes	Yes	Blue Circle
32SW08	32SW08(WATER)	04/12/95	Explosives, Metals	SW	Table 6-7	GPC	Yes	Yes		Red X
32SW09	32SW09(WATER)	04/12/95	Explosives, Metals	SW	Table 6-7	GPC	Yes	Yes		Red X
32SW10	32SW10(WATER)	02/20/95	Explosives, Metals	SW	Table 6-7	GPC	Yes	Yes		Red X
32SW14	32SW14(WATER)	02/19/95	Explosives, Metals	SW	Table 6-7	GPC	Yes	Yes		Red X
32SW15	32SW15(WATER)	02/19/95	Explosives, Metals	SW	Table 6-7	GPC	Yes	Yes		Red X
32SW16	32SW16(WATER)	02/19/95	Explosives, Metals	SW	Table 6-7	GPC	Yes	Yes		Red X
32SW19	32SW19-981008	10/08/98	Dioxins/Furans, Explosives, General Chemistry, Metals, Pest/PCB, SVOC, VOC	SW	Table 6-7	GPC	Yes		Yes	Green +
35ASW01	35ASW01-981109	11/09/98	Explosives, General Chemistry, Metals, Pest/PCB, SVOC, VOC	SW	Table 6-7	GPC	Yes		Yes	Green +
35ASW01	35ASW01-981203	12/03/98	Pest/PCB	SW	Table 6-7	GPC				
35ASW02	35ASW02-981109	11/09/98	Explosives, General Chemistry, Metals, SVOC, VOC	SW	Table 6-7	GPC	Yes		Yes	Green +
35ASW02	35ASW02-981203	12/03/98	Pest/PCB	SW	Table 6-7	GPC				
46SW03	46SW03-981110	11/10/98	Explosives, General Chemistry, Metals, SVOC, VOC	SW	Table 6-7	GPC	Yes		Yes	Green +
46SW03	46SW03-981203	12/03/98	Pest/PCB	SW	Table 6-7	GPC				
46SW04	46SW04-981110	11/10/98	Explosives, General Chemistry, Metals, SVOC, VOC	SW	Table 6-7	GPC	Yes		Yes	Green +
46SW04	46SW04-981207	12/07/98	Pest/PCB	SW	Table 6-7	GPC				
46SW07	46SW07-981110	11/10/98	Explosives, General Chemistry, Metals, SVOC, VOC	SW	Table 6-7	GPC	Yes		Yes	Green +
46SW07	46SW07-981203	12/03/98	Pest/PCB	SW	Table 6-7	GPC				
46SW08	46SW08-981110	11/10/98	Explosives, General Chemistry, Metals, SVOC, VOC	SW	Table 6-7	GPC	Yes		Yes	Green +

Attachment A
Samples in Surface Water and Sediment

Location	Sample Number	Date	Analyses	Matrix	LHAAP BERA Source	Basin	Explosives?	1993-1995?	SVOCs analyzed?	Map Symbol
46SW08	46SW08-981203	12/03/98	Pest/PCB	SW	Table 6-7	GPC				
50SW03	50SW03-981112	11/12/98	Explosives, General Chemistry, Metals, SVOC, VOC	SW	Table 6-7	GPC	Yes		Yes	Green +
50SW04	50SW04-981111	11/11/98	Explosives, General Chemistry, Metals, SVOC, VOC	SW	Table 6-7	GPC	Yes		Yes	Green +
50SW05	50SW05-981111	11/11/98	Explosives, General Chemistry, Metals, SVOC, VOC	SW	Table 6-7	GPC	Yes		Yes	Green +
50SW06	50SW06-981110	11/10/98	Explosives, General Chemistry, Metals, Pest/PCB, SVOC, VOC	SW	Table 6-7	GPC	Yes		Yes	Green +
50SW06	50SW06-981111	11/11/98	Dioxins/Furans	SW	Table 6-7	GPC				
50SW07	50SW07-981111	11/11/98	Explosives, General Chemistry, Metals, SVOC, VOC	SW	Table 6-7	GPC	Yes		Yes	Green +
50SW08	50SW08-981111	11/11/98	Dioxins/Furans, Explosives, General Chemistry, Metals, Pest/PCB, SVOC, VOC	SW	Table 6-7	GPC	Yes		Yes	Green +
60SW01	60SW01-981110	11/10/98	Pesticides	SW	Table 6-7	GPC				
60SW02	60SW02-981110	11/10/98	Pesticides	SW	Table 6-7	GPC				
60SW02	60SW02QC	11/10/98	Pesticides	SW	Table 6-7	GPC				
50SW06	C-50SW06QC-981110	11/10/98	Explosives, General Chemistry, Metals, Pest/PCB, SVOC, VOC	SW	Table 6-7	GPC	Yes		Yes	Green +
50SW06	C-50SW06QC-981111	11/11/98	Dioxins/Furans	SW	Table 6-7	GPC				
GPW-6	C-GPW-6AR-960810	08/10/96	SVOC, VOC	SW	Table 6-7	GPC			Yes	Pink Circle
GPW-6	C-GPW-6AR-980211	02/11/98	Explosives, VOC	SW	Table 6-7	GPC	Yes			Green +
GPW-7	C-GPW-7QC-000420	04/20/00	Explosives, Perchlorate, VOC	SW	Table 6-7	GPC	Yes			Green +
GPW-7	C-GPW-7QC-030213	02/13/03	Explosives, Perchlorate, VOC	SW	Table 6-7	GPC	Yes			Green +
GPCSW01	GPCSW01-981118	11/18/98	Explosives, General Chemistry, Metals, SVOC, VOC	SW	Table 6-7	GPC	Yes		Yes	Green +
GPCSW01	GPCSW01-981202	12/02/98	Pest/PCB	SW	Table 6-7	GPC				
GPCSW02	GPCSW02-981118	11/18/98	Explosives, General Chemistry, Metals, SVOC, VOC	SW	Table 6-7	GPC	Yes		Yes	Green +
GPCSW02	GPCSW02-981202	12/02/98	Pest/PCB	SW	Table 6-7	GPC				
GPCSW03	GPCSW03-981117	11/17/98	Dioxins/Furans, Explosives, General Chemistry, Metals, Pest/PCB, SVOC, VOC	SW	Table 6-7	GPC	Yes		Yes	Green +
GPCSW04	GPCSW04-981116	11/16/98	Explosives, General Chemistry, Metals, SVOC, VOC	SW	Table 6-7	GPC	Yes		Yes	Green +
GPCSW04	GPCSW04-981202	12/02/98	Pest/PCB	SW	Table 6-7	GPC				
GPCSW05	GPCSW05-981116	11/16/98	Explosives, General Chemistry, Metals, SVOC, VOC	SW	Table 6-7	GPC	Yes		Yes	Green +
GPCSW05	GPCSW05-981202	12/02/98	Pest/PCB	SW	Table 6-7	GPC				
GPCSW06	GPCSW06-981116	11/16/98	Dioxins/Furans, Explosives, General Chemistry, Metals, Pest/PCB, SVOC, VOC	SW	Table 6-7	GPC	Yes		Yes	Green +
GPCSW06	GPCSW06QC	11/16/98	Dioxins/Furans, Explosives, General Chemistry, Metals, Pest/PCB, SVOC, VOC	SW	Table 6-7	GPC	Yes		Yes	Green +
GPCSW07	GPCSW07-981116	11/16/98	Explosives, General Chemistry, Metals, SVOC, VOC	SW	Table 6-7	GPC	Yes		Yes	Green +
GPCSW07	GPCSW07-981203	12/03/98	Pest/PCB	SW	Table 6-7	GPC				
GPCSW07	GPCSW07-981207	12/07/98	Pest/PCB	SW	Table 6-7	GPC				
GPCSW08	GPCSW08-981111	11/11/98	Dioxins/Furans, Explosives, General Chemistry, Metals, Pest/PCB, SVOC, VOC	SW	Table 6-7	GPC	Yes		Yes	Green +
GPCSW10	GPCSW10-981111	11/11/98	Explosives, General Chemistry, Metals, SVOC, VOC	SW	Table 6-7	GPC	Yes		Yes	Green +
GPCSW10	GPCSW10-981203	12/03/98	Pest/PCB	SW	Table 6-7	GPC				
GPW-1	GPW-1-000204	02/04/00	Explosives, Perchlorate, VOC	SW	Table 6-7	GPC	Yes			Green +
GPW-1	GPW-1-000421	04/21/00	Explosives, Perchlorate, VOC	SW	Table 6-7	GPC	Yes			Green +
GPW-1	GPW-1-000808	08/08/00	Explosives, Perchlorate, VOC	SW	Table 6-7	GPC	Yes			Green +
GPW-1	GPW-1-001205	12/05/00	Explosives, Perchlorate, VOC	SW	Table 6-7	GPC	Yes			Green +
GPW-1	GPW-1-010418	04/18/01	Explosives, Perchlorate, VOC	SW	Table 6-7	GPC	Yes			Green +
GPW-1	GPW-1-010717	07/17/01	Explosives, Perchlorate, VOC	SW	Table 6-7	GPC	Yes			Green +
GPW-1	GPW-1-011030	10/30/01	Explosives, Perchlorate, VOC	SW	Table 6-7	GPC	Yes			Green +
GPW-1	GPW-1-020115	01/15/02	Explosives, Perchlorate, VOC	SW	Table 6-7	GPC	Yes			Green +
GPW-1	GPW-1-020618	06/18/02	Explosives, Perchlorate, VOC	SW	Table 6-7	GPC	Yes			Green +
GPW-1	GPW-1-020926	09/26/02	Explosives, Perchlorate, VOC	SW	Table 6-7	GPC	Yes			Green +
GPW-1	GPW-1-021204	12/04/02	Explosives, Perchlorate, VOC	SW	Table 6-7	GPC	Yes			Green +
GPW-1	GPW-1-030213	02/13/03	Explosives, Perchlorate, VOC	SW	Table 6-7	GPC	Yes			Green +
GPW-1	GPW-1-030619	06/19/03	Explosives, Perchlorate, VOC	SW	Table 6-7	GPC	Yes			Green +
GPW-10	GPW-10-970903	09/03/97	Explosives, VOC	SW	Table 6-7	GPC	Yes			Green +
GPW-10	GPW-10-971210	12/10/97	VOC	SW	Table 6-7	GPC				
GPW-10	GPW-10-980210	02/10/98	Explosives, VOC	SW	Table 6-7	GPC	Yes			Green +
GPW-10	GPW-10-980602	06/02/98	Explosives, VOC	SW	Table 6-7	GPC	Yes			Green +
GPW-11	GPW-11-970904	09/04/97	Explosives, VOC	SW	Table 6-7	GPC	Yes			Green +
GPW-12	GPW-12-000204	02/04/00	Explosives, Perchlorate, VOC	SW	Table 6-7	GPC	Yes			Green +
GPW-12	GPW-12-000421	04/21/00	Explosives, Perchlorate, VOC	SW	Table 6-7	GPC	Yes			Green +
GPW-12	GPW-12-001205	12/05/00	Explosives, Perchlorate, VOC	SW	Table 6-7	GPC	Yes			Green +
GPW-12	GPW-12-010418	04/18/01	Explosives, Perchlorate, VOC	SW	Table 6-7	GPC	Yes			Green +
GPW-12	GPW-12-011030	10/30/01	Explosives, Perchlorate, VOC	SW	Table 6-7	GPC	Yes			Green +
GPW-12	GPW-12-020115	01/15/02	Explosives, Perchlorate, VOC	SW	Table 6-7	GPC	Yes			Green +
GPW-12	GPW-12-021204	12/04/02	Explosives, Perchlorate, VOC	SW	Table 6-7	GPC	Yes			Green +
GPW-12	GPW-12-030213	02/13/03	Explosives, Perchlorate, VOC	SW	Table 6-7	GPC	Yes			Green +
GPW-12	GPW-12-030619	06/19/03	Explosives, Perchlorate, VOC	SW	Table 6-7	GPC	Yes			Green +
GPW-12	GPW-12-970904	09/04/97	Explosives, VOC	SW	Table 6-7	GPC	Yes			Green +
GPW-12	GPW-12-971209	12/09/97	Explosives, VOC	SW	Table 6-7	GPC	Yes			Green +
GPW-12	GPW-12-980210	02/10/98	Explosives, VOC	SW	Table 6-7	GPC	Yes			Green +
GPW-12	GPW-12-990325	03/25/99	Explosives, VOC	SW	Table 6-7	GPC	Yes			Green +
GPW-12	GPW-12-990707	07/07/99	Explosives, Perchlorate, VOC	SW	Table 6-7	GPC	Yes			Green +
GPW-12	GPW-12AR	02/11/98	Explosives, VOC	SW	Table 6-7	GPC	Yes			Green +
GPW-13	GPW-13-971210	12/10/97	VOC	SW	Table 6-7	GPC				
GPW-14	GPW-14-971210	12/10/97	VOC	SW	Table 6-7	GPC				
GPW-1	GPW-1-960807	08/07/96	Explosives, SVOC, VOC	SW	Table 6-7	GPC	Yes		Yes	Green +
GPW-1	GPW-1-970206	02/06/97	VOC	SW	Table 6-7	GPC				
GPW-1	GPW-1-970521	05/21/97	Explosives, VOC	SW	Table 6-7	GPC	Yes			Green +
GPW-1	GPW-1-970903	09/03/97	Explosives, VOC	SW	Table 6-7	GPC	Yes			Green +
GPW-1	GPW-1-971209	12/09/97	Explosives, VOC	SW	Table 6-7	GPC	Yes			Green +
GPW-1	GPW-1-980210	02/10/98	Explosives, VOC	SW	Table 6-7	GPC	Yes			Green +
GPW-1	GPW-1-980602	06/02/98	Explosives, VOC	SW	Table 6-7	GPC	Yes			Green +
GPW-1	GPW-1-990325	03/25/99	Explosives, VOC	SW	Table 6-7	GPC	Yes			Green +
GPW-1	GPW-1-990707	07/07/99	Explosives, Perchlorate, VOC	SW	Table 6-7	GPC	Yes			Green +

Attachment A
Samples in Surface Water and Sediment

Location	Sample Number	Date	Analyses	Matrix	LHAAP BERA Source	Basin	Explosives?	1993-1995?	SVOCs analyzed?	Map Symbol
GPW-1	GPW-1AR-960810	08/10/96	SVOC, VOC	SW	Table 6-7	GPC			Yes	Pink Circle
GPW-1	GPW-1AR-980211	02/11/98	Explosives, VOC	SW	Table 6-7	GPC	Yes			Green +
GPW-1	GPW-1QC	06/19/03	Explosives, Perchlorate, VOC	SW	Table 6-7	GPC	Yes			Green +
GPW-1	GPW-1-QC	08/07/96	Explosives, SVOC, VOC	SW	Table 6-7	GPC	Yes		Yes	Green +
GPW-2	GPW-2 QC-000204	02/04/00	Explosives, Perchlorate, VOC	SW	Table 6-7	GPC	Yes			Green +
GPW-2	GPW-2 QC-970521	05/21/97	Explosives, VOC	SW	Table 6-7	GPC	Yes			Green +
GPW-2	GPW-2-000204	02/04/00	Explosives, Perchlorate, VOC	SW	Table 6-7	GPC	Yes			Green +
GPW-2	GPW-2-000421	04/21/00	Explosives, Perchlorate, VOC	SW	Table 6-7	GPC	Yes			Green +
GPW-2	GPW-2-000808	08/08/00	Explosives, Perchlorate, VOC	SW	Table 6-7	GPC	Yes			Green +
GPW-2	GPW-2-001205	12/05/00	Explosives, Perchlorate, VOC	SW	Table 6-7	GPC	Yes			Green +
GPW-2	GPW-2-010418	04/18/01	Explosives, Perchlorate, VOC	SW	Table 6-7	GPC	Yes			Green +
GPW-2	GPW-2-010717	07/17/01	Explosives, Perchlorate, VOC	SW	Table 6-7	GPC	Yes			Green +
GPW-2	GPW-2-011030	10/30/01	Explosives, Perchlorate, VOC	SW	Table 6-7	GPC	Yes			Green +
GPW-2	GPW-2-020115	01/15/02	Explosives, Perchlorate, VOC	SW	Table 6-7	GPC	Yes			Green +
GPW-2	GPW-2-020618	06/18/02	Explosives, Perchlorate, VOC	SW	Table 6-7	GPC	Yes			Green +
GPW-2	GPW-2-020926	09/26/02	Explosives, Perchlorate, VOC	SW	Table 6-7	GPC	Yes			Green +
GPW-2	GPW-2-021204	12/04/02	Explosives, Perchlorate, VOC	SW	Table 6-7	GPC	Yes			Green +
GPW-2	GPW-2-030213	02/13/03	Explosives, Perchlorate, VOC	SW	Table 6-7	GPC	Yes			Green +
GPW-2	GPW-2-030619	06/19/03	Explosives, Perchlorate, VOC	SW	Table 6-7	GPC	Yes			Green +
GPW-2	GPW-2-030820	08/20/03	Explosives, Perchlorate, VOC	SW	Table 6-7	GPC	Yes			Green +
GPW-2	GPW-2-960807	08/07/96	Explosives, SVOC, VOC	SW	Table 6-7	GPC	Yes		Yes	Green +
GPW-2	GPW-2-970206	02/06/97	VOC	SW	Table 6-7	GPC				
GPW-2	GPW-2-970521	05/21/97	Explosives, VOC	SW	Table 6-7	GPC	Yes			Green +
GPW-2	GPW-2-970903	09/03/97	Explosives, VOC	SW	Table 6-7	GPC	Yes			Green +
GPW-2	GPW-2-971209	12/09/97	Explosives, VOC	SW	Table 6-7	GPC	Yes			Green +
GPW-2	GPW-2-980210	02/10/98	Explosives, VOC	SW	Table 6-7	GPC	Yes			Green +
GPW-2	GPW-2-980602	06/02/98	Explosives, VOC	SW	Table 6-7	GPC	Yes			Green +
GPW-2	GPW-2-990325	03/25/99	Explosives, VOC	SW	Table 6-7	GPC	Yes			Green +
GPW-2	GPW-2-990707	07/07/99	Explosives, Perchlorate, VOC	SW	Table 6-7	GPC	Yes			Green +
GPW-2	GPW-2-990923	09/23/99	Explosives, Perchlorate, VOC	SW	Table 6-7	GPC	Yes			Green +
GPW-2	GPW-2AR-960810	08/10/96	SVOC, VOC	SW	Table 6-7	GPC			Yes	Pink Circle
GPW-2	GPW-2AR-980211	02/11/98	Explosives, VOC	SW	Table 6-7	GPC	Yes			Green +
GPW-2	GPW-2ARQC	02/11/98	Explosives, VOC	SW	Table 6-7	GPC	Yes			Green +
GPW-2	GPW-2AR-QC	08/10/96	SVOC, VOC	SW	Table 6-7	GPC			Yes	Pink Circle
GPW-2	GPW-2-QC	12/09/97	Explosives, VOC	SW	Table 6-7	GPC	Yes			Green +
GPW-2	GPW-2QC-000808	08/08/00	Explosives, Perchlorate, VOC	SW	Table 6-7	GPC	Yes			Green +
GPW-2	GPW-2QC-001205	12/05/00	Explosives, Perchlorate, VOC	SW	Table 6-7	GPC	Yes			Green +
GPW-2	GPW-2QC-010717	07/17/01	Explosives, Perchlorate, VOC	SW	Table 6-7	GPC	Yes			Green +
GPW-2	GPW-2QC-011030	10/30/01	Explosives, Perchlorate, VOC	SW	Table 6-7	GPC	Yes			Green +
GPW-2	GPW-2QC-020115	01/15/02	Explosives, Perchlorate, VOC	SW	Table 6-7	GPC	Yes			Green +
GPW-2	GPW-2QC-020618	06/18/02	Explosives, Perchlorate, VOC	SW	Table 6-7	GPC	Yes			Green +
GPW-2	GPW-2QC-020926	09/26/02	Explosives, Perchlorate, VOC	SW	Table 6-7	GPC	Yes			Green +
GPW-2	GPW-2QC-021204	12/04/02	Explosives, Perchlorate, VOC	SW	Table 6-7	GPC	Yes			Green +
GPW-2	GPW-2QC-980210	02/10/98	Explosives, VOC	SW	Table 6-7	GPC	Yes			Green +
GPW-2	GPW-2QC-980602	06/02/98	Explosives, VOC	SW	Table 6-7	GPC	Yes			Green +
GPW-2	GPW-2QC-990707	07/07/99	Explosives, Perchlorate, VOC	SW	Table 6-7	GPC	Yes			Green +
GPW-2	GPW-2QC-990923	09/23/99	Explosives, Perchlorate, VOC	SW	Table 6-7	GPC	Yes			Green +
GPW-3	GPW-3 QC	02/06/97	VOC	SW	Table 6-7	GPC				
GPW-3	GPW-3-000204	02/04/00	Explosives, Perchlorate, VOC	SW	Table 6-7	GPC	Yes			Green +
GPW-3	GPW-3-000421	04/21/00	Explosives, Perchlorate, VOC	SW	Table 6-7	GPC	Yes			Green +
GPW-3	GPW-3-000808	08/08/00	Explosives, Perchlorate, VOC	SW	Table 6-7	GPC	Yes			Green +
GPW-3	GPW-3-001205	12/05/00	Explosives, Perchlorate, VOC	SW	Table 6-7	GPC	Yes			Green +
GPW-3	GPW-3-010418	04/18/01	Explosives, Perchlorate, VOC	SW	Table 6-7	GPC	Yes			Green +
GPW-3	GPW-3-010717	07/17/01	Explosives, Perchlorate, VOC	SW	Table 6-7	GPC	Yes			Green +
GPW-3	GPW-3-011030	10/30/01	Explosives, Perchlorate, VOC	SW	Table 6-7	GPC	Yes			Green +
GPW-3	GPW-3-020115	01/15/02	Explosives, Perchlorate, VOC	SW	Table 6-7	GPC	Yes			Green +
GPW-3	GPW-3-020618	06/18/02	Explosives, Perchlorate, VOC	SW	Table 6-7	GPC	Yes			Green +
GPW-3	GPW-3-020926	09/26/02	Explosives, Perchlorate, VOC	SW	Table 6-7	GPC	Yes			Green +
GPW-3	GPW-3-021204	12/04/02	Explosives, Perchlorate, VOC	SW	Table 6-7	GPC	Yes			Green +
GPW-3	GPW-3-030213	02/13/03	Explosives, Perchlorate, VOC	SW	Table 6-7	GPC	Yes			Green +
GPW-3	GPW-3-030619	06/19/03	Explosives, Perchlorate, VOC	SW	Table 6-7	GPC	Yes			Green +
GPW-3	GPW-3-960807	08/07/96	Explosives, SVOC, VOC	SW	Table 6-7	GPC	Yes		Yes	Green +
GPW-3	GPW-3-970206	02/06/97	VOC	SW	Table 6-7	GPC				
GPW-3	GPW-3-970521	05/21/97	Explosives, VOC	SW	Table 6-7	GPC	Yes			Green +
GPW-3	GPW-3-970903	09/03/97	Explosives, VOC	SW	Table 6-7	GPC	Yes			Green +
GPW-3	GPW-3-971209	12/09/97	Explosives, VOC	SW	Table 6-7	GPC	Yes			Green +
GPW-3	GPW-3-980210	02/10/98	Explosives, VOC	SW	Table 6-7	GPC	Yes			Green +
GPW-3	GPW-3-980602	06/02/98	Explosives, VOC	SW	Table 6-7	GPC	Yes			Green +
GPW-3	GPW-3-990325	03/25/99	Explosives, VOC	SW	Table 6-7	GPC	Yes			Green +
GPW-3	GPW-3-990707	07/07/99	Explosives, Perchlorate, VOC	SW	Table 6-7	GPC	Yes			Green +
GPW-3	GPW-3-990924	09/24/99	Explosives, Perchlorate, VOC	SW	Table 6-7	GPC	Yes			Green +
GPW-3	GPW-3AR-960810	08/10/96	SVOC, VOC	SW	Table 6-7	GPC			Yes	Pink Circle
GPW-3	GPW-3AR-980211	02/11/98	Explosives, VOC	SW	Table 6-7	GPC	Yes			Green +
GPW-4	GPW-4-000204	02/04/00	Explosives, Perchlorate, VOC	SW	Table 6-7	GPC	Yes			Green +
GPW-4	GPW-4-000421	04/21/00	Explosives, Perchlorate, VOC	SW	Table 6-7	GPC	Yes			Green +
GPW-4	GPW-4-001205	12/05/00	Explosives, Perchlorate, VOC	SW	Table 6-7	GPC	Yes			Green +
GPW-4	GPW-4-010418	04/18/01	Explosives, Perchlorate, VOC	SW	Table 6-7	GPC	Yes			Green +
GPW-4	GPW-4-010717	07/17/01	Explosives, Perchlorate, VOC	SW	Table 6-7	GPC	Yes			Green +

Attachment A
Samples in Surface Water and Sediment

Location	Sample Number	Date	Analyses	Matrix	LHAAP BERA Source	Basin	Explosives?	1993-1995?	SVOCs analyzed?	Map Symbol
GPW-4	GPW-4-011030	10/30/01	Perchlorate, VOC	SW	Table 6-7	GPC				
GPW-4	GPW-4-020115	01/15/02	Explosives, Perchlorate, VOC	SW	Table 6-7	GPC	Yes			Green +
GPW-4	GPW-4-020618	06/18/02	Explosives, Perchlorate, VOC	SW	Table 6-7	GPC	Yes			Green +
GPW-4	GPW-4-020926	09/26/02	Explosives, Perchlorate, VOC	SW	Table 6-7	GPC	Yes			Green +
GPW-4	GPW-4-021204	12/04/02	Explosives, Perchlorate, VOC	SW	Table 6-7	GPC	Yes			Green +
GPW-4	GPW-4-030213	02/13/03	Explosives, Perchlorate, VOC	SW	Table 6-7	GPC	Yes			Green +
GPW-4	GPW-4-030619	06/19/03	Explosives, Perchlorate, VOC	SW	Table 6-7	GPC	Yes			Green +
GPW-4	GPW-4-960807	08/07/96	Explosives, SVOC, VOC	SW	Table 6-7	GPC	Yes		Yes	Green +
GPW-4	GPW-4-970206	02/06/97	VOC	SW	Table 6-7	GPC				
GPW-4	GPW-4-970521	05/21/97	Explosives, VOC	SW	Table 6-7	GPC	Yes			Green +
GPW-4	GPW-4-970904	09/04/97	Explosives, VOC	SW	Table 6-7	GPC	Yes			Green +
GPW-4	GPW-4-971209	12/09/97	Explosives, VOC	SW	Table 6-7	GPC	Yes			Green +
GPW-4	GPW-4-980210	02/10/98	Explosives, VOC	SW	Table 6-7	GPC	Yes			Green +
GPW-4	GPW-4-980602	06/02/98	Explosives, VOC	SW	Table 6-7	GPC	Yes			Green +
GPW-4	GPW-4-990325	03/25/99	Explosives, VOC	SW	Table 6-7	GPC	Yes			Green +
GPW-4	GPW-4-990707	07/07/99	Explosives, Perchlorate, VOC	SW	Table 6-7	GPC	Yes			Green +
GPW-4	GPW-4AR-960810	08/10/96	SVOC, VOC	SW	Table 6-7	GPC			Yes	Pink Circle
GPW-4	GPW-4AR-980211	02/11/98	Explosives, VOC	SW	Table 6-7	GPC	Yes			Green +
GPW-4	GPW-4QC	04/18/01	Explosives, Perchlorate, VOC	SW	Table 6-7	GPC	Yes			Green +
GPW-4	GPW-4-QC	03/25/99	Explosives, VOC	SW	Table 6-7	GPC	Yes			Green +
GPW-5	GPW-5-000204	02/04/00	Explosives, Perchlorate, VOC	SW	Table 6-7	GPC	Yes			Green +
GPW-5	GPW-5-000421	04/21/00	Explosives, Perchlorate, VOC	SW	Table 6-7	GPC	Yes			Green +
GPW-5	GPW-5-001205	12/05/00	Explosives, Perchlorate	SW	Table 6-7	GPC	Yes			Green +
GPW-5	GPW-5-010418	04/18/01	Explosives, Perchlorate, VOC	SW	Table 6-7	GPC	Yes			Green +
GPW-5	GPW-5-010717	07/17/01	Explosives, Perchlorate, VOC	SW	Table 6-7	GPC	Yes			Green +
GPW-5	GPW-5-011030	10/30/01	Explosives, Perchlorate, VOC	SW	Table 6-7	GPC	Yes			Green +
GPW-5	GPW-5-020115	01/15/02	Explosives, Perchlorate	SW	Table 6-7	GPC	Yes			Green +
GPW-5	GPW-5-020618	06/18/02	Explosives, Perchlorate, VOC	SW	Table 6-7	GPC	Yes			Green +
GPW-5	GPW-5-020926	09/26/02	Explosives, Perchlorate, VOC	SW	Table 6-7	GPC	Yes			Green +
GPW-5	GPW-5-021204	12/04/02	Explosives, Perchlorate, VOC	SW	Table 6-7	GPC	Yes			Green +
GPW-5	GPW-5-030213	02/13/03	Explosives, Perchlorate, VOC	SW	Table 6-7	GPC	Yes			Green +
GPW-5	GPW-5-960808	08/08/96	Explosives, SVOC, VOC	SW	Table 6-7	GPC	Yes		Yes	Green +
GPW-5	GPW-5-970206	02/06/97	VOC	SW	Table 6-7	GPC				
GPW-5	GPW-5-970521	05/21/97	Explosives, VOC	SW	Table 6-7	GPC	Yes			Green +
GPW-5	GPW-5-970904	09/04/97	Explosives, VOC	SW	Table 6-7	GPC	Yes			Green +
GPW-5	GPW-5-971209	12/09/97	Explosives, VOC	SW	Table 6-7	GPC	Yes			Green +
GPW-5	GPW-5-980210	02/10/98	Explosives, VOC	SW	Table 6-7	GPC	Yes			Green +
GPW-5	GPW-5-980602	06/02/98	Explosives, VOC	SW	Table 6-7	GPC	Yes			Green +
GPW-5	GPW-5-990325	03/25/99	Explosives, VOC	SW	Table 6-7	GPC	Yes			Green +
GPW-5	GPW-5-990707	07/07/99	Explosives, Perchlorate, VOC	SW	Table 6-7	GPC	Yes			Green +
GPW-5	GPW-5-990924	09/24/99	Explosives, Perchlorate, VOC	SW	Table 6-7	GPC	Yes			Green +
GPW-5	GPW-5AR-960810	08/10/96	SVOC, VOC	SW	Table 6-7	GPC			Yes	Pink Circle
GPW-5	GPW-5AR-980211	02/11/98	Explosives, VOC	SW	Table 6-7	GPC	Yes			Green +
GPW-6	GPW-6-000204	02/04/00	Explosives, Perchlorate, VOC	SW	Table 6-7	GPC	Yes			Green +
GPW-6	GPW-6-000421	04/21/00	Explosives, Perchlorate, VOC	SW	Table 6-7	GPC	Yes			Green +
GPW-6	GPW-6-001205	12/05/00	Explosives, Perchlorate	SW	Table 6-7	GPC	Yes			Green +
GPW-6	GPW-6-010418	04/18/01	Explosives, Perchlorate, VOC	SW	Table 6-7	GPC	Yes			Green +
GPW-6	GPW-6-011030	10/30/01	Explosives, Perchlorate, VOC	SW	Table 6-7	GPC	Yes			Green +
GPW-6	GPW-6-020115	01/15/02	Explosives, Perchlorate	SW	Table 6-7	GPC	Yes			Green +
GPW-6	GPW-6-021204	12/04/02	Explosives, Perchlorate, VOC	SW	Table 6-7	GPC	Yes			Green +
GPW-6	GPW-6-030213	02/13/03	Explosives, Perchlorate, VOC	SW	Table 6-7	GPC	Yes			Green +
GPW-6	GPW-6-960808	08/08/96	Explosives, SVOC, VOC	SW	Table 6-7	GPC	Yes		Yes	Green +
GPW-6	GPW-6-970206	02/06/97	VOC	SW	Table 6-7	GPC				
GPW-6	GPW-6-970521	05/21/97	Explosives, VOC	SW	Table 6-7	GPC	Yes			Green +
GPW-6	GPW-6-970904	09/04/97	Explosives, VOC	SW	Table 6-7	GPC	Yes			Green +
GPW-6	GPW-6-971209	12/09/97	Explosives, VOC	SW	Table 6-7	GPC	Yes			Green +
GPW-6	GPW-6-980210	02/10/98	Explosives, VOC	SW	Table 6-7	GPC	Yes			Green +
GPW-6	GPW-6-980602	06/02/98	Explosives, VOC	SW	Table 6-7	GPC	Yes			Green +
GPW-6	GPW-6-990325	03/25/99	Explosives, VOC	SW	Table 6-7	GPC	Yes			Green +
GPW-6	GPW-6-990707	07/07/99	Explosives, Perchlorate, VOC	SW	Table 6-7	GPC	Yes			Green +
GPW-7	GPW-7-000204	02/04/00	Explosives, Perchlorate, VOC	SW	Table 6-7	GPC	Yes			Green +
GPW-7	GPW-7-000420	04/20/00	Explosives, Perchlorate, VOC	SW	Table 6-7	GPC	Yes			Green +
GPW-7	GPW-7-001205	12/05/00	Explosives, Perchlorate, VOC	SW	Table 6-7	GPC	Yes			Green +
GPW-7	GPW-7-010418	04/18/01	Explosives, Perchlorate, VOC	SW	Table 6-7	GPC	Yes			Green +
GPW-7	GPW-7-011030	10/30/01	Explosives, Perchlorate, VOC	SW	Table 6-7	GPC	Yes			Green +
GPW-7	GPW-7-020115	01/15/02	Explosives, Perchlorate, VOC	SW	Table 6-7	GPC	Yes			Green +
GPW-7	GPW-7-020926	09/26/02	Explosives, Perchlorate, VOC	SW	Table 6-7	GPC	Yes			Green +
GPW-7	GPW-7-021204	12/04/02	Explosives, Perchlorate, VOC	SW	Table 6-7	GPC	Yes			Green +
GPW-7	GPW-7-030213	02/13/03	Explosives, Perchlorate, VOC	SW	Table 6-7	GPC	Yes			Green +
GPW-7	GPW-7-030619	06/19/03	Explosives, Perchlorate, VOC	SW	Table 6-7	GPC	Yes			Green +
GPW-7	GPW-7-970206	02/06/97	VOC	SW	Table 6-7	GPC				
GPW-7	GPW-7-970521	05/21/97	Explosives, VOC	SW	Table 6-7	GPC	Yes			Green +
GPW-7	GPW-7-970903	09/03/97	Explosives, VOC	SW	Table 6-7	GPC	Yes			Green +
GPW-7	GPW-7-971209	12/09/97	Explosives, VOC	SW	Table 6-7	GPC	Yes			Green +
GPW-7	GPW-7-980210	02/10/98	Explosives, VOC	SW	Table 6-7	GPC	Yes			Green +
GPW-7	GPW-7-980602	06/02/98	Explosives	SW	Table 6-7	GPC	Yes			Green +
GPW-7	GPW-7-990325	03/25/99	Explosives, VOC	SW	Table 6-7	GPC	Yes			Green +
GPW-7	GPW-7-990707	07/07/99	Explosives, Perchlorate, VOC	SW	Table 6-7	GPC	Yes			Green +

Attachment A
Samples in Surface Water and Sediment

Location	Sample Number	Date	Analyses	Matrix	LHAAP BERA Source	Basin	Explosives?	1993-1995?	SVOCs analyzed?	Map Symbol
GPW-7	GPW-7AR	02/11/98	Explosives, VOC	SW	Table 6-7	GPC	Yes			Green +
GPW-8	GPW-8 QC	09/04/97	Explosives, VOC	SW	Table 6-7	GPC	Yes			Green +
GPW-8	GPW-8-970206	02/06/97	VOC	SW	Table 6-7	GPC				
GPW-8	GPW-8-970521	05/21/97	Explosives, VOC	SW	Table 6-7	GPC	Yes			Green +
GPW-8	GPW-8-970904	09/04/97	Explosives, VOC	SW	Table 6-7	GPC	Yes			Green +
GPW-8	GPW-8-971209	12/09/97	Explosives, VOC	SW	Table 6-7	GPC	Yes			Green +
GPW-9	GPW-9-000204	02/04/00	Explosives, Perchlorate, VOC	SW	Table 6-7	GPC	Yes			Green +
GPW-9	GPW-9-000421	04/21/00	Explosives, Perchlorate, VOC	SW	Table 6-7	GPC	Yes			Green +
GPW-9	GPW-9-001205	12/05/00	Explosives, Perchlorate	SW	Table 6-7	GPC	Yes			Green +
GPW-9	GPW-9-010418	04/18/01	Explosives, Perchlorate, VOC	SW	Table 6-7	GPC	Yes			Green +
GPW-9	GPW-9-020115	01/15/02	Explosives, Perchlorate, VOC	SW	Table 6-7	GPC	Yes			Green +
GPW-9	GPW-9-021204	12/04/02	Explosives, Perchlorate, VOC	SW	Table 6-7	GPC	Yes			Green +
GPW-9	GPW-9-030213	02/13/03	Explosives, Perchlorate, VOC	SW	Table 6-7	GPC	Yes			Green +
GPW-9	GPW-9-030619	06/19/03	Explosives, Perchlorate, VOC	SW	Table 6-7	GPC	Yes			Green +
GPW-9	GPW-9-970206	02/06/97	VOC	SW	Table 6-7	GPC				
GPW-9	GPW-9-970521	05/21/97	Explosives, VOC	SW	Table 6-7	GPC	Yes			Green +
GPW-9	GPW-9-970904	09/04/97	Explosives, VOC	SW	Table 6-7	GPC	Yes			Green +
GPW-9	GPW-9-971209	12/09/97	Explosives, VOC	SW	Table 6-7	GPC	Yes			Green +
GPW-9	GPW-9-980210	02/10/98	Explosives, VOC	SW	Table 6-7	GPC	Yes			Green +
GPW-9	GPW-9-980602	06/02/98	Explosives, VOC	SW	Table 6-7	GPC	Yes			Green +
GPW-9	GPW-9-990325	03/25/99	Explosives, VOC	SW	Table 6-7	GPC	Yes			Green +
GPW-9	GPW-9-990707	07/07/99	Explosives, Perchlorate, VOC	SW	Table 6-7	GPC	Yes			Green +
GPW-9	GPW-9AR	02/11/98	Explosives, VOC	SW	Table 6-7	GPC	Yes			Green +
GPWSW01	GPWSW01-981119	11/19/98	Dioxins/Furans, Explosives, General Chemistry, Metals, Pest/PCB, SVOC, VOC	SW	Table 6-7	GPC	Yes		Yes	Green +
GPWSW01	GPWSW01QC	11/19/98	Dioxins/Furans, Explosives, General Chemistry, Metals, Pest/PCB, SVOC, VOC	SW	Table 6-7	GPC	Yes		Yes	Green +
GPWSW02	GPWSW02-981201	12/01/98	Explosives, General Chemistry, Metals, SVOC, VOC	SW	Table 6-7	GPC	Yes		Yes	Green +
GPWSW02	GPWSW02-981202	12/02/98	Pest/PCB	SW	Table 6-7	GPC				
GPWSW03	GPWSW03-981201	12/01/98	Explosives, General Chemistry, Metals, SVOC, VOC	SW	Table 6-7	GPC	Yes		Yes	Green +
GPWSW03	GPWSW03-981202	12/02/98	Pest/PCB	SW	Table 6-7	GPC				
GPWSW04	GPWSW04-981120	11/20/98	Dioxins/Furans, Explosives, General Chemistry, Metals, Pest/PCB, SVOC, VOC	SW	Table 6-7	GPC	Yes		Yes	Green +
IWSW03	IWSW03	09/16/04	Metals, Perchlorate, Explosives	SW	App. G_Table G-1	GPC	Yes			Purple Triangle
IWSW03-QC	IWSW03-QC	09/16/04	Metals, Perchlorate, Explosives	SW	App. G_Table G-1	GPC	Yes			Purple Triangle
IWSW04	IWSW04	09/16/04	Metals, Perchlorate, Explosives, SVOCs, Pesticides, Herbicides, PCBs, Dioxins/Furans	SW	App. G_Table G-1	GPC	Yes			Purple Triangle
LHS-GPC-01	LHS-GPC-01	01/11/95	Metals, SVOC, VOC	SW	Table 6-7	GPC		Yes	Yes	Blue Circle
LHS-GPC-01	LHS-GPC-01QC	01/11/95	Metals, SVOC, VOC	SW	Table 6-7	GPC		Yes	Yes	Blue Circle
LHS-GPC-03	LHS-GPC-03	01/12/95	Metals, SVOC, VOC	SW	Table 6-7	GPC		Yes	Yes	Blue Circle
LHS-GPC-05	LHS-GPC-05	01/12/95	Metals, SVOC, VOC	SW	Table 6-7	GPC		Yes	Yes	Blue Circle
LHS-GPC-07	LHS-GPC-07	01/12/95	Metals, SVOC, VOC	SW	Table 6-7	GPC		Yes	Yes	Blue Circle
16SW01	16SW01	05/04/93	Explosives, General Chemistry, Metals, SVOC, VOC	SW	Table 6-5	HB	Yes	Yes	Yes	Blue Circle
16SW01	16SW01(WATER)	02/21/95	Explosives, Metals, VOC	SW	Table 6-5	HB	Yes	Yes		Red X
16SW03	16SW03	04/14/93	Explosives, General Chemistry, Metals, SVOC, VOC	SW	Table 6-5	HB	Yes	Yes	Yes	Blue Circle
16SW03	16SW03(WATER)	02/20/95	Explosives, Metals, VOC	SW	Table 6-5	HB	Yes	Yes		Red X
16SW04	16SW04	04/14/93	Explosives, General Chemistry, Metals, SVOC, VOC	SW	Table 6-5	HB	Yes	Yes	Yes	Blue Circle
16SW04	16SW04(WATER)	02/21/95	Explosives, Metals, VOC	SW	Table 6-5	HB	Yes	Yes		Red X
16SW05	16SW05	05/13/93	Explosives, General Chemistry, Metals, SVOC, VOC	SW	Table 6-5	HB	Yes	Yes	Yes	Blue Circle
16SW08	16SW08(WATER)	02/21/95	Explosives, Metals, VOC	SW	Table 6-5	HB	Yes	Yes		Red X
16SW10	16SW10(WATER)	02/21/95	Explosives, Metals, VOC	SW	Table 6-5	HB	Yes	Yes		Red X
16SW12	16SW12(WATER)	02/21/95	Explosives, Metals, VOC	SW	Table 6-5	HB	Yes	Yes		Red X
16SW13	16SW13(WATER)	02/21/95	Explosives, Metals, VOC	SW	Table 6-5	HB	Yes	Yes		Red X
16SW14	16SW14(WATER)	02/21/95	Explosives, Metals, VOC	SW	Table 6-5	HB	Yes	Yes		Red X
16SW14	16SW14(WATER)QC	02/21/95	Explosives, Metals, VOC	SW	Table 6-5	HB	Yes	Yes		Red X
16SW15	16SW15(WATER)	03/16/95	Explosives, Metals, VOC	SW	Table 6-5	HB	Yes	Yes		Red X
16SW16	16SW16(WATER)	03/16/95	Explosives, Metals, VOC	SW	Table 6-5	HB	Yes	Yes		Red X
16SW35	16SW35	10/29/97	Dioxins/Furans, Explosives, General Chemistry, Metals, Pest/PCB, VOC	SW	Table 6-5	HB	Yes			Green +
17SW13	17SW13	09/17/98	Explosives, General Chemistry, Metals, VOC	SW	Table 6-5	HB	Yes			Green +
17SW14	17SW14	09/17/98	Dioxins/Furans, Explosives, General Chemistry, Metals, Pest/PCB, SVOC, VOC	SW	Table 6-5	HB	Yes		Yes	Green +
18SD20	18SD20(WATER)	06/15/95	Explosives	SW	Table 6-5	HB	Yes	Yes		Red X
18SD21	18SD21(WATER)	06/15/95	Explosives	SW	Table 6-5	HB	Yes	Yes		Red X
18SD22	18SD22(WATER)	06/15/95	Explosives	SW	Table 6-5	HB	Yes	Yes		Red X
18SW01	18SW01	06/13/93	Explosives, General Chemistry, Metals, SVOC, VOC	SW	Table 6-5	HB	Yes	Yes	Yes	Blue Circle
18SW02	18SW02	05/11/93	Explosives, General Chemistry, Metals, SVOC, VOC	SW	Table 6-5	HB	Yes	Yes	Yes	Blue Circle
18SW12	18SW12(WATER)	02/18/95	Metals, VOC	SW	Table 6-5	HB		Yes		
18SW13	18SW13(WATER)	02/18/95	Metals, VOC	SW	Table 6-5	HB		Yes		
18SW13	18SW13(WATER)QC	02/18/95	Metals, VOC	SW	Table 6-5	HB		Yes		
18SW14	18SW14(WATER)	02/21/95	Metals, VOC	SW	Table 6-5	HB		Yes		
18SW15	18SW15(WATER)	02/21/95	Metals, VOC	SW	Table 6-5	HB		Yes		
18SW23	18SW23(WATER)	03/16/95	Metals, VOC	SW	Table 6-5	HB		Yes		
18SW24	18SW24(WATER)	03/15/95	Metals, VOC	SW	Table 6-5	HB		Yes		
18SW25	18SW25(WATER)	02/20/95	Metals, VOC	SW	Table 6-5	HB		Yes		
18SW26	18SW26(WATER)	02/20/95	Metals, VOC	SW	Table 6-5	HB		Yes		
18SW27	18SW27	10/07/98	Dioxins/Furans, Explosives, General Chemistry, Metals, Pest/PCB, SVOC, VOC	SW	Table 6-5	HB	Yes		Yes	Green +
18SW27	18SW27QC	10/07/98	Dioxins/Furans, Explosives, General Chemistry, Metals, Pest/PCB, SVOC, VOC	SW	Table 6-5	HB	Yes		Yes	Green +
18SW28	18SW28	11/12/98	Dioxins/Furans, Explosives, General Chemistry, Metals, Pest/PCB, SVOC, VOC	SW	Table 6-5	HB	Yes		Yes	Green +
18SW20	C-18SW20(WATER)-9502	02/22/95	Metals, VOC	SW	Table 6-5	HB		Yes		
18SW20	C-18SW20(WATER)-9506	06/19/95	Explosives	SW	Table 6-5	HB	Yes	Yes		Red X
18SW21	C-18SW21(WATER)-9502	02/22/95	Metals, VOC	SW	Table 6-5	HB		Yes		
18SW21	C-18SW21(WATER)-9506	06/19/95	Explosives	SW	Table 6-5	HB	Yes	Yes		Red X
18SW22	C-18SW22(WATER)-9503	03/16/95	Metals, VOC	SW	Table 6-5	HB		Yes		

Attachment A
Samples in Surface Water and Sediment

Location	Sample Number	Date	Analyses	Matrix	LHAAP BERA Source	Basin	Explosives?	1993-1995?	SVOCs analyzed?	Map Symbol
18SW22	C-18SW22(WATER)-9506	06/19/95	Explosives	SW	Table 6-5	HB	Yes	Yes		Red X
XXSW15	C930331-XXSW15-QC00	03/31/93	Explosives, General Chemistry, Metals, SVOC, VOC	SW	Table 6-5	HB	Yes	Yes	Yes	Blue Circle
CL-HB-1	CL-HB-1-000601	06/01/00	Perchlorate	SW	Table 6-5	HB				
CL-HB-1	CL-HB-1-010201	02/01/01	Perchlorate	SW	Table 6-5	HB				
CL-HB-1	CL-HB-1-010719	07/19/01	Perchlorate	SW	Table 6-5	HB				
CL-HB-1	CL-HB-1-020619	06/19/02	Perchlorate	SW	Table 6-5	HB				
CL-HB-1	CL-HB-1-020925	09/25/02	Perchlorate	SW	Table 6-5	HB				
CL-HB-1	CL-HB-1-021203	12/03/02	Perchlorate	SW	Table 6-5	HB				
CL-HB-1	CL-HB-1-030604	06/04/03	Perchlorate	SW	Table 6-5	HB				
CL-HB-1	CL-HB-1QC	06/01/00	Perchlorate	SW	Table 6-5	HB				
CL-HB-2	CL-HB-2-000601	06/01/00	Perchlorate	SW	Table 6-5	HB				
CL-HB-2	CL-HB-2-010201	02/01/01	Perchlorate	SW	Table 6-5	HB				
CL-HB-2	CL-HB-2-010719	07/19/01	Perchlorate	SW	Table 6-5	HB				
CL-HB-2	CL-HB-2-020619	06/19/02	Perchlorate	SW	Table 6-5	HB				
CL-HB-2	CL-HB-2-020925	09/25/02	Perchlorate	SW	Table 6-5	HB				
CL-HB-2	CL-HB-2-021203	12/03/02	Perchlorate	SW	Table 6-5	HB				
CL-HB-2	CL-HB-2-030604	06/04/03	Perchlorate	SW	Table 6-5	HB				
CL-HB-2	CL-HB-2-030826	08/26/03	Perchlorate	SW	Table 6-5	HB				
HB-1	HB-1-000427	04/27/00	Perchlorate	SW	Table 6-5	HB				
HB-2	HB-2-000427	04/27/00	Perchlorate	SW	Table 6-5	HB				
HBW-1	HBW-1 S5 0193-2	08/31/95	VOC	SW	Table 6-5	HB		Yes		
HBW-10	HBW-10-000203	02/03/00	Perchlorate, VOC	SW	Table 6-5	HB				
HBW-10	HBW-10-000420	04/20/00	Perchlorate	SW	Table 6-5	HB				
HBW-10	HBW-10-000810	08/10/00	Perchlorate	SW	Table 6-5	HB				
HBW-1	HBW-1-000203	02/03/00	Perchlorate, VOC	SW	Table 6-5	HB				
HBW-1	HBW-1-000421	04/21/00	Perchlorate, VOC	SW	Table 6-5	HB				
HBW-1	HBW-1-000810	08/10/00	VOC	SW	Table 6-5	HB				
HBW-10	HBW-10-010201	02/01/01	Perchlorate	SW	Table 6-5	HB				
HBW-10	HBW-10-010718	07/18/01	Perchlorate	SW	Table 6-5	HB				
HBW-10	HBW-10-020619	06/19/02	Perchlorate	SW	Table 6-5	HB				
HBW-10	HBW-10-020925	09/25/02	Perchlorate	SW	Table 6-5	HB				
HBW-10	HBW-10-021203	12/03/02	Perchlorate	SW	Table 6-5	HB				
HBW-10	HBW-10-030604	06/04/03	Perchlorate	SW	Table 6-5	HB				
HBW-1	HBW-1-010201	02/01/01	Perchlorate, VOC	SW	Table 6-5	HB				
HBW-1	HBW-1-010718	07/18/01	Perchlorate, VOC	SW	Table 6-5	HB				
HBW-1	HBW-1-011030	10/30/01	Perchlorate, VOC	SW	Table 6-5	HB				
HBW-1	HBW-1-020115	01/15/02	Perchlorate, VOC	SW	Table 6-5	HB				
HBW-1	HBW-1-020616	06/16/02	Perchlorate, VOC	SW	Table 6-5	HB				
HBW-1	HBW-1-020925	09/25/02	Perchlorate, VOC	SW	Table 6-5	HB				
HBW-1	HBW-1-021203	12/03/02	Perchlorate, VOC	SW	Table 6-5	HB				
HBW-1	HBW-1-030604	06/04/03	Perchlorate, VOC	SW	Table 6-5	HB				
HBW-1	HBW-1-030826	08/26/03	Perchlorate, VOC	SW	Table 6-5	HB				
HBW-10	HBW-10-990708	07/08/99	Perchlorate	SW	Table 6-5	HB				
HBW-10	HBW-10-990923	09/23/99	Perchlorate	SW	Table 6-5	HB				
HBW-1	HBW-1-960612	06/12/96	VOC	SW	Table 6-5	HB				
HBW-1	HBW-1-960807	08/07/96	Explosives, VOC	SW	Table 6-5	HB	Yes			Green +
HBW-1	HBW-1-970205	02/05/97	VOC	SW	Table 6-5	HB				
HBW-1	HBW-1-970522	05/22/97	General Chemistry, VOC	SW	Table 6-5	HB				
HBW-1	HBW-1-971210	12/10/97	VOC	SW	Table 6-5	HB				
HBW-1	HBW-1-980209	02/09/98	VOC	SW	Table 6-5	HB				
HBW-1	HBW-1-980601	06/01/98	VOC	SW	Table 6-5	HB				
HBW-1	HBW-1-981027	10/27/98	VOC	SW	Table 6-5	HB				
HBW-1	HBW-1-990324	03/24/99	VOC	SW	Table 6-5	HB				
HBW-1	HBW-1-990708	07/08/99	Perchlorate, VOC	SW	Table 6-5	HB				
HBW-1	HBW-1-990923	09/23/99	Perchlorate, VOC	SW	Table 6-5	HB				
HBW-1	HBW-1AR	08/10/96	VOC	SW	Table 6-5	HB				
HBW-1	HBW-1QA-DIL	09/23/99	VOC	SW	Table 6-5	HB				
HBW-1	HBW-1QC-000810	08/10/00	VOC	SW	Table 6-5	HB				
HBW-1	HBW-1QC-010201	02/01/01	Perchlorate, VOC	SW	Table 6-5	HB				
HBW-1	HBW-1QC-010718	07/18/01	Perchlorate, VOC	SW	Table 6-5	HB				
HBW-1	HBW-1QC-020115	01/15/02	Perchlorate, VOC	SW	Table 6-5	HB				
HBW-1	HBW-1QC-020619	06/19/02	Perchlorate, VOC	SW	Table 6-5	HB				
HBW-1	HBW-1QC-020925	09/25/02	Perchlorate, VOC	SW	Table 6-5	HB				
HBW-1	HBW-1QC-021203	12/03/02	Perchlorate, VOC	SW	Table 6-5	HB				
HBW-1	HBW-1QC-030604	06/04/03	Perchlorate, VOC	SW	Table 6-5	HB				
HBW-1	HBW-1QC-030826	08/26/03	Perchlorate, VOC	SW	Table 6-5	HB				
HBW-1	HBW-1QC-971210	12/10/97	VOC	SW	Table 6-5	HB				
HBW-1	HBW-1QC-980209	02/09/98	VOC	SW	Table 6-5	HB				
HBW-1	HBW-1QC-980601	06/01/98	VOC	SW	Table 6-5	HB				
HBW-1	HBW-1QC-990923	09/23/99	Perchlorate, VOC	SW	Table 6-5	HB				
HBW-2	HBW-2 S5 0193-4	08/31/95	VOC	SW	Table 6-5	HB		Yes		
HBW-3	HBW-3 S5 0193-6	08/31/95	VOC	SW	Table 6-5	HB		Yes		
HBW-4	HBW-4 S5 0193-8	08/31/95	VOC	SW	Table 6-5	HB		Yes		
HBW-4	HBW-4-990708	07/08/99	Perchlorate	SW	Table 6-5	HB				
HBW-5.5	HBW-5.5-000203	02/03/00	Perchlorate, VOC	SW	Table 6-5	HB				
HBW-5.5	HBW-5.5-000421	04/21/00	Perchlorate, VOC	SW	Table 6-5	HB				
HBW-5.5	HBW-5.5-990708	07/08/99	Perchlorate, VOC	SW	Table 6-5	HB				
HBW-5	HBW-5-000203	02/03/00	Perchlorate, VOC	SW	Table 6-5	HB				

Attachment A
Samples in Surface Water and Sediment

Location	Sample Number	Date	Analyses	Matrix	LHAAP BERA Source	Basin	Explosives?	1993-1995?	SVOCs analyzed?	Map Symbol
HBW-5	HBW-5-000421	04/21/00	Perchlorate, VOC	SW	Table 6-5	HB				
HBW-5	HBW-5-000810	08/10/00	VOC	SW	Table 6-5	HB				
HBW-5	HBW-5-010201	02/01/01	Perchlorate, VOC	SW	Table 6-5	HB				
HBW-5	HBW-5-010718	07/18/01	Perchlorate, VOC	SW	Table 6-5	HB				
HBW-5	HBW-5-011030	10/30/01	Perchlorate, VOC	SW	Table 6-5	HB				
HBW-5	HBW-5-020115	01/15/02	Perchlorate, VOC	SW	Table 6-5	HB				
HBW-5	HBW-5-020619	06/19/02	Perchlorate, VOC	SW	Table 6-5	HB				
HBW-5	HBW-5-020925	09/25/02	Perchlorate, VOC	SW	Table 6-5	HB				
HBW-5	HBW-5-021203	12/03/02	Perchlorate, VOC	SW	Table 6-5	HB				
HBW-5	HBW-5-030604	06/04/03	Perchlorate, VOC	SW	Table 6-5	HB				
HBW-5	HBW-5-950831	08/31/95	VOC	SW	Table 6-5	HB		Yes		
HBW-5	HBW-5-960612	06/12/96	VOC	SW	Table 6-5	HB				
HBW-5	HBW-5-960807	08/07/96	Explosives, VOC	SW	Table 6-5	HB	Yes			Green +
HBW-5	HBW-5-970205	02/05/97	VOC	SW	Table 6-5	HB				
HBW-5	HBW-5-970522	05/22/97	General Chemistry, VOC	SW	Table 6-5	HB				
HBW-5	HBW-5-971210	12/10/97	VOC	SW	Table 6-5	HB				
HBW-5	HBW-5-980209	02/09/98	VOC	SW	Table 6-5	HB				
HBW-5	HBW-5-980601	06/01/98	VOC	SW	Table 6-5	HB				
HBW-5	HBW-5-981027	10/27/98	VOC	SW	Table 6-5	HB				
HBW-5	HBW-5-990326	03/26/99	VOC	SW	Table 6-5	HB				
HBW-5	HBW-5-990708	07/08/99	Perchlorate, VOC	SW	Table 6-5	HB				
HBW-5	HBW-5-990924	09/24/99	Perchlorate, VOC	SW	Table 6-5	HB				
HBW-5	HBW-5AR	08/10/96	VOC	SW	Table 6-5	HB				
HBW-6.5	HBW-6.5-000203	02/03/00	Perchlorate, VOC	SW	Table 6-5	HB				
HBW-6.5	HBW-6.5-000421	04/21/00	Perchlorate, VOC	SW	Table 6-5	HB				
HBW-6.5	HBW-6.5-000810	08/10/00	Perchlorate, VOC	SW	Table 6-5	HB				
HBW-6.5	HBW-6.5-010201	02/01/01	Perchlorate, VOC	SW	Table 6-5	HB				
HBW-6.5	HBW-6.5-011030	10/30/01	Perchlorate, VOC	SW	Table 6-5	HB				
HBW-6.5	HBW-6.5-020115	01/15/02	Perchlorate, VOC	SW	Table 6-5	HB				
HBW-6.5	HBW-6.5-020619	06/19/02	Perchlorate, VOC	SW	Table 6-5	HB				
HBW-6.5	HBW-6.5-020925	09/25/02	Perchlorate, VOC	SW	Table 6-5	HB				
HBW-6.5	HBW-6.5-021203	12/03/02	Perchlorate, VOC	SW	Table 6-5	HB				
HBW-6.5	HBW-6.5-030604	06/04/03	Perchlorate, VOC	SW	Table 6-5	HB				
HBW-6.5	HBW-6.5-970205	02/05/97	VOC	SW	Table 6-5	HB				
HBW-6.5	HBW-6.5-970522	05/22/97	General Chemistry, VOC	SW	Table 6-5	HB				
HBW-6.5	HBW-6.5-971210	12/10/97	VOC	SW	Table 6-5	HB				
HBW-6.5	HBW-6.5-980209	02/09/98	VOC	SW	Table 6-5	HB				
HBW-6.5	HBW-6.5-980601	06/01/98	VOC	SW	Table 6-5	HB				
HBW-6.5	HBW-6.5-981027	10/27/98	VOC	SW	Table 6-5	HB				
HBW-6.5	HBW-6.5-990326	03/26/99	VOC	SW	Table 6-5	HB				
HBW-6.5	HBW-6.5-990708	07/08/99	Perchlorate, VOC	SW	Table 6-5	HB				
HBW-6.5	HBW-6.5-990924	09/24/99	Perchlorate, VOC	SW	Table 6-5	HB				
HBW-6	HBW-6-000203	02/03/00	Perchlorate, VOC	SW	Table 6-5	HB				
HBW-6	HBW-6-000420	04/20/00	Perchlorate, VOC	SW	Table 6-5	HB				
HBW-6	HBW-6-000810	08/10/00	VOC	SW	Table 6-5	HB				
HBW-6	HBW-6-010201	02/01/01	Perchlorate, VOC	SW	Table 6-5	HB				
HBW-6	HBW-6-010718	07/18/01	Perchlorate, VOC	SW	Table 6-5	HB				
HBW-6	HBW-6-011030	10/30/01	Perchlorate, VOC	SW	Table 6-5	HB				
HBW-6	HBW-6-020115	01/15/02	Perchlorate, VOC	SW	Table 6-5	HB				
HBW-6	HBW-6-020619	06/19/02	Perchlorate, VOC	SW	Table 6-5	HB				
HBW-6	HBW-6-020925	09/25/02	Perchlorate, VOC	SW	Table 6-5	HB				
HBW-6	HBW-6-021203	12/03/02	Perchlorate, VOC	SW	Table 6-5	HB				
HBW-6	HBW-6-030604	06/04/03	Perchlorate, VOC	SW	Table 6-5	HB				
HBW-6.5	HBW-6-5	07/18/01	Perchlorate, VOC	SW	Table 6-5	HB				
HBW-6	HBW-6-950911	09/11/95	VOC	SW	Table 6-5	HB		Yes		
HBW-6	HBW-6-970205	02/05/97	VOC	SW	Table 6-5	HB				
HBW-6	HBW-6-970522	05/22/97	General Chemistry, VOC	SW	Table 6-5	HB				
HBW-6	HBW-6-971210	12/10/97	VOC	SW	Table 6-5	HB				
HBW-6	HBW-6-980209	02/09/98	VOC	SW	Table 6-5	HB				
HBW-6	HBW-6-980601	06/01/98	VOC	SW	Table 6-5	HB				
HBW-6	HBW-6-981027	10/27/98	VOC	SW	Table 6-5	HB				
HBW-6	HBW-6-990326	03/26/99	VOC	SW	Table 6-5	HB				
HBW-6	HBW-6-990708	07/08/99	Perchlorate, VOC	SW	Table 6-5	HB				
HBW-6	HBW-6-990924	09/24/99	Perchlorate, VOC	SW	Table 6-5	HB				
HBW-6A	HBW-6A-960807	08/07/96	Explosives, VOC	SW	Table 6-5	HB	Yes			Green +
HBW-6A	HBW-6AAR	08/10/96	VOC	SW	Table 6-5	HB				
HBW-6	HBW-6QC	04/20/00	Perchlorate, VOC	SW	Table 6-5	HB				
HBW-7	HBW-7-000203	02/03/00	Perchlorate, VOC	SW	Table 6-5	HB				
HBW-7	HBW-7-000420	04/20/00	Perchlorate, VOC	SW	Table 6-5	HB				
HBW-7	HBW-7-010201	02/01/01	Perchlorate, VOC	SW	Table 6-5	HB				
HBW-7	HBW-7-010718	07/18/01	Perchlorate, VOC	SW	Table 6-5	HB				
HBW-7	HBW-7-011030	10/30/01	Perchlorate, VOC	SW	Table 6-5	HB				
HBW-7	HBW-7-020115	01/15/02	Perchlorate, VOC	SW	Table 6-5	HB				
HBW-7	HBW-7-020619	06/19/02	Perchlorate, VOC	SW	Table 6-5	HB				
HBW-7	HBW-7-020925	09/25/02	Perchlorate, VOC	SW	Table 6-5	HB				
HBW-7	HBW-7-021203	12/03/02	Perchlorate, VOC	SW	Table 6-5	HB				
HBW-7	HBW-7-030604	06/04/03	Perchlorate, VOC	SW	Table 6-5	HB				
HBW-7	HBW-7-030826	08/26/03	Perchlorate, VOC	SW	Table 6-5	HB				

Attachment A
Samples in Surface Water and Sediment

Location	Sample Number	Date	Analyses	Matrix	LHAAP BERA Source	Basin	Explosives?	1993-1995?	SVOCs analyzed?	Map Symbol
HBW-7	HBW-7-950911	09/11/95	VOC	SW	Table 6-5	HB		Yes		
HBW-7	HBW-7-981027	10/27/98	VOC	SW	Table 6-5	HB				
HBW-7	HBW-7-990326	03/26/99	VOC	SW	Table 6-5	HB				
HBW-7	HBW-7-990708	07/08/99	Perchlorate, VOC	SW	Table 6-5	HB				
HBW-7	HBW-7-990924	09/24/99	Perchlorate, VOC	SW	Table 6-5	HB				
HBW-8	HBW-8-000203	02/03/00	Perchlorate, VOC	SW	Table 6-5	HB				
HBW-8	HBW-8-000421	04/21/00	Perchlorate, VOC	SW	Table 6-5	HB				
HBW-8	HBW-8-010201	02/01/01	Perchlorate, VOC	SW	Table 6-5	HB				
HBW-8	HBW-8-010718	07/18/01	Perchlorate, VOC	SW	Table 6-5	HB				
HBW-8	HBW-8-011030	10/30/01	Perchlorate, VOC	SW	Table 6-5	HB				
HBW-8	HBW-8-020115	01/15/02	Perchlorate, VOC	SW	Table 6-5	HB				
HBW-8	HBW-8-020619	06/19/02	Perchlorate, VOC	SW	Table 6-5	HB				
HBW-8	HBW-8-020925	09/25/02	Perchlorate, VOC	SW	Table 6-5	HB				
HBW-8	HBW-8-021203	12/03/02	Perchlorate, VOC	SW	Table 6-5	HB				
HBW-8	HBW-8-030604	06/04/03	Perchlorate, VOC	SW	Table 6-5	HB				
HBW-8	HBW-8-030826	08/26/03	Perchlorate, VOC	SW	Table 6-5	HB				
HBW-8	HBW-8-950911	09/11/95	VOC	SW	Table 6-5	HB		Yes		
HBW-8	HBW-8-990924	09/24/99	Perchlorate, VOC	SW	Table 6-5	HB				
HBW-9	HBW-9-000203	02/03/00	Perchlorate, VOC	SW	Table 6-5	HB				
HBW-9	HBW-9-000810	08/10/00	Perchlorate, VOC	SW	Table 6-5	HB				
HBW-9	HBW-9-010201	02/01/01	Perchlorate, VOC	SW	Table 6-5	HB				
HBW-9	HBW-9-010718	07/18/01	Perchlorate, VOC	SW	Table 6-5	HB				
HBW-9	HBW-9-011030	10/30/01	Perchlorate, VOC	SW	Table 6-5	HB				
HBW-9	HBW-9-020115	01/15/02	Perchlorate, VOC	SW	Table 6-5	HB				
HBW-9	HBW-9-020619	06/19/02	Perchlorate, VOC	SW	Table 6-5	HB				
HBW-9	HBW-9-020925	09/25/02	Perchlorate, VOC	SW	Table 6-5	HB				
HBW-9	HBW-9-021203	12/03/02	Perchlorate, VOC	SW	Table 6-5	HB				
HBW-9	HBW-9-030604	06/04/03	Perchlorate, VOC	SW	Table 6-5	HB				
HBW-9	HBW-9-030826	08/26/03	Perchlorate, VOC	SW	Table 6-5	HB				
HBW-9	HBW-9-950911	09/11/95	VOC	SW	Table 6-5	HB		Yes		
HBW-9	HBW-9-990708	07/08/99	Perchlorate, VOC	SW	Table 6-5	HB				
HBW-B	HBW-B-981027	10/27/98	VOC	SW	Table 6-5	HB				
HBW-D	HBW-D-981027	10/27/98	VOC	SW	Table 6-5	HB				
HBW-F	HBW-F-981027	10/27/98	VOC	SW	Table 6-5	HB				
HBW-H	HBW-H-981027	10/27/98	VOC	SW	Table 6-5	HB				
HBW-M	HBW-M-981027	10/27/98	VOC	SW	Table 6-5	HB				
IWSW17	IWSW17	09/16/04	Metals, Perchlorate, Explosives	SW	App. G_Table G-1	HB	Yes			Purple Triangle
27SW02	LH27-SW02	03/30/93	Explosives, General Chemistry, Metals, SVOC, VOC	SW	Table 6-5	HB	Yes	Yes	Yes	Blue Circle
27SW03	LH27-SW03	03/30/93	Explosives, General Chemistry, Metals, SVOC, VOC	SW	Table 6-5	HB	Yes	Yes	Yes	Blue Circle
27SW04	LH27-SW04	03/30/93	Explosives, General Chemistry, Metals, SVOC, VOC	SW	Table 6-5	HB	Yes	Yes	Yes	Blue Circle
XXSW01	LHXX-SW01	03/30/93	Explosives, General Chemistry, Metals, SVOC, VOC	SW	Table 6-5	HB	Yes	Yes	Yes	Blue Circle
XXSW15	LHXX-SW15	03/31/93	Explosives, General Chemistry, Metals, SVOC, VOC	SW	Table 6-5	HB	Yes	Yes	Yes	Blue Circle
HBSW01	P3HBSW01	09/17/98	Dioxins/Furans, Explosives, General Chemistry, Metals, Pest/PCB, SVOC, VOC	SW	Table 6-5	HB	Yes		Yes	Green +
HBSW01	P3HBSW01-981204	12/04/98	Dioxins/Furans, Explosives, General Chemistry, Metals, Pest/PCB, SVOC, VOC	SW	Table 6-5	HB	Yes		Yes	Green +
HBSW01	P3HBSW01QC	09/17/98	Dioxins/Furans, Explosives, General Chemistry, Metals, Pest/PCB, SVOC, VOC	SW	Table 6-5	HB	Yes		Yes	Green +
18SW16	18SW16(WATER)	02/21/95	Metals, VOC	SW	Table 6-11	SB		Yes		
18SW16	18SW16(WATER)QC	02/21/95	Metals, VOC	SW	Table 6-11	SB		Yes		
18SW17	18SW17(WATER)	03/05/95	Metals, VOC	SW	Table 6-11	SB		Yes		
18SW18	18SW18(WATER)	03/05/95	Metals, VOC	SW	Table 6-11	SB		Yes		
18SW19	18SW19(WATER)	03/05/95	Metals, VOC	SW	Table 6-11	SB		Yes		
IWSW18	IWSW18	09/15/04	Metals, Perchlorate, Explosives	SW	App. G_Table G-1	SB	Yes			Purple Triangle
IWSW19	IWSW19	09/15/04	Metals, Perchlorate, Explosives	SW	App. G_Table G-1	SB	Yes			Purple Triangle
IWSW20	IWSW20	09/15/04	Metals, Perchlorate, Explosives	SW	App. G_Table G-1	SB	Yes			Purple Triangle
XXSW17	LHXX-SW17	03/31/93	Explosives, General Chemistry, Metals, SVOC, VOC	SW	Table 6-11	SB	Yes	Yes	Yes	Blue Circle
XXSW18	LHXX-SW18	03/31/93	Explosives, General Chemistry, Metals, SVOC, VOC	SW	Table 6-11	SB	Yes	Yes	Yes	Blue Circle
XXSW19	LHXX-SW19	03/31/93	Explosives, General Chemistry, Metals, SVOC, VOC	SW	Table 6-11	SB	Yes	Yes	Yes	Blue Circle
XXSW20	LHXX-SW20	04/01/93	Explosives, General Chemistry, Metals, SVOC, VOC	SW	Table 6-11	SB	Yes	Yes	Yes	Blue Circle

APPENDIX B

Sampling and Analysis Plan

This page is intentionally left blank.

Appendix B
Sampling and Analysis Plan

This page is intentionally left blank.

APPENDIX B
Sampling and Analysis Plan

This Sampling and Analysis Plan (SAP) for the Baseline Ecological Risk Assessment (BERA) Addendum for Longhorn Army Ammunition Plant (LHAAP) presents worksheets developed in the *Final Baseline Ecological Risk Assessment Addendum, Longhorn Army Ammunition Plant, Karnack, Texas Uniform Federal Policy for Quality Assurance Project Plan* (QAPP) (AGEISS, 2013). These worksheets provide details on specific tasks necessary to collect and analyze the data gaps samples to be collected in soil, surface water, and sediment at the LHAAP installation. In addition to the worksheets presented in this SAP, the QAPP (AGEISS, 2013) presents additional details that may be useful in performing the collection, analysis, validation, and reporting of the data described in the Work Plan.

The following worksheets are included in the SAP (the worksheet and table numbers are the same as assigned in the QAPP):

- **WORKSHEET #12-1: MEASUREMENT PERFORMANCE CRITERIA - SW-846 METHOD 8330A - SOIL**
- **WORKSHEET #12-2: MEASUREMENT PERFORMANCE CRITERIA - SW-846 METHOD 8330A - SEDIMENT**
- **WORKSHEET #12-3: MEASUREMENT PERFORMANCE CRITERIA - SW-846 METHOD 8330A - WATER**
- **WORKSHEET #15: PROJECT ACTION LIMITS AND LABORATORY-SPECIFIC DETECTION/QUANTITATION LIMITS**
- **WORKSHEET #18: SAMPLING LOCATIONS AND METHODS**
- **WORKSHEETS #19 & #30: SAMPLE CONTAINERS, PRESERVATION, AND HOLD TIMES**
- **WORKSHEET #20: FIELD QC SUMMARY**
- **WORKSHEET #21: FIELD SOPSWORKSHEET #22: FIELD EQUIPMENT CALIBRATION, MAINTENANCE, TESTING, AND INSPECTION**
- **WORKSHEET #23: ANALYTICAL SOPS**
- **WORKSHEET #26 & 27: SAMPLE HANDLING, CUSTODY, AND DISPOSAL**
- **WORKSHEET #28: ANALYTICAL QUALITY CONTROL AND CORRECTIVE ACTION**
- **WORKSHEET #28-1: QUALITY CONTROL SAMPLES – NITROAROMATICS AND NITRAMINES IN SOIL**
- **WORKSHEET #28-2: QUALITY CONTROL SAMPLES – NITROAROMATICS AND NITRAMINES IN SEDIMENTS**
- **WORKSHEET #28-3: QUALITY CONTROL SAMPLES – NITROAROMATICS AND NITRAMINES IN WATER**
- **WORKSHEET #34: DATA VERIFICATION AND VALIDATION INPUTS**
- **WORKSHEET #35: DATA VERIFICATION PROCEDURES**
- **WORKSHEET #36: DATA VALIDATION PROCEDURES**
- **WORKSHEET #37: DATA USABILITY ASSESSMENT**

Worksheet #12-1: Measurement Performance Criteria - SW-846 Method 8330A - Soil

Matrix	Soil		
Analytical Method	SW-846 Method 8330A		
Analytical Group	Nitroaromatics and Nitramines by High Performance Liquid Chromatography		
Concentration Level	All		
Sampling SOPs	**Data Quality Indicators**	**Measurement Performance Criteria**	**QC Sample and/or Activity Used to Assess Measurement Performance**
(See Worksheet #18)	Precision	≤30% RPD	Field Duplicate
	Accuracy/Bias	Recovery acceptance criteria listed in QAPP, Appendix A, Table A-1	LCS and MS/MSD
	Individual Sample Accuracy/Bias	Recovery acceptance criteria listed in QAPP, Appendix A, Table A-1	Surrogate
	Sensitivity	<QL	Limit of Quantitation
	Accuracy/Bias/Contamination	No analytes detected >½ RL and > 1/10 the amount measured in any sample or 1/10 the regulatory limit (whichever is greater)	Method Blanks, Equipment Rinsate Blanks
	Precision	RPD criteria listed in QAPP, Appendix A, Table A-1	MS/MSD

HPLC High Performance Liquid Chromatography
LCS laboratory control sample
MS/MSD matrix spike/matrix spike duplicate
QC quality control
QL quantitation limit
RL reporting limit
RPD relative percent difference
SOP standard operating procedure

Worksheet #12-2: Measurement Performance Criteria - SW-846 Method 8330A - Sediment

Matrix	Sediment		
Analytical Method	SW-846 Method 8330A		
Analytical Group	Nitroaromatics and Nitramines by High Performance Liquid Chromatography		
Concentration Level	All		
Sampling SOPs	**Data Quality Indicators**	**Measurement Performance Criteria**	**QC Sample and/or Activity Used to Assess Measurement Performance**
(See Worksheet #18)	Precision	≤30% RPD	Field Duplicate
	Accuracy/Bias	Recovery acceptance criteria listed in QAPP, Appendix A, Table A-2	LCS and MS/MSD
	Individual Sample Accuracy/Bias	Recovery acceptance criteria listed in QAPP, Appendix A, Table A-2	Surrogate
	Sensitivity	<QL	Limit of Quantitation
	Accuracy/Bias/Contamination	No analytes detected >½ RL and > 1/10 the amount measured in any sample or 1/10 the regulatory limit (whichever is greater)	Method Blanks, Equipment Rinsate Blanks
	Precision	RPD criteria listed in QAPP, Appendix A, Table A-2	MS/MSD

HPLC High Performance Liquid Chromatography
LCS laboratory control sample
MS/MSD matrix spike/matrix spike duplicate
QC quality control
QL quantitation limit
RL reporting limit
RPD relative percent difference
SOP standard operating procedure

Worksheet #12-3: Measurement Performance Criteria - SW-846 Method 8330A - Water

Matrix	Water		
Analytical Method	SW-846 Method 8330A		
Analytical Group	Nitroaromatics and Nitramines by High Performance Liquid Chromatography		
Concentration Level	All		
Sampling SOPs	**Data Quality Indicators**	**Measurement Performance Criteria**	**QC Sample and/or Activity Used to Assess Measurement Performance**
(See Worksheet #18)	Precision	≤30% RPD	Field Duplicate
	Accuracy/Bias	Recovery acceptance criteria listed in QAPP, Appendix A, Table A-3	LCS and MS/MSD
	Individual Sample Accuracy/Bias	Recovery acceptance criteria listed in QAPP, Appendix A, Table A-3	Surrogate
	Sensitivity	<QL	Limit of Quantitation
	Accuracy/Bias/Contamination	No analytes detected >½ RL and > 1/10 the amount measured in any sample or 1/10 the regulatory limit (whichever is greater)	Method Blanks, Equipment Rinsate Blanks
	Precision	RPD criteria listed in QAPP, Appendix A, Table A-3	MS/MSD

HPLC High Performance Liquid Chromatography
LCS laboratory control sample
MS/MSD matrix spike/matrix spike duplicate
QC quality control
QL quantitation limit
RL reporting limit
RPD relative percent difference
SOP standard operating procedure

Worksheet #15: Project Action Limits and Laboratory-Specific Detection/Quantitation Limits

This worksheet is comprised of Tables 2, 3, and 4, which present the project action limits (PALs) for each target compound and matrix (soil, sediment, and surface water, respectively). The purpose of this worksheet is to make sure the selected analytical laboratory and analytical method can provide accurate data at the PAL. Tables supporting this worksheet are presented in Appendix B of the QAPP which include Microbac Laboratories analytical method detection limits (MDLs), levels of quantitation (LOQs), and a comparison of these values to the PALs.

Table 1. Soil - Project Action Limits

Compounds	Units	PAL	PAL Reference	LOQ	MDL
HMX (Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine)	mg/kg	No Value Available	N/A	0.25	0.1
RDX (Hexahydro-1,3,5-trinitro-1,3,5-triazine)	mg/kg	100	Final Ecological Screening Value (1)	0.25	0.1
1,3,5-TNB (1,3,5-Trinitrobenzene)	mg/kg	0.376	Final Ecological Screening Value (1)	0.25	0.1
1,3-DNB (1,3-Dinitrobenzene)	mg/kg	0.655	Final Ecological Screening Value (1)	0.25	0.1
Tetryl (Methyl-2,4,6-trinitrophenylnitramine)	mg/kg	25	Talmage et al. (1999)	0.25	0.1
NB (Nitrobenzene)	mg/kg	40	Final Ecological Screening Value (1)	0.25	0.1
2,4,6-TNT (2,4,6-Trinitrotoluene)	mg/kg	30	Final Ecological Screening Value (1)	0.25	0.1
4-Am-DNT (4-Amino-2,6-dinitrotoluene)	mg/kg	80	Final Ecological Screening Value (1)	0.25	0.1
2-Am-DNT (2-Amino-4,6-dinitrotoluene)	mg/kg	80	Final Ecological Screening Value (1)	0.25	0.1
2,4-DNT (2,4-Dinitrotoluene)	mg/kg	1.28	Final Ecological Screening Value (1)	0.25	0.1
2,6-DNT (2,6-Dinitrotoluene)	mg/kg	0.0328	Final Ecological Screening Value (1)	0.25	0.1
2-NT (2-Nitrotoluene)	mg/kg	No Value Available	N/A	0.25	0.1
3-NT (3-Nitrotoluene)	mg/kg	No Value Available	N/A	0.25	0.1
4-NT (4-Nitrotoluene)	mg/kg	No Value Available	N/A	0.25	0.1

(1) LHAAP Installation-Wide BERA Volume I Shaw Environmental, Inc. 2007
LOQ limit of quantitation
MDL method detection limit
mg/kg milligrams per kilogram
N/A not applicable
PAL project action limit

The following hierarchy was used to select the final soil ecological screening toxicity values:

1) U.S. Environmental Protection Agency (USEPA), 2010, *Guidance for Developing Ecological Soil Screening Levels (Eco-SSL)*, Office of Solid Waste and Emergency Response, Website version last updated October 20, 2010. http://www.epa.gov/ecotox/ecossl.
2) Texas Commission on Environmental Quality (TCEQ), 2005, *Guidance for Conducting Ecological Risk Assessments at Remediation Sites in Texas*, RG-263 (Revised), and *Update to Guidance for Conducting Ecological Risk Assessments at Remediation Sites in Texas, RG-263 (Revised), January 2006 Version*.
3) Lower of Efroymson, 1997 and Region 5
    - Efroymson, R.A., Suter II, G.W., Sample, B.E. and Jones, D.S., 1997. Preliminary Remediation Goals for Ecological Endpoints. Lockheed Martin Energy Systems, Inc. ES/ER/TM-162/R2

- USEPA, 2003, *U.S. EPA Region 5 RCRA Ecological Screening Levels (ESL)*, Website version last updated August 22, 2003 http://www.epa.gov/reg5rcra/ca/edql.htm.

4) Other available screening values including the following:

- USEPA, 2001, *Supplemental Guidance to RAGS: Region 4 Bulletins, Ecological Risk Assessment*. Originally published November 1995. Website version last updated November 30, 2001 http://www.epa.gov/region4/waste/ots/ecolbul.htm.,
- Talmage, S.S., D.M. Opresko, C.J. Maxwell, C.J.E. Welsh, F.M. Cretella, P.H. Reno, and F.B. Daniel, 1999, Nitroaromatic Munition Compounds: Environmental Effects and Screening Values **Rev. Environ. Contam. Toxicol.** 161:1-156, Springer-Verlag. Screening concentration used is the lowest of the Plant and Soil Invertebrate concentrations. Wildlife (shrew) values were not included as candidates for screening values. This is consistent with TCEQ's method of only using the Plant and Earthworm values to select their screening values.
- Earthworm and plant soil benchmark values in TCEQ 2005 were transposed, the values were corrected to reflect the Eco-SSLs (2005). *Personal Communication* with Vickie Reat, TCEQ, 12/06/05.

Table 2. Sediment - Project Action Limits

Compounds	Units	PAL	PAL Reference	LOQ	MDL
HMX (Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine)	mg/kg	27000	LANL (2012)	0.25	0.1
RDX (Hexahydro-1,3,5-trinitro-1,3,5-triazine)	mg/kg	45	LANL (2012)	0.25	0.1
1,3,5-TNB (1,3,5-Trinitrobenzene)	mg/kg	1300	LANL (2012)	0.25	0.1
1,3-DNB (1,3-Dinitrobenzene)	mg/kg	1.2	LANL (2012)	0.25	0.1
Tetryl (Methyl-2,4,6-trinitrophenylnitramine)	mg/kg	100	LANL (2012)	0.25	0.1
NB (Nitrobenzene)	mg/kg	27	LANL (2012)	0.25	0.1
2,4,6-TNT (2,4,6-Trinitrotoluene)	mg/kg	0.092	Final Ecological Screening Value (1)	0.25	0.1
4-Am-DNT (4-Amino-2,6-dinitrotoluene)	mg/kg	1.40	Final Ecological Screening Value (1)	0.25	0.1
2-Am-DNT (2-Amino-4,6-dinitrotoluene)	mg/kg	7.00	Final Ecological Screening Value (1)	0.25	0.1
2,4-DNT (2,4-Dinitrotoluene)	mg/kg	0.29	LANL (2012)	0.25	0.1
2,6-DNT (2,6-Dinitrotoluene)	mg/kg	0.0398	Final Ecological Screening Value (1)	0.25	0.1
2-NT (2-Nitrotoluene)	mg/kg	28	LANL (2012)	0.25	0.1
3-NT (3-Nitrotoluene)	mg/kg	24	LANL (2012)	0.25	0.1
4-NT (4-Nitrotoluene)	mg/kg	52	LANL (2012)	0.25	0.1

[1] LHAAP Installation-Wide BERA Volume I Shaw Environmental, Inc. 2007

LANL Los Alamos National Laboratory
LOQ limit of quantitation
MDL method detection limit
mg/kg milligrams per kilogram
N/A not applicable
PAL project action limit

The following hierarchy was used to select the final sediment ecological screening toxicity values:

1) Texas Commission on Environmental Quality (TCEQ), 2005, *Guidance for Conducting Ecological Risk Assessments at Remediation Sites in Texas, RG-263 (Revised)*, and *Update to Guidance for Conducting Ecological Risk Assessments at Remediation Sites in Texas, RG-263 (Revised), January 2006 Version*.
2) Lower value from the following:
   - ♦ Ecological Screening Levels (ESLs), U.S. Environmental Protection Agency (USEPA) Region V, August 2003.
   - ♦ Preliminary Remediation Goals (PRGs), ORNL, ES/ER/TM-162/R2, Efroymson, R.A., et al., 1997.
   - ♦ Canadian Interim Sediment Quality Guidelines (ISQGs) Summary Table, CCME, December 2003.
3) Ecological Benchmark Screening Values for Sediment, USEPA Region IV, 2000.
4) ESLs for Los Alamos National Laboratory (LANL), 2005, and LANL (2012) for 2012 QAPP.

Table 3. Surface Water - Project Action Limits

Compounds	Units	PAL	PAL Reference	LOQ	MDL
HMX (Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine)	µg/L	150	TCEQ (2005)	1	0.25
RDX (Hexahydro-1,3,5-trinitro-1,3,5-triazine)	µg/L	180	Final Ecological Screening Value (1)	1	0.25
1,3,5-TNB (1,3,5-Trinitrobenzene)	µg/L	11	Final Ecological Screening Value (1)	1	0.25
1,3-DNB (1,3-Dinitrobenzene)	µg/L	72	Final Ecological Screening Value (1)	1	0.25
Tetryl (Methyl-2,4,6-trinitrophenylnitramine)	µg/L	5800	Final Ecological Screening Value (1)	1	0.25
NB (Nitrobenzene)	µg/L	270	TCEQ (2005)	1	0.25
2,4,6-TNT (2,4,6-Trinitrotoluene)	µg/L	50	Final Ecological Screening Value (1)	1	0.25
4-Am-DNT (4-Amino-2,6-dinitrotoluene)	µg/L	740	Final Ecological Screening Value (1)	1	0.25
2-Am-DNT (2-Amino-4,6-dinitrotoluene)	µg/L	740	Final Ecological Screening Value (1)	1	0.25
2,4-DNT (2,4-Dinitrotoluene)	µg/L	1,220	Final Ecological Screening Value (1)	1	0.25
2,6-DNT (2,6-Dinitrotoluene)	µg/L	1,220	Final Ecological Screening Value (1)	1	0.25
2-NT (2-Nitrotoluene)	µg/L	440	Final Ecological Screening Value (1)	1	0.25
3-NT (3-Nitrotoluene)	µg/L	47000	LANL (2012)	1	0.25
4-NT (4-Nitrotoluene)	µg/L	950	LANL (2012)	1	0.25

[1] LHAAP Installation-Wide BERA Volume I Shaw Environmental, Inc. 2007

µg/kg milligrams per kilogram
LOQ limit of quantitation
MDL method detection limit
N/A not applicable
PAL project action limit

The following hierarchy was used to select the final surface water ecological screening toxicity value:

1) Texas Commission on Environmental Quality (TCEQ), 2005, *Guidance for Conducting Ecological Risk Assessments at Remediation Sites in Texas, RG-263 (Revised)*, and *Update to Guidance for Conducting Ecological Risk Assessments at Remediation Sites in Texas, RG-263 (Revised), January 2006*.
2) Lower value from the following:
   - Ecological Screening Levels (ESLs), U.S. Environmental Protection Agency (USEPA) Region V, August 2003
   - Preliminary Remediation Goals (PRGs), ORNL, ES/ER/TM-162/R2, Efroymson, R.A., et al., 1997
   - Canadian Environmental Quality Guidelines (EQGs), CCME, 2002
3) Ecological Benchmark Screening Values for Surface Water, USEPA Region IV, 2000.
4) Talmage et al., 1999, Los Alamos National Laboratory (LANL), Los Alamos National Laboratory Eco Risk database, 2002 or LANL (2012) for 2012 QAPP.

Worksheet #18: Sampling Locations and Methods

This worksheet provides the planned sampling locations and methods for each sample to be taken for soil, sediment, and surface water samples. Figures 2, 3, 4, and 5, located at the end of this worksheet, show the locations for samples at the WSA, LISA, ISA, and HB, respectively. The sample naming scheme is provided in SOP LHAAP-F-7, *Sample Handling, Labeling, Packaging, and Custody*.

Table 4. Planned Soil Replacement Samples to Address Data Gaps for the BERA at the Waste Sub-Area

Site	Number of Surface Soil (0-0.5 feet) Samples*	Number of Subsurface Soil (0.5-3 feet) Samples**	Total Number of Samples	Planned Replacement Sample Locations	Type	Analytical Method	Sampling SOP	Comments
LHAAP-12	4	1	5	12SB01 (DS), 12WW05 (SS), 12WW01 (SS), 12WW02 (SS), 12WW07 (SS)	Shovel/scoop; Direct Push or Hand Auger	Method 8330A	LHAAP-F-3 LHAAP-F-9	GPS coordinates will be recorded
LHAAP-16	1	0	1	16SD02 (SS)	Shovel/scoop	Method 8330A	LHAAP-F-3 LHAAP-F-9	GPS coordinates will be recorded
LHAAP-18	6	0	6	18SD03, 18SD04, 18SD05, 18SD06, 18SD07, 18SD08 (all SS)	Shovel/scoop	Method 8330A	LHAAP-F-3 LHAAP-F-9	GPS coordinates will be recorded
		WSA Total:	**12**					

*Indicates grab sample
**Indicates composite sample covering indicated depth interval GPS global positioning system
DS subsurface soil sample
SS surface soil sample
SOP standard operating procedure
WSA Waste Sub-Area

Table 5. Planned Soil Replacement Samples to Address Data Gaps for the BERA at the Low Impact Sub-Area

Site	Number of Surface Soil (0-0.5 feet) Samples*	Number of Subsurface Soil (0.5-3 feet) Samples**	Total Number of Samples	Planned Replacement Sample Locations	Type	Analytical Method	Sampling SOP	Comments
LHAAP-11	3	3	6	11SB03, 11SB05, 11SD13	Shovel/scoop; Direct Push or Hand Auger	Method 8330A	LHAAP-F-3 LHAAP-F-9	GPS coordinates will be recorded
LHAAP-27	2	2	4	27SB34, 27SB38	Shovel/scoop; Direct Push or Hand Auger	Method 8330A	LHAAP-F-3 LHAAP-F-9	GPS coordinates will be recorded
LHAAP-54	3	3	6	XXSB15, XXSB17, XXSB20	Shovel/scoop; Direct Push or Hand Auger	Method 8330A	LHAAP-F-3 LHAAP-F-9	GPS coordinates will be recorded
		LISA Total:	**16**					

*Indicates grab sample
**Indicates composite sample covering indicated depth interval GPS global positioning system
LISA Low Impact Sub-Area
SOP standard operating procedure

Table 6. Planned Soil Replacement Samples to Address Data Gaps for the BERA at the Industrial Sub-Area

Site	Number of Surface Soil (0-0.5 feet) Samples*	Number of Subsurface Soil (0.5-3 feet) Samples**	Total Number of Samples	Planned Replacement Sample Locations	Type	Analytical Method	Sampling SOP	Comments
LHAAP-01	5	5	10	01A-SB02, 01A-SB04, 01-SD09, 01SB23, 01SB28	Shovel/scoop; Direct Push or Hand Auger	Method 8330A	LHAAP-F-3 LHAAP-F-9	GPS coordinates will be recorded
LHAAP-04	2	2	4	LHSMW01, LHSMW02	Shovel/scoop; Direct Push or Hand Auger	Method 8330A	LHAAP-F-3 LHAAP-F-9	GPS coordinates will be recorded
LHAAP-29	12	12	24	29SD01, 29SB05, 29SB07, 29SB08, 29SB09, 29SB11, 29SD10, 29WL02, 29SB14, 29SB15, 29SB12, 29SB13	Shovel/scoop; Direct Push or Hand Auger	Method 8330A	LHAAP-F-3 LHAAP-F-9	GPS coordinates will be recorded
LHAAP-32	8	8	16	32SB13, 32SB03, 32SB06, 32SB14, 32SS03, 32SS04, 32WL01, 32SD06	Shovel/scoop; Direct Push or Hand Auger	Method 8330A	LHAAP-F-3 LHAAP-F-9	GPS coordinates will be recorded
LHAAP-35A (58)	5	5	10	LH-S723-01, LH-S111-01, LH-S112-01, LH-S113-01, LH-S117-01	Shovel/scoop; Direct Push or Hand Auger	Method 8330A	LHAAP-F-3 LHAAP-F-9	GPS coordinates will be recorded
LHAAP-35C (53)	5	5	10	LHSMW67, LHSMW68, LHSMW69, LHSMW70, LHSMW71	Shovel/scoop; Direct Push or Hand Auger	Method 8330A	LHAAP-F-3 LHAAP-F-9	GPS coordinates will be recorded
LHAAP-46	20	20	40	LH-S30-01, LH-S32-01, LH-S14-02, LH-S16-01, LH-S22-01, LH-S27-01, LH-S05-01, LH-S29-01, LH-S026-01, LH-S025-01, LH-S19-01, LH-S021-01, LH-S43-01, LH-S41-01, LH-S08-01, LH-S06-01, LH-S12-01, LH-S10-01,	Shovel/scoop; Direct Push or Hand Auger	Method 8330A	LHAAP-F-3 LHAAP-F-9	GPS coordinates will be recorded

Site	Number of Surface Soil (0-0.5 feet) Samples*	Number of Subsurface Soil (0.5-3 feet) Samples**	Total Number of Samples	Planned Replacement Sample Locations	Type	Analytical Method	Sampling SOP	Comments
				LH-S11-01, 46SD02				
LHAAP-47	23	23	46	LH-S93-01, LH-S92-01, LH-S88-01, LH-S89-02, LH-S86-01, LH-S83-01, LH-S82-01, LH-S73-01, LH-DL74-01, LH-DL75-01, LH-S77-01, LH-S71-01, LH-S61-01, LH-S59-01, LH-S58-01, LH-S55-01, LH-S121-01, LH-S44-01, H-DL45-01, LH-S47-01, LH-S49-01, LH-S48-01, LH-S50-01	Shovel/scoop; Direct Push or Hand Auger	Method 8330A	LHAAP-F-3 LHAAP-F-9	GPS coordinates will be recorded
LHAAP-48	5	5	10	LH-S94-01, LH-S95-01, LH-S97-01, LH-S98-01, LH-S100-01	Shovel/scoop; Direct Push or Hand Auger	Method 8330A	LHAAP-F-3 LHAAP-F-9	GPS coordinates will be recorded
		ISA Total:	**170**					

*Indicates grab sample
**Indicates composite sample covering indicated depth interval
GPS global positioning system
ISA Industrial Sub-Area
SOP standard operating procedure

Table 7. Planned Sediment Samples for the Harrison Bayou Watershed

Site	Matrix	Depth (ft bgs)*	Total Number of Sediment Samples	Planned Replacement Sample Locations	Type	Analytical Method	Sampling SOP	Comments
Harrison Bayou	Sediment	0-0.5	8	LHAAP-HB-ABERA-01, LHAAP-HB-ABERA-02, LHAAP-HB-ABERA-03, LHAAP-HB-ABERA-04, LHAAP-HB-ABERA-05, LHAAP-HB-ABERA-06, LHAAP-HB-ABERA-07, LHAAP-HB-ABERA-08	Scoop/trowel/ petite ponar	Method 8330A	LHAAP-F-4 LHAAP-F-9	GPS coordinates will be recorded

*Indicates grab sample
bgs below ground surface
ft feet
GPS global positioning system
SOP standard operating procedure

Table 8. Planned Surface Water Samples for the Harrison Bayou Watershed

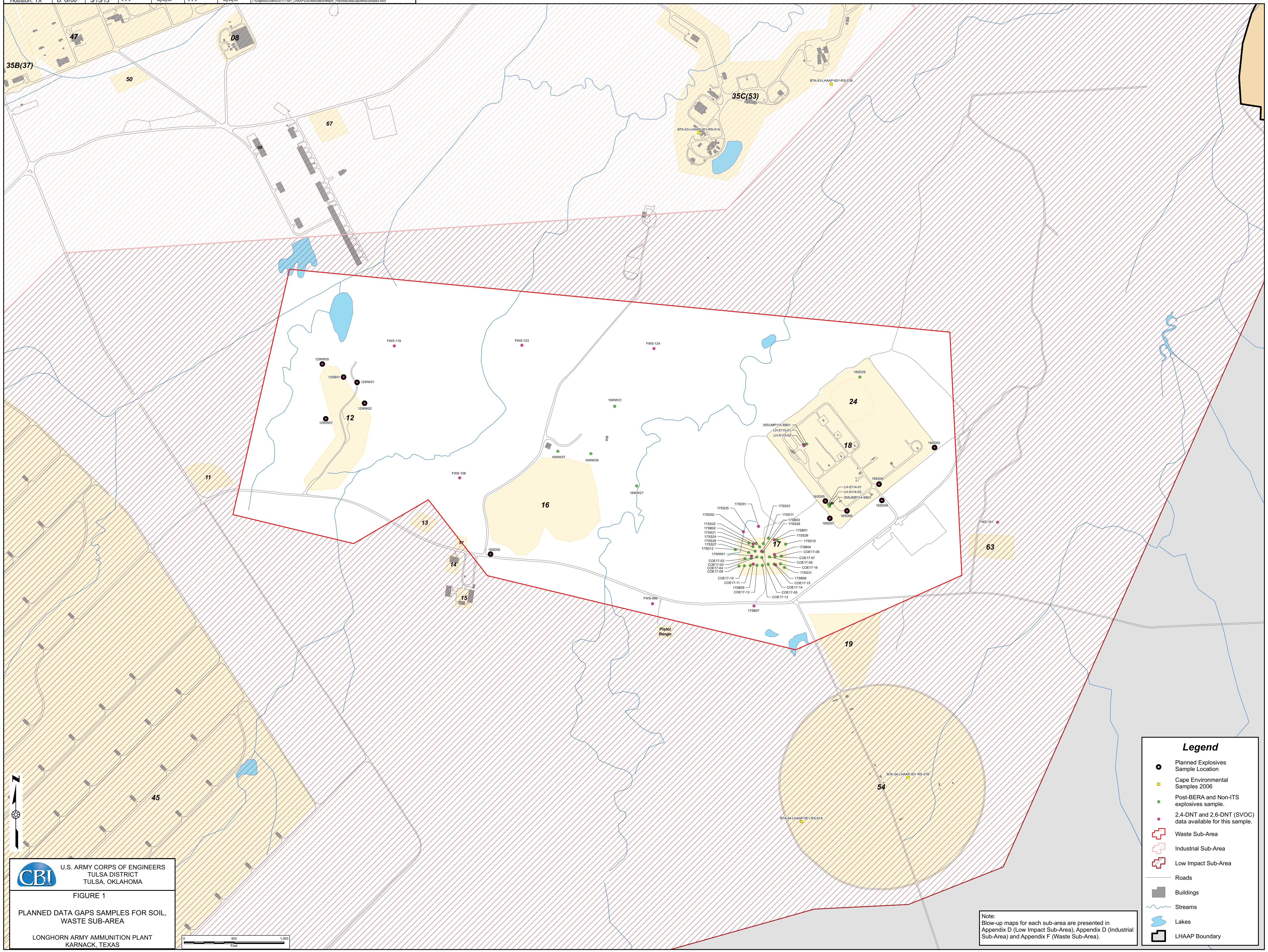
Site	Matrix	Total Number of Surface Water Samples*	Planned Replacement Sample Locations	Type	Analytical Method	Sampling SOP	Comments
Harrison Bayou	Surface Water	5	LHAAP-HB-ABERA-01 LHAAP-HB-ABERA-03, LHAAP-HB-ABERA-04, LHAAP-HB-ABERA-07, LHAAP-HB-ABERA-08	Sample bottle or scoop/dipper/pond sampler	Method 8330A	LHAAP-F-5 LHAAP-F-9	GPS coordinates will be recorded

* Surface water samples will be collected if water is present. Samples will be collected from areas with flow or recent runoff. Sampling from still or standing water, or water pooled in small areas of the drainage, will be avoided when possible. Samples will be collected approximately 1 ft below the water surface.

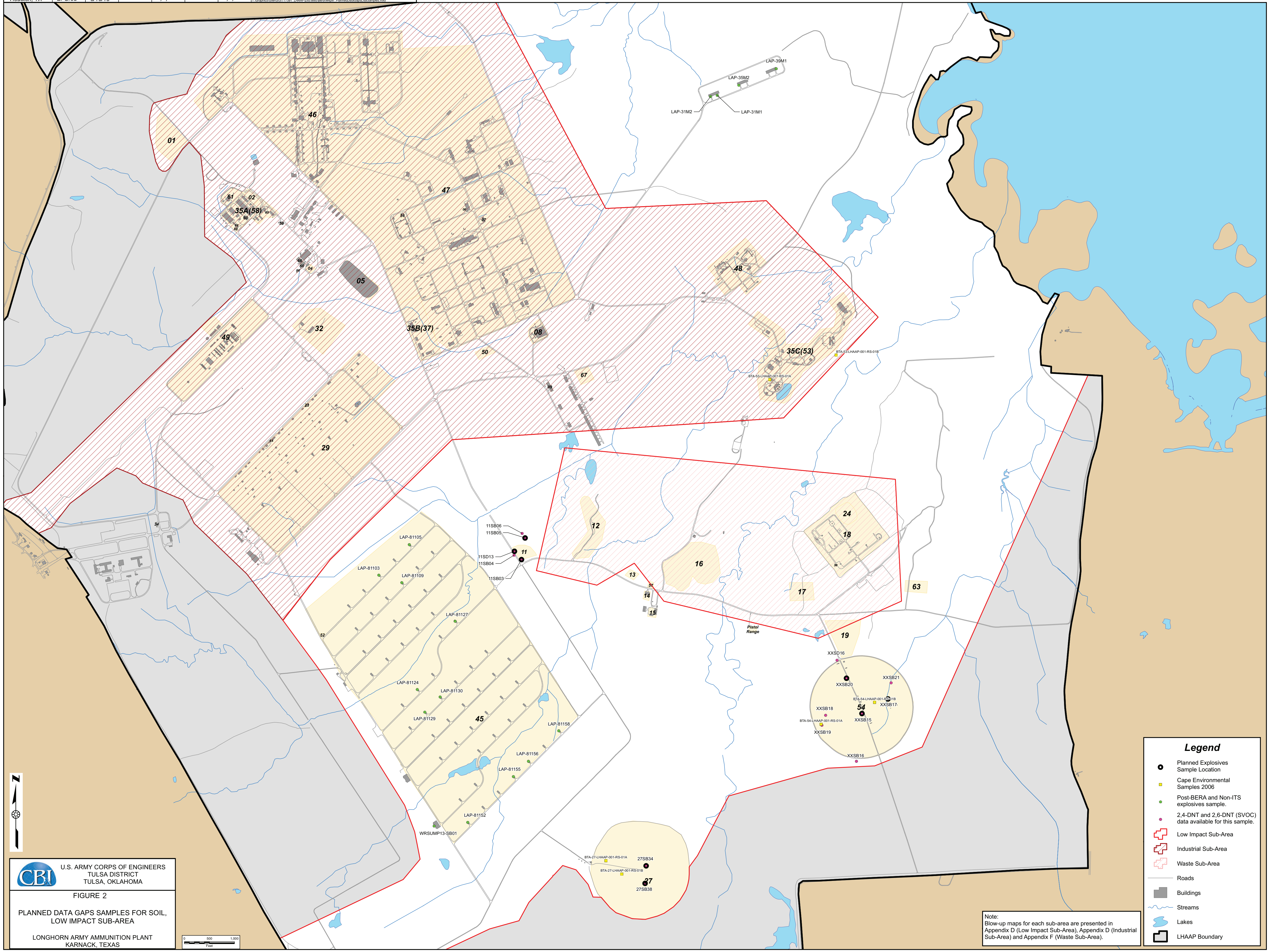
GPS global positioning system
SOP standard operating procedure
ft foot

00188128

OFFICE	DRAWN BY		CHECKED BY		APPROVED BY		FILE PATH
Houston, TX	B. Grod	5/15/13	- - -	--/--/--	- - -	--/--/--	T:\Graphics\GIM\GIS\117591_LHAAP\Doc\Mxd\Bera\Wkpln_PlannedDataGapsWsaSamples.mxd

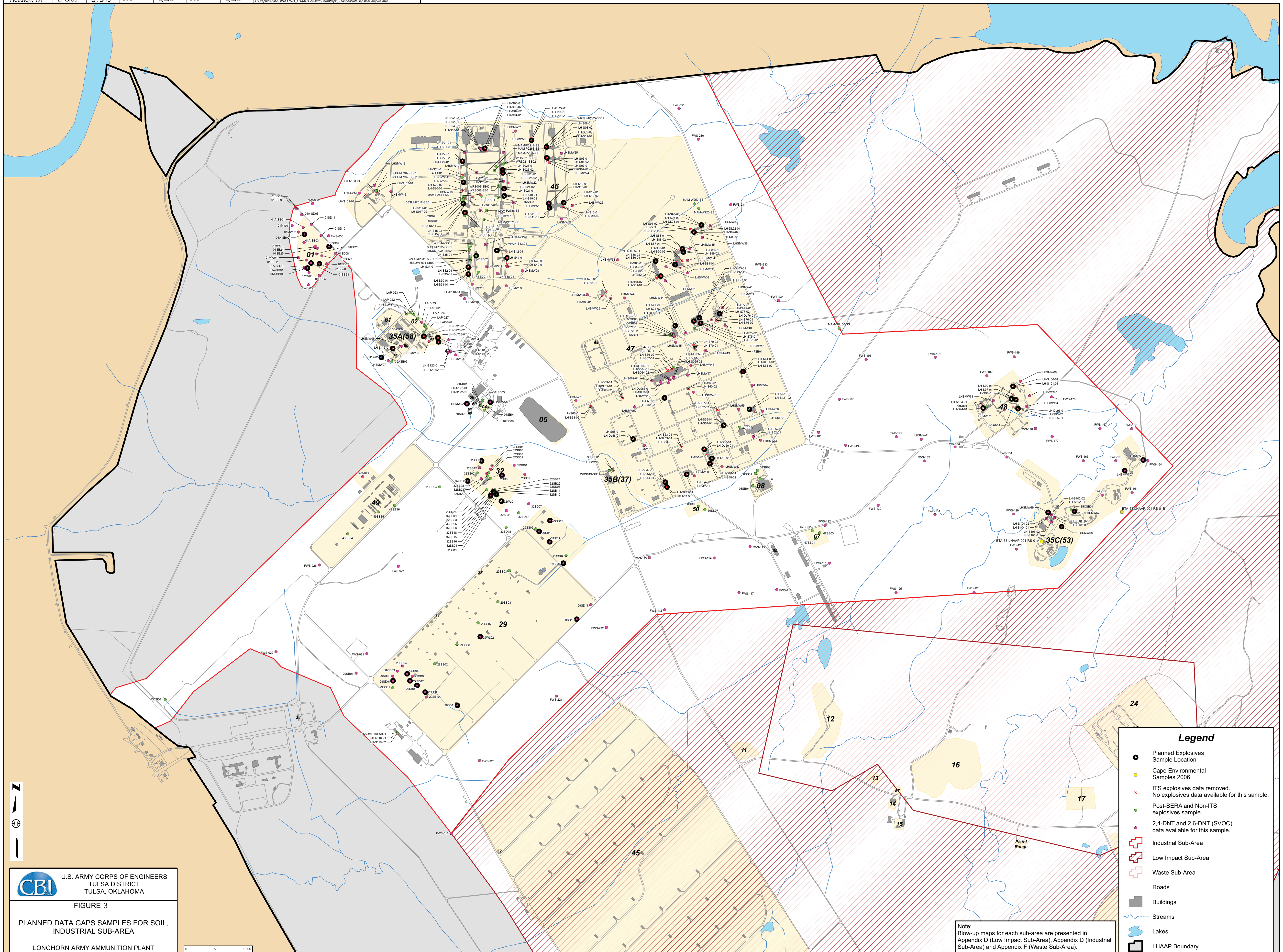


OFFICE	DRAWN BY		CHECKED BY		APPROVED BY		FILE PATH
Houston, TX	B. Grod	5/15/13	- - -	--/--/--	- - -	--/--/--	T:\Graphics\GIM\GIS\117591_LHAAP\Doc\Mxd\Bera\Wkpln_PlannedDataGapsLisaSamples.mxd



00188132

OFFICE	DRAWN BY		CHECKED BY		APPROVED BY		FILE PATH
Houston, TX	B. Grod	5/15/13	- - -	--/--/--	- - -	--/--/--	T:\Graphics\GIM\GIS\117591_LHAAP\Doc\Mxd\Bera\Wkpln_PlannedDataGapsIsaSamples.mxd



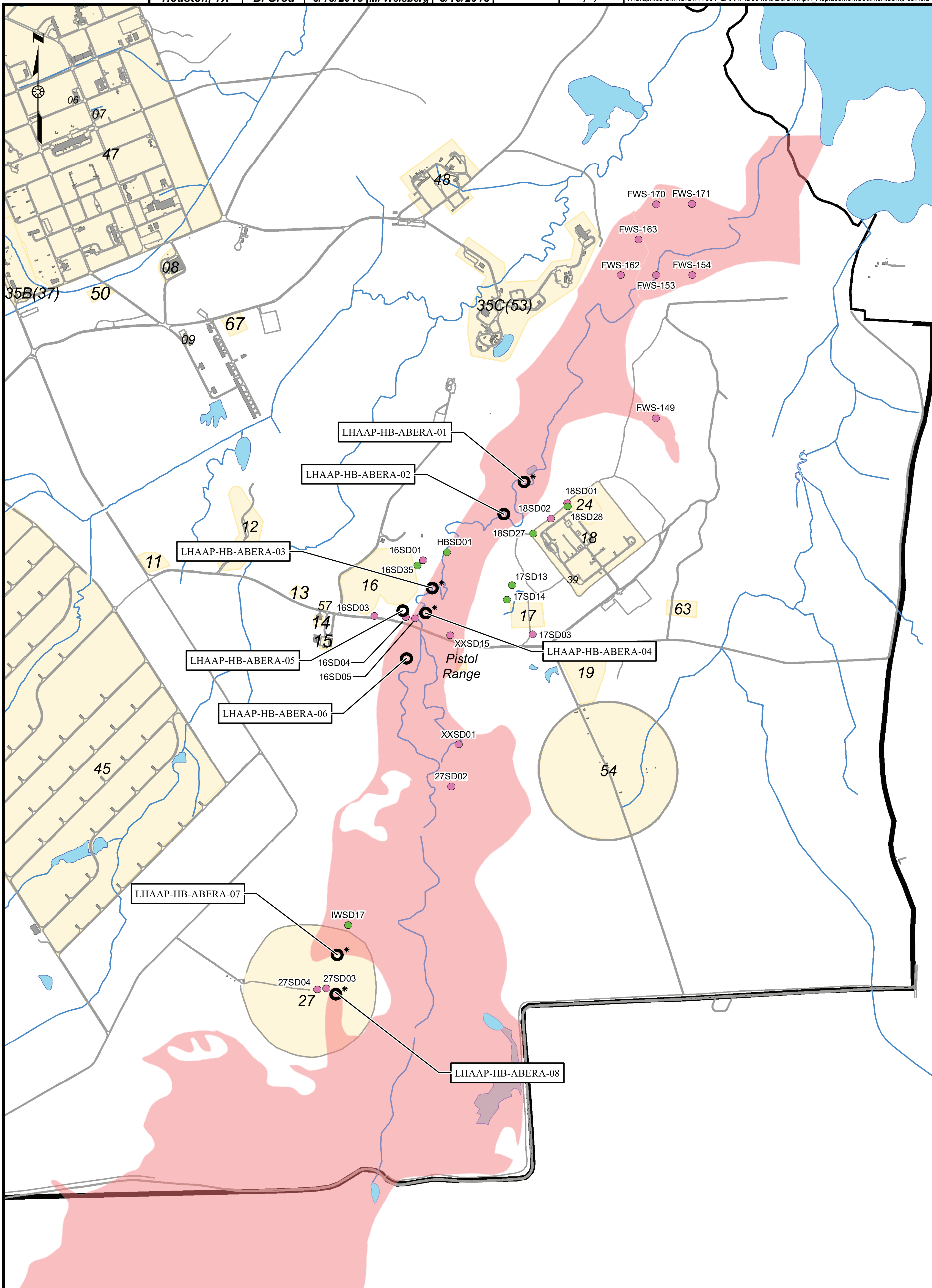
U.S. ARMY CORPS OF ENGINEERS
TULSA DISTRICT
TULSA, OKLAHOMA

FIGURE 3

PLANNED DATA GAPS SAMPLES FOR SOIL, INDUSTRIAL SUB-AREA

LONGHORN ARMY AMMUNITION PLANT
KARNACK, TEXAS

OFFICE	DRAWN BY		CHECKED BY		APPROVED BY		FILE PATH
Houston, TX	B. Grod	5/16/2013	M. Weisberg	5/16/2013	---	--/--/--	T:\Graphics\GIM\GIS\117591_LHAAP\Doc\Mxd\Bera\Wkpln_ReplacementSedimentSamples.mxd



LEGEND

- Planned Explosives Sediment Sample Location
- Planned Explosives Surface Water Sample Location (if water present)
- Post-BERA and Non-ITS explosives Sample
- 2,4-DNT and 2,6-DNT (SVOC) data available for this sample
- Watershed
- Roads
- Buildings
- Streams
- Lakes
- LHAAP Boundary

0 650 1,300 2,600 Feet

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

FIGURE 4

PLANNED REPLACEMENT SEDIMENT AND SURFACE WATER SAMPLES IN THE HARRISON BAYOU WATERSHED

LONGHORN ARMY AMMUNITION PLANT
KARNACK, TEXAS

Worksheets #19 & #30: Sample Containers, Preservation, and Hold Times

Laboratory: Microbac Laboratories Inc.
158 Starlite Drive
Marietta, OH 45750
1-800-373-4071
PM: Stephanie Mossburg

Certifications: DOD ELAP, TCEQ

Sample Delivery Method: Shipped by Federal Express

Matrix	Analyte/ Analyte Group	Method/ SOP	Accreditation Expiration Date	Container	Minimum Sample Volume or Weight	Preservation	Preparation Holding Time	Analytical Holding Time
Soil	Nitroaromatics and Nitramines by HPLC	SW-846 Method 8330A Microbac SOP #L-1	DOD ELAP 12/31/2013 TCEQ 3/31/2013	4 ounce Glass Amber with Teflon-lined cap	4 ounce Glass Amber with Teflon-lined cap	Cool to 4 ± 2°C	14 days	40 days
Sediment	Nitroaromatics and Nitramines by HPLC	SW-846 Method 8330A Microbac SOP #L-1	DOD ELAP 12/31/2013 TCEQ 3/31/2013	4 ounce Glass Amber with Teflon-lined cap	4 ounce Glass Amber with Teflon-lined cap	Cool to 4 ± 2°C	14 days	40 days
Water	Nitroaromatics and Nitramines HPLC	SW-846 Method 8330A Microbac SOP #L-1	DOD ELAP 12/31/2013 TCEQ 3/31/2013	2 1 Liter Amber	1 Liter	Cool to 4 ± 2°C	14 days	40 days

°C degrees Celsius
DOD ELAP Department of Defense Environmental Laboratory Accreditation Program
HPLC High Performance Liquid Chromatography
PM Project Manager
SOP standard operating procedure
TCEQ Texas Commission on Environmental Quality

Worksheet #20: Field QC Summary

Worksheet #20 summarizes the field QC samples that will be collected for the LHAAP project (SOP LHAAP-F-6). The following field QC samples will be collected and submitted for the LHAAP project.

- Field duplicates will be collected at a frequency of one per every 20 environmental samples for each analyte and matrix.
- Matrix spike (MS) and matrix spike duplicate (MSD) samples will be collected at a frequency of one per every 20 environmental samples for each analyte and matrix.
- Equipment rinsate blank samples will be collected at a rate of 5 percent for each analyte for soil and sediment samples.
- Temperature blanks will be submitted with every cooler containing analytical samples.

Soil and sediment samples will be collected using non-disposable sampling equipment. The following table presents a summary of the field QC samples.

Table 9. Field QC Summary

Matrix	Analyte/Analytical Group	Field Samples (Estimated)	Field Duplicates (Estimated	Matrix Spikes/Matrix Spike Duplicates (Estimated)	Equipment Rinsate Blanks (Estimated)	Total # Analyses (Estimated)
Soil	Nitroaromatics and Nitramines by HPLC	198	10	10	10	238
Sediment	Nitroaromatics and Nitramines by HPLC	8	1	1	1	12
Surface Water	Nitroaromatics and Nitramines by HPLC	5	1	1	0	8

HPLC High Performance Liquid Chromatography
QC quality control

Field Duplicate Samples

A field duplicate is a generic term for two or more field samples collected at the same time in the same location. Field duplicate samples are submitted to the laboratory labeled as "DUP" and are taken through all steps of the analytical preparation and analysis process in an identical manner. These samples are used to assess precision of the entire data collection activity, including sampling, analysis, and site heterogeneity.

Matrix Spike/Matrix Spike Duplicate Samples

The MS is used to assess the performance of the method as applied to a particular matrix. MS and MSD samples are aliquots of samples spiked with known amounts of all target analytes. The spiking occurs in the laboratory prior to sample preparation and analysis. The spiking level should be greater than the lowest concentration standard used for calibration and less than or equal to the midpoint of the linear calibration range.

Equipment Rinsate Blanks

An equipment rinsate blank (i.e, decontamination rinsate or equipment rinsate) sample consists of a sample of analyte-free or distilled source water poured over or through decontaminated field sampling equipment that is considered ready to collect or process an additional sample. Equipment rinsate blanks are to be collected from non-dedicated sampling equipment to assess the adequacy of the decontamination process.

To collect an equipment rinsate blank sample, pump or pour the source water over and/or through the decontaminated sampling equipment. Collect this runoff water into the sample containers directly or with the use of a funnel, if necessary. The source water may be poured by use of an electric or hand submersible pump, by tipping the jug of water upside down, or by use of a stopcock and gravity. Results of equipment rinsate blank samples are used to evaluate whether equipment decontamination was effective.

When disposable or dedicated sampling equipment is used, equipment rinsate blank samples do not need to be collected.

Temperature Blanks

A temperature blank is a container of water that is packed and shipped to the laboratory with the field samples which require a cooling preservation not to exceed 6 degrees Celsius (C). Upon arrival of a cooler at the laboratory, the laboratory measures the temperature of the temperature blank. The temperature reading is used to represent the conditions of the field samples during shipment to the laboratory. This information is used by both the laboratory and by the data reviewer. If the temperature blank exceeds the criteria of less than 2 or greater than 6 degrees C (4 plus or minus 2 degrees C), then the laboratory must notify the Project Chemist immediately for guidance.

Worksheet #21: Field SOPs

The following is a list of field SOPs which will be used on the LHAAP project. The field SOPs can be found in Appendix C of the QAPP.

SOP Number	Title and Revision Date	Originating Organization	Equipment Type	Modified for Project Work? (Yes/No)	Description
LHAAP-F-1	Field Documentation	AGEISS	See SOP for specific equipment needs	Yes	This document establishes procedures for preparing, maintaining, and archiving field documentation.
LHAAP-F-2	Field Equipment Calibration and Maintenance	AGEISS	See SOP for specific equipment needs	Yes	This document establishes procedures for conducting field equipment calibration, calibration verification, and maintenance.
LHAAP-F-3	Soil Sampling	AGEISS	See SOP for specific equipment needs	Yes	This document establishes procedures for soil sampling.
LHAAP-F-4	Sediment Sampling	AGEISS	See SOP for specific equipment needs	Yes	This document establishes procedures for sediment sampling
LHAAP-F-5	Surface Water Sampling	AGEISS	See SOP for specific equipment needs	Yes	This document establishes procedures for surface water sampling
LHAAP-F-6	Field Quality Control Samples	AGEISS	See SOP for specific equipment needs	Yes	This document establishes procedures for field quality control sample collection.
LHAAP-F-7	Sample Handling, Labeling, Packaging, and Custody	AGEISS	See SOP for specific equipment needs	Yes	This document establishes procedures for sample handling, labeling, packaging, and custody.
LHAAP-F-8	Field Equipment Cleaning and Decontamination	AGEISS	See SOP for specific equipment needs	Yes	This document establishes procedures for field equipment cleaning and decontamination.
LHAAP-F-9	Global Positioning System Measurements	AGEISS	See SOP for specific equipment needs	Yes	This document establishes procedures for conducting global positioning system measurements.

Worksheet #22: Field Equipment Calibration, Maintenance, Testing, and Inspection

This worksheet provides information for calibration, maintenance, testing and inspection of field equipment.

Field Equipment	Activity	SOP Reference	Title or Position of Responsible Person	Frequency	Acceptance Criteria	Corrective Action
PID	Daily Calibration Checks	LHAAP-F-2	Field Operations Leader	Checked at the start of each day	See manufacturer's manual	Replace with new PID
Water Quality Meters	Daily Calibration Checks	LHAAP-F-2	Field Operations Leader	Checked at the start of each day	See manufacturer's manual	Replace with new meter or probe

PID photoionization detector
SOP standard operating procedure

Worksheet #23: Analytical SOPs

The following is a list of analytical methods and SOPs which will be utilized by Microbac Laboratory on the LHAAP project. The analytical SOPs can be found in Appendix D of the QAPP.

SOP Reference Number	Title, Revision Date, and/or Number	Definitive or Screening Data	Analytical Group	Instrument	Organization Performing Analysis	Modified for Project Work? (Yes/No)
L-1	Standard Operating Procedure Nitroaromatics and Nitramines by High Performance Liquid Chromatography Method 8330A, Rev. 16, 09/15/2012, Microbac SOP# HPLC02	Definitive	Nitroaromatics and Nitramines	HPLC	Microbac Laboratories, Inc. 158 Starlite Drive Marietta, OH 45750	No

HPLC High Performance Liquid Chromatography
SOP standard operating procedure

Worksheet #26 & 27: Sample Handling, Custody, and Disposal

Sampling Organizations: AGEISS and CB&I (AGEISS Team)

Laboratory: Microbac Laboratories Inc.
158 Starlite Drive
Marietta, OH 45750
1-800-373-4071
PM: Stephanie Mossburg

Sample Delivery Method: Shipped by Federal Express

Number of days from reporting until sample disposal: 60 days

Activity	Organization and Title or Position of Person Responsible for the Activity	Standard Operating Procedure Reference
Sample labeling	AGEISS Team	LHAAP-F-7
Chain-of-custody form completion	AGEISS Team	LHAAP-F-7
Packaging	AGEISS Team	LHAAP-F-7
Shipping coordination	AGEISS Team AGEISS Project Chemist	LHAAP-F-7
Sample receipt, inspection, & log-in	Sample custodian and analyst Microbac Laboratory	LHAAP-F-7 and per laboratory sample receipt procedure
Sample custody and storage	Sample custodian and analyst Microbac Laboratory	LHAAP-F-7 and per laboratory sample custody and storage procedures
Sample disposal	Sample custodian and analyst Microbac Laboratory	LHAAP-F-7 and per laboratory sample disposal procedure

Worksheet #28: Analytical Quality Control and Corrective Action

The purpose of this worksheet is to ensure that the selected analytical methods are capable of meeting project-specific Measurement Performance Criteria (Worksheets #12-1, #12-2, and #12-3) which are based on PQOs/DQOs.

Worksheet #28-1: Quality Control Samples – Nitroaromatics and Nitramines in Soil

Matrix	Soil	**Analytical Method/ Lab SOP Reference**	SW-846 8330A L-1 Method 8330	**No. of Sample Locations**	See Worksheet #18	
Analytical Group	Nitroaromatics and Nitramines	**Sampler's Name**	To Be Determined			
Concentration Level	All	**Field Sampling Organization**	AGEISS Team			
SOP	See Worksheet #21	**Analytical Organization**	Microbac Laboratories			
QC Sample	**Frequency/Number(1)**	**Method/SOP QC Acceptance Limits**	**Corrective Action**	**Person(s) Responsible for Corrective Action**	**Data Quality Indicator**	**Measurement Performance Criteria**
Field duplicate	One per 20 field samples of similar matrix	See Worksheet #12-1	Qualify data as needed	Data Validator	Precision – Overall	See Worksheet #12-1
Surrogates	Three per sample	See QAPP, Appendix A Table A-1	Reanalyze sample	Lab personnel	Accuracy/bias	See Worksheet #12-1
Method blanks	One per analytical batch	See Worksheet #12-1	Qualify data as needed or reanalyze batch	Lab personnel and/or Data Validator	Accuracy/bias contamination	See Worksheet #12-1
Equipment rinsate blanks	One per 20 field samples	See Worksheet #12-1	Qualify data as needed	Data Validator	Accuracy/bias contamination	See Worksheet #12-1
Laboratory control sample	One per batch	See QAPP, Appendix A Table A-1	Qualify data as needed or reanalyze batch	Lab personnel	Precision	See Worksheet #12-1
Matrix Spike/Matrix Spike Duplicate	One per batch	See QAPP, Appendix A Table A-1	Qualify data as needed	Lab and/or Data Validator	Precision	See Worksheet #12-1

(1) An analytical batch is defined as no more than 20 analytical samples.
QC quality control
SOP standard operating procedure

Worksheet #28-2: Quality Control Samples – Nitroaromatics and Nitramines in Sediments

Matrix	Sediment	**Analytical Method/ Lab SOP Reference**	SW-846 8330A L-1 Method 8330	**No. of Sample Locations**	See Worksheet #18	
Analytical Group	Nitroaromatics and Nitramines	**Sampler's Name**	To Be Determined			
Concentration Level	All	**Field Sampling Organization**	AGEISS Team			
SOP	See Worksheet #21	**Analytical Organization**	Microbac Laboratories			
QC Sample	**Frequency/Number(1)**	**Method/SOP QC Acceptance Limits**	**Corrective Action**	**Person(s) Responsible for Corrective Action**	**Data Quality Indicator**	**Measurement Performance Criteria**
Field duplicate	One per 20 field samples of similar matrix	See Worksheet #12-2	Qualify data as needed	Data Validator	Precision – Overall	See Worksheet #12-2
Surrogates	Three per sample	See QAPP, Appendix A Table A-2	Reanalyze sample	Lab personnel	Accuracy/bias	See Worksheet #12-2
Method blanks	One per analytical batch	See Worksheet #12-2	Qualify data as needed or reanalyze batch	Lab personnel and/or Data Validator	Accuracy/bias contamination	See Worksheet #12-2
Equipment rinsate blanks	One per 20 field samples	See Worksheet #12-2	Qualify data as needed	Data Validator	Accuracy/bias contamination	See Worksheet #12-2
Laboratory control sample	One per batch	See QAPP, Appendix A Table A-2	Qualify data as needed or reanalyze batch	Lab personnel	Precision	See Worksheet #12-2
Matrix Spike/Matrix Spike Duplicate	One per batch	See QAPP, Appendix A Table A-2	Qualify data as needed	Lab and/or Data Validator	Precision	See Worksheet #12-2

(1) An analytical batch is defined as no more than 20 analytical samples.
QC quality control
SOP standard operating procedure

Worksheet #28-3: Quality Control Samples – Nitroaromatics and Nitramines in Water

Matrix	Water	**Analytical Method/ Lab SOP Reference**	SW-846 8330A L-1 Method 8330	**No. of Sample Locations**	See Worksheet #18
Analytical Group	Nitroaromatics and Nitramines	**Sampler's Name**	To Be Determined		
Concentration Level	All	**Field Sampling Organization**	AGEISS Team		
SOP	See Worksheet #21	**Analytical Organization**	Microbac Laboratories		

QC Sample	Frequency/Number(1)	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator	Measurement Performance Criteria
Field duplicate	One per 20 field samples of similar matrix	See Worksheet #12-3	Qualify data as needed	Data Validator	Precision – Overall	See Worksheet #12-3
Surrogates	Three per sample	See QAPP, Appendix A Table A-3	Reanalyze sample	Lab personnel	Accuracy/bias	See Worksheet #12-3
Method blanks	One per analytical batch	See Worksheet #12-3	Qualify data as needed or reanalyze batch	Lab personnel and/or Data Validator	Accuracy/bias contamination	See Worksheet #12-3
Laboratory control sample	One per batch	See QAPP, Appendix A Table A-3	Qualify data as needed or reanalyze batch	Lab personnel	Precision	See Worksheet #12-3
Matrix Spike/Matrix Spike Duplicate	One per batch	See QAPP, Appendix A Table A-3	Qualify data as needed	Lab and/or Data Validator	Precision	See Worksheet #12-3

(1) An analytical batch is defined as no more than 20 analytical samples.
QC quality control
SOP standard operating procedure

Worksheet #34: Data Verification and Validation Inputs

This worksheet provides verification and validation inputs for planning documents/records, field records, and analytical data packages.

Description		Level III Verification (Completeness)	Level IV Validation (Conformance to Specifications)
Planning Documents/Records			
1	Approved QAPP	**X**	
2	Contract	**X**	
3	Field SOPs	**X**	
4	Laboratory certifications, SOPs, and reporting limits	**X**	**X**
5	Statement(s) of work	**X**	
Field Records			
1	Field logbooks	**X**	**X**
2	Field instrument calibration records	**X**	**X**
3	Chain-of-custody forms and custody seals	**X**	**X**
4	Sampling diagrams/surveys	**X**	**X**
5	Soil sampling form	**X**	**X**
6	Sediment sampling form	**X**	**X**
7	Surface water sampling form	**X**	**X**
8	Relevant correspondence	**X**	**X**
9	Change orders/deviations	**X**	**X**
10	Field corrective action reports	**X**	**X**
Analytical Data Package			
1	Cover sheet (laboratory identifying information)	**X**	**X**
2	Case narrative	**X**	**X**
3	Internal laboratory chain-of-custody	**X**	**X**
4	Sample receipt records for each cooler	**X**	**X**
5	Sample chronology (i.e. dates and times of receipt, preparation, & analysis)	**X**	**X**
6	Communication records	**X**	**X**
7	DL, LOD and LOQ establishment, verification, and reporting	**X**	**X**
8	Standards traceability	**X**	**X**
9	Initial and continuing calibration records	**X**	**X**
10	Definition of laboratory qualifiers	**X**	**X**

Description		Level III Verification (Completeness)	Level IV Validation (Conformance to Specifications)
11	Results reporting forms	**X**	**X**
12	Laboratory QC sample results	**X**	**X**
13	Field sample and field QC sample results	**X**	**X**
14	Documentation of data quality issues and their resolution, including corrective action reports	**X**	**X**
15	Raw data	**X**	**X**
16	Electronic data deliverable	**X**	**X**

DL detection limit
LOD limit of detection
LOQ limit of quantitation
QAPP Quality Assurance Project Plan
QC quality control
SOP standard operating procedure

Worksheet #35: Data Verification Procedures

This worksheet provides data verification procedures including a description of the verification process and the responsible person.

Records Reviewed	Requirement Documents	Process Description	Responsible Person, Organization
Field logbook	• UFP-QAPP • SOP LHAAP-F-1	Verify that records are present and complete for each day of field activities. Verify that all planned samples including field QC samples were collected and that sample collection locations are documented. Verify that meteorological data were provided for each day of field activities. Verify that changes/exceptions are documented and were reported in accordance with requirements. Verify that any required field monitoring was performed and results are documented.	Daily — AGEISS Field Operations Leader Jennifer Loos At conclusion of field activities — AGEISS Field Operations Leader Jennifer Loos
Chain-of-custody forms	• UFP-QAPP • SOP LHAAP-F-1 • SOP LHAAP-F-7	Verify the completeness of COC records. Examine entries for consistency with the field logbook. Check that appropriate methods and sample preservation have been recorded. Verify that the required volume of sample has been collected and that sufficient sample volume is available for QC samples (e.g., MS/MSD). Verify that all required signatures and dates are present. Check for transcription errors.	Daily — AGEISS Field Operations Leader Jennifer Loos At conclusion of field activities — AGEISS Project Chemist Gloria Beilke
Laboratory deliverable	UFP-QAPP	Verify that the laboratory deliverable contains all records specified in the QAPP. Check sample receipt records to ensure sample condition upon receipt was noted, and any missing/broken sample containers were noted and reported according to plan. Compare the data package with the COCs to verify that results were provided for all collected samples. Review the narrative to ensure all QC exceptions are described. Check for evidence that any required notifications were provided to project personnel as specified in the QAPP. Verify that necessary signatures and dates are present.	Before release — Microbac Laboratory Project Manager Upon receipt – AGEISS Project Chemist Gloria Beilke
Audit reports, corrective action reports	UFP-QAPP	Examine audit reports. For any deficiencies noted, verify that corrective action was implemented according to plan.	AGEISS QC Manager – Leroy Shaser

COC chain-of-custody
MS/MSD matrix spike/matrix spike duplicate
QC quality control
SOP standard operating procedure
UFP-QAPP Uniform Federal Policy for Quality Assurance Project Plan

Worksheet #36: Data Validation Procedures

The following data validation procedures will be performed by the CB&I Project Chemist.

Analytical Group/Method:	Nitroaromatics and Nitramines by High Performance Liquid Chromatography by SW-846 Method 8330A
Data deliverable requirements:	ERPIMS compatible format
Analytical specifications:	QAPP, Appendix A Table A-1 through Table A-3 QAPP, Appendix B Table B-1 through Table B-3
Measurement performance criteria:	QAPP, Appendix A Table A-1 through Table A-3
Percent of data packages to be validated:	10% Level IV Data Validation 100% Level III Data Review (Investigative Derived Waste characterization samples excepted)
Percent of raw data reviewed:	100% of laboratory data
Percent of results to be recalculated:	10% of laboratory data
Validation procedure:	USEPA National Functional Guidelines
Validation code:	S4VM - Stage 4 Validation Manual
Electronic validation program/version:	Not Applicable
Validation qualifiers:	U, UJ, R or J

ERPIMS Environmental Restoration Program Information Management System
J Estimated
R Rejected
U Not detected
UJ Not detected, result is estimated
USEPA United States Environmental Protection Agency

Worksheet #37: Data Usability Assessment

This worksheet describes the procedures, methods, or activities that will be used to determine whether data are of the right type, quality, and quantity to support environmental decision-making for the project. The usability assessment report identifies all of the procedures, interim steps, and an assessment of the data inputs to verify the adequacy of the data and whether the resulting data meet the PQOs as outlined in Worksheet #11.

The following personnel (organization and position/title) are responsible for participating in the data usability assessment:

- ♦ AGEISS TO Manager
- ♦ AGEISS QC Manager
- ♦ AGEISS and CB&I Risk Assessor
- ♦ AGEISS Geologist/Hydrogeologist
- ♦ CB&I Project Chemist
- ♦ AGEISS Project Chemist
- ♦ AGEISS Field Operations Leader

A Data Validation Summary Report (DVSR), which includes a section regarding data usability will be completed by the AGEISS Project Chemist. The information contained in the document will discuss the usability of the data based upon the overall quality in relation to the verification and validation process. The data will be evaluated using the parameters of precision, accuracy, representativeness, completeness, comparability, sensitivity, and bias. Qualified data and the impacts of the qualifications will also be discussed in the DVSR.

- ♦ **Precision**: Results of all duplicates (lab or field) (relative percent difference [RPD]) will be calculated for each analysis. For each duplicated pair, its RPD will be compared to its method and matrix performance acceptance criteria. All data outside the criteria will be flagged appropriately.
- ♦ **Accuracy/Bias**: Blanks (rinsate, field, lab method, etc.) will be evaluated to determine the impact on the associated sample. Data results will be flagged appropriately.
- ♦ **Overall Accuracy**: Control standards and spiked samples will be compared to the method-specific criteria. Associated data will be flagged appropriately.
- ♦ **Sensitivity**: The test methods used meet the required reporting limits.
- ♦ **Comparability**: Assessed by evaluation of laboratory reported detection limits, sample dilution factors, and the overall performance of the designated methods.
- ♦ **Representativeness**: Sample representativeness will be assessed through the evaluation of the field sampling activities and QC sample data and field duplicate precision checks.

- **Completeness**: For each analyte, completeness will be calculated as the number of data points for each analyte that meet the measurement performance criteria for precision, accuracy, and sensitivity divided by the total number of data points. Note: The completeness evaluation will include "lost" (broken sample containers, lost extracts, etc) in the completeness calculation.

The following tables summarize the data usability assessment process that will be used to analyze the data by the AGEISS and CB&I Project Chemists and definitions for the data usability qualifiers.

Table 10. Data Usability Assessment Process

Process Step	Action
Step #1: Review the project's objectives and sampling design	The project DQOs and measurement performance criteria will be reviewed to ensure they support the project objectives and determine if the CSM needs to be revised based upon the most current site data.
Step #2: Review the data verification and data validation outputs	The applicable members of the project team will prepare and/or review project QA/QC reports. Summarized data will be evaluated for patterns, trends, and anomalies not consistent with past observations or the CSM. Deviations from planned activities will be reviewed (e.g., number and locations of samples, holding time exceedances, damaged samples, and standard operating procedure deviations) and their effects on the data usability will be determined.
Step #3: Document data usability and draw conclusions	Data usability recommendations and limitations will be provided in data validation reports. Data collected that are not qualified as rejected will be used to address data gaps.

CSM Conceptual Site Model
DQO data quality objective
QA/QC quality assurance/quality control

Table 11. Data Usability Qualifier Definitions

Qualifier	Definition
U	Not detected: Analysis for the analyte was performed, but the analyte was not detected above the level of the associated value. The associated value is the SDL.
J	Estimated: The analyte was detected and identified. The associated numerical value is the approximate concentration of the analyte in the sample.
UJ	Not detected, SDL is estimated: The analyte was not detected above the reported SDL. Value of the SDL is estimated and may be inaccurate.
R	Rejected: The data are unusable.

SDL sample detection limit

This page is intentionally left blank.

APPENDIX C

Accident Prevention Plan

This page is intentionally left blank.

Appendix C
Accident Prevention Plan

This page is intentionally left blank.

00188158

DRAFT FINAL

BASELINE ECOLOGICAL RISK ASSESSMENT ADDENDUM LONGHORN ARMY AMMUNITION PLANT, KARNACK, TEXAS

ACCIDENT PREVENTION PLAN

Contract No. W912BV-10-D-2010

Task Order 0004

PREPARED FOR:

U.S. Army Corps of Engineers, Tulsa District
1645 South 101 East Avenue
Tulsa, OK 74128

PREPARED BY:

AGEISS Inc.
1202 Bergen Parkway, Suite 310
Evergreen, CO 80439

September 2013
Revision 0

This page is intentionally left blank.

TABLE OF CONTENTS

Section **Page**

LIST OF TABLES

Table **Page**

LIST OF ATTACHMENTS

This page is intentionally left blank.

AGEISS Inc.

ACCIDENT PREVENTION PLAN ACKNOWLEDGEMENT

September 2013

This General Accident Prevention Plan is generated to ensure AGEISS employees, associated government personnel, contractors, and customers and equipment/missions are protected. Through the implementation of this plan and any site-specific plans, employees are provided operating procedures to protect themselves and equipment/missions; processes to obtain necessary safety training and report hazardous conditions; and information concerning their rights and responsibilities relative to AGEISS' occupational safety and health program.

____

AGEISS Project Manager

____

AGEISS Program Manager

____

AGEISS Safety and Health Coordinator

____

CB&I Project Manager

____

Tulsa District, USACE Contracting Officer's Representative

____

Tulsa District, USACE Contracting Officer's Technical Representative

This page is intentionally left blank.

ABBREVIATION / ACRONYM LIST

AGEISS	AGEISS Inc.
AHA	Activity Hazard Analysis
APP	Accident Prevention Plan
ATSDR	Agency for Toxic Substances and Disease Registry
BERA	Baseline ecological risk assessment
CB&I	Chicago Bridge and Iron
CO	Contracting Officer
COR	Contracting Officer’s Representative
COTR	Contracting Officer’s Technical Representative
CPR	Cardiopulmonary Resuscitation
DACR	Days Away Case Rate
DART	Days Away plus Restricted Duty plus Job Transfer Rate
FFA	Federal Facilities Agreement
ITS	Intertek Testing Services
LHAAP	Longhorn Army Ammunition Plant
MEC	munitions and explosives of concern
MVA	motor vehicle accident
OSHA	Occupational Safety and Health Administration
QA	quality assurance
RCRA	Resource Conservation and Recovery Act
S&H	safety and health
Shaw	Shaw Environmental & Infrastructure Group
SHO	Safety and Health Officer
SHP	Safety and Health Plan
SOP	standard operating procedure
SSHO	Site Safety and Health Officer
TCEQ	Texas Commission on Environmental Quality
TNT	trinitrotoluene
TRIR	Total Recordable Injury Rate
USACE	U.S. Army Corps of Engineers
USEPA	U.S. Environmental Protection Agency
USFWS	U.S. Fish and Wildlife Service

This page is intentionally left blank.

1.0 BACKGROUND INFORMATION

Currently inactive, Longhorn Army Ammunition Plant (LHAAP) was an 8,493-acre government-owned, contractor-operated facility in Karnack, TX that was established in 1942. The Monsanto Chemical Company selected the site in December 1941 to produce trinitrotoluene (TNT). The plant produced 393,000,000 pounds of TNT throughout World War II. After the signing of the Intermediate-Range Nuclear Forces Treaty on December 8, 1987, LHAAP was operated by Thiokol and used to destroy Pershing IA and II missiles.

LHAAP was proposed for the National Priorities List on July 14, 1989 due to metals and explosives contamination. The installation was placed on the final National Priorities List on August 30, 1990. The U.S. Environmental Protection Agency (USEPA) Region 6, the Texas Water Commission (now Texas Commission on Environmental Quality [TCEQ]), and the Army signed a Federal Facilities Agreement (FFA) on December 30, 1991. LHAAP applied for a Resource Conservation and Recovery Act (RCRA) Part A Permit; a RCRA Part B Permit was signed February 1992 (TNRCC Permit No. HW-50195); however, this permit has since expired.

LHAAP became inactive and excess to the Army’s needs in July 1997. Between 1998 and 2000, the Army liquidated all personal property and specific installed property. In 1999, the Army demolished several structurally unsafe buildings. A Memorandum of Agreement between the Army and U.S. Fish and Wildlife Service (USFWS) was signed on October 21, 2000 designating an area consisting of approximately 7,200 acres for establishment of a wildlife refuge at LHAAP. LHAAP was administratively transferred to the Base Realignment and Closure Division in October 2002.

1.1 Project Objectives

The project objective is to complete the on-going Baseline Ecological Risk Assessment (BERA) for LHAAP. To complete the BERA, AGEISS Inc. (AGEISS) and Chicago Bridge and Iron (CB&I) (formerly Shaw Environmental & Infrastructure Group [Shaw]), referred to as the AGEISS Team, will prepare for and conduct sampling to fill the data gaps resulting from the loss of rejected Intertek Testing Services (ITS) explosives data. The data gaps are identified and rationale for sample collection are explained in detail in the *Data Gap Memorandum for Explosives in Soil at the Longhorn Army Ammunition Plant, Karnack, TX* (AGEISS/CB&I 2013) and the *Data Gap Memorandum for Explosives in Sediment and Surface Water at the Longhorn Army Ammunition Plant, Karnack, TX* (AGEISS/CB&I 2013). The AGEISS Team will meet the project objectives by preparing a BERA Addendum in compliance with the FFA.

1.2 Purpose of the Accident Prevention Plan

On behalf of the U.S. Army Corps of Engineers (USACE), Tulsa District, AGEISS has prepared this Accident Prevention Plan (APP), Safety and Health Plan (SHP), and Activity Hazards Analysis (AHA) to address sampling activities to be performed at selected areas at LHAAP, Karnack, TX under AGEISS Contract Number W912BV-10-D-2010 outlined in the *Data Gap Memorandum for Explosives in Soil at the Longhorn Army Ammunition Plant, Karnack, TX* (AGEISS/CB&I 2013) and the *Data Gap Memorandum for Explosives In Sediment and Surface Water at the Longhorn Army Ammunition Plant, Karnack, TX* (AGEISS/CB&I 2013). Work will involve collecting approximately 200 soil, sediment, and surface water samples within the limits of the project areas. While conducting these activities, there is a remote possibility that personnel may come in contact with soils, sediments, and surface water which may potentially contain hazardous materials. To ensure that no direct contact with potentially contaminated materials occurs by AGEISS Team personnel, the SHP, AHA, and HAZCOM Plan were developed (Attachments 1, 2, and 4).

This project includes collection of soil, sediment, and surface water samples; it does not involve containment or cleanup of an uncontrolled hazardous waste site as per 29 CFR 1910.120. Control measures identified in the APP, SHP, and AHA include employee decontamination of tools and equipment and use of personal protective equipment (PPE). These measures will minimize potential for employee exposure. Munitions and explosives of concern (MEC) were addressed during the project planning session on August 23, 2012 (see the *Baseline Ecological Risk Assessment Addendum Longhorn Army Ammunition Plant, Karnack, Texas, Uniform Federal Policy for Quality Assurance Project Plan* [UFP-QAPP], [AGEISS 2013]). The Army reported that MEC is not expected to be present at the work sites. Therefore, there is minimal reasonable possibility for employee exposure to health hazards given the following:

- This is not an uncontrolled hazardous waste site as described in 29 CFR 1910.120
- The analytical results of previous soil, sediment, and surface water samples taken from the proposed work sites
- The type of work being conducted
- All protective measures found in the APP, SHP, and AHA are emplaced
- The precautions taken during sampling activities to protect human health and the environment

This APP is designed to ensure the following:

- AGEISS Team Site personnel are not adversely exposed to the compounds of concern as well as the physical and biological hazards present.
- AGEISS Team's operations, procedures, and equipment will meet the requirements of 29 CFR 1910.120, Hazardous Waste Operations and Emergency Response, the applicable subparts of 29 CFR 1926 and 29 CFR 1910, and USACE Manual, EM 385-1-1, Safety and Health Requirements Manual.

This APP is based on the USACE Engineering Manual 385-1-1 Safety and Health Requirements Manual, 29 CFR 1910, General Industry, and 29 CFR 1926, Construction.

2.0 SAFETY AND HEALTH POLICY

AGEISS is committed to ensuring the safety and health (S&H) of our employees, others potentially affected by our operations, and property belonging to us and to stakeholders. At AGEISS, we believe that no project is so important, urgent, or constrained by budget that we cannot follow necessary precautions to protect ourselves, and our employees, clients, and neighbors.

AGEISS employees are expected to demonstrate excellence and persistence in their daily work activities and safety is intrinsically incorporated into every operation, task, and procedure. AGEISS' definition of excellence includes implementation of safety measures in every task and avoidance of short cuts that can lead to accidents. A safe working environment is of primary importance to AGEISS; safety policies and risk assessments that provide the basis for a safe workplace are provided to our employees. AGEISS' Corporate S&H Program incorporates lessons-learned from our work-site experiences, employees, Corporate and industry best practices, and Occupational Safety and Health Administration (OSHA) updates. We encourage both clients and employees to comment and make suggestions so that we may improve AGEISS' S&H Program.

The purpose of AGEISS' S&H Program is to avoid accidents and injuries; comply with Federal, state, and any applicable local laws and regulations at our job sites; and enable communication of S&H information amongst our employees at our work-sites and with the Corporate S&H Manager.

AGEISS' S&H Program includes general and hazard-specific Safety Standard Operating Procedures (SOPs) for the work conducted at our various work site locations. The index to these Safety SOPs may be found in the AGEISS S&H Program Management and Administration SOP.

It is AGEISS' policy that all employees and subcontractors will read and then incorporate the AGEISS S&H Plan and SOPs into all tasks and operations. AGEISS employees will exemplify the characteristics of excellence, persistence, and concern for the welfare of themselves and others in compliance with the AGEISS S&H Program and OSHA regulations.

The AGEISS Team embraces the following in conducting business activities.

- Preventing accidents through the implementation of effective S&H-control policies, training, and practices integrated into day-to-day operations with employee commitment and the overall management of our business.
- Protecting the S&H of our employees takes precedence over productivity. This constitutes good business and prevents human suffering. Our people are our greatest asset.
- Work is not performed unless a designated competent person is present at the work site.
- Managers, team members, and/or employees are responsible for their safety and the safety of others in the workplace. Everyone is responsible for following S&H policies and procedures at all times.
- Managers will audit and review safety performance in the working environment and take corrective action to ensure compliance with company policies, goals, and objectives.
- Employees are trained to identify, evaluate, and control safety, health, and environmental hazards to protect themselves, others, and property. Working safely is a condition of employment.
- Employees are required to integrate safety, health, and environmental policies and procedures into their daily work practices and to communicate hazards and near misses to the Corporate Management. Each employee is responsible for recognizing potential hazards and near misses and ensuring the hazards are controlled or managed.

3.0 GOALS AND OBJECTIVES

The primary goal of the AGEISS Team APP is to provide and maintain a safe and healthy workplace free from mishaps. This goal can best be achieved by management responsibility for safety and employee involvement in our S&H program. All AGEISS Team employees will be trained in S&H procedures. Topics presented in this APP provide employees with basic knowledge of OSHA regulations and the AGEISS Team requirements pertaining to field operations. All employees are responsible for implementing the S&H program as it pertains to their specific work tasks and conduct of business under the AGEISS Team APP.

3.1 Annual Safety and Health Goals and Objectives

The primary goal of the AGEISS Team S&H Program is to encounter no incidents, injuries, or illnesses in the course of our work. AGEISS strives to provide and maintain a safe and healthy workplace free from mishaps for all employees. This goal can best be achieved through management responsibility for safety and employee involvement in our S&H Program. Hazard assessments are conducted and controls developed for each employee; which are then provided to our employee(s) and then each employee is trained in S&H procedures applicable to their respective work and location(s) prior to the performance of tasks. The employees' work areas and task performance is reviewed and reassessed where necessary; when improvements are made to the hazard assessment, the employee is then retrained. This results in the continuous improvement system that AGEISS requires of our S&H Program.

Specific S&H objectives for the AGEISS Team include:

- Providing all employees with basic knowledge of OSHA regulatory requirements and training in S&H practices and procedures based on their specific duties and the hazards they will encounter during normal operations
- Maintaining mishap and injury free operations
- Eliminating or controlling all identified hazards and potential exposures to hazards related to site-specific tasks
- Achieving and exceeding compliance with applicable OSHA S&H regulations
- Supporting and implementing annual safety, health and environmental goals and objectives established by AGEISS; and, incorporating our customers' goals and objectives where they would provide improvements to our S&H program

The benefits of achieving our objectives include:

- Maintaining a well-trained, healthy, and productive staff
- Creating optimal conditions for S&H in the workplace (in effect, reducing the number of employee injuries and disabilities)
- Reducing or minimizing damages or losses to company property and equipment
- Staying free of OSHA violations and fines for noncompliance

This APP represents a means to recognize, evaluate, and control potential workplace hazards associated with the AGEISS Team activities, and to comply with applicable Federal, State, and local regulations. The Plan shall be reviewed annually and revised, updated, or changed as necessary. New policies and procedures to the APP and SHP shall be distributed to the AGEISS Team. To track our performance on our S&H goals, the AGEISS Team applies the performance measurements for this worksite listed in Table 1.

Table 1. AGEISS S&H Performance Measurement

S&H Area	FY12 Actual	FY13 Goal	Method to Achieve Goal	Measure
OSHA Illnesses and Injuries	0	0	Compliance with the AGEISS Safety and Health Plan, EM385-1-1 requirements, training, development of site-specific Activity Hazards Analyses, and application of controls where hazards exist.	Number of OSHA Reportable Illnesses & Injuries
Safety Equipment	0	0	The operator inspects his equipment daily prior to use. Unserviceable equipment is removed from the workplace and replaced.	Number of reported safety equipment failures
Motor Vehicle Accident (MVA) (Preventable)	0	0	Employees are trained that AGEISS expects each employee to drive safely and defensively. Any MVA occurring on-duty is reviewed to determine the root cause.	Number of preventable MVAs occurring on-duty

S&H Area	FY12 Actual	FY13 Goal	Method to Achieve Goal	Measure
Near-Miss Reporting/Safety Strategy or Work Practice Improvements	1	≤1	Employees are rewarded for suggestions, which include near-miss reports. Following each near-miss report, action is taken to mitigate any existing hazards.	Number of Near-Miss Reports ÷ Resulting Safety Improvements
Documented Safety Inspections	NA	100%	SSHO conducts and documents daily inspections. Corporate Safety &Health Officer or qualified designee reviews daily inspections.	Number of documented inspections ÷ Number of days on site

OSHA Occupational Safety and Health Administration
NA not applicable
SSHO Site Safety and Health Officer

3.2 Tracking OSHA Safety Statistics

AGEISS implements an aggressive Quality Assurance (QA) Program that incorporates Continuous Improvement. If the Days Away Case Rate (DACR), the Total Recordable Injury Rate (TRIR), or the Days Away plus Restricted Duty plus Job Transfer Rate (DART) require improvement, issues specific to the injury or illness are tracked through the S&H and the QA committees. Tracking of any issues continues until a root cause is determined and either eliminated or managed to ensure the safety of AGEISS employees, equipment, and other potentially affected personnel. All issues tracked through these committees are communicated directly to the AGEISS Team Leadership.

4.0 RESPONSIBILITIES AND LINES OF AUTHORITIES

AGEISS considers S&H integral to business at all levels of AGEISS missions. The AGEISS Team will lead and support AGEISS’ S&H procedures and policies. If any hazards are discovered through employee notification, near miss reports, self-inspections, an OSHA on-site review, accident investigations, process hazard reviews, annual evaluations, or any other means or report, investigation, or analysis; they are tracked and corrected in a timely manner with interim protection provided as necessary. Each of the following employees has specific responsibilities for the implementation of the S&H Program.

4.1 The Project Manager

The Project Manager is responsible and accountable for the S&H Program. Certain responsibilities may be delegated to an appointed Site Safety and Health Officer (SSHO) but the ultimate management responsibility is retained by the Project Manager.

4.2 The Site Safety and Health Officer

The SSHO is responsible for the management of contract safety reporting and day-to-day S&H oversight, management, and coordination. The SSHO conducts walk-around inspections of work-sites to ensure S&H procedures are incorporated and to identify any changes in conditions, tasks, or procedures. The SSHO will communicate emerging S&H issues with the Project Manager and the Corporate Safety and Health Officer (SHO).

4.3 The Safety and Health Officer

The SHO is a qualified safety professional and ensures the initial identification, evaluation and control of hazards. The SHO will, in coordination with the Project Manager and SSHO, develop and review procedures, ensure appropriate recordkeeping, and monitor the S&H Program overall. The SHO will review operations periodically to identify, correct and manage emerging hazards as appropriate applying best practices (OSHA 511 Certificate). The SHO reports directly to the Vice President.

4.4 Employee Involvement

Employees are involved in every stage of a task, from the planning and hazard analysis to implementation. Employees are required to actively participate in the S&H Program and make suggestions on how to perform their respective tasks in a safer and more efficient manner. All employees are responsible for their own safety and the S&H of their coworkers. Employees will conduct themselves in a safe manner, adhering to all policies and procedures. They will use provided protective equipment. They will immediately report any injury, accident, or violation to their respective manager. Employees will conduct a daily S&H check of their areas and correct deficiencies immediately. Employees will communicate to the SSHO, Project Manager, and the SHO deficiencies that are not immediately corrected and which present a hazard at the work-site.

Annual performance reviews for employees will include measurements of safety performance.

To encourage employee participation and personal accountability in the safety program, AGEISS will implement an employee suggestion program. Employees will receive recognition for providing suggestions that are incorporated into the S&H Program and that improve S&H procedures applied on the job.

Employees who are given S&H duties as part of the S&H Program are protected from discriminatory actions resulting from carrying out such duties, just as Section 11(c) of the OSHA of 1970 and 29 CFR 1960.46(a) protects employees for the exercise of their rights. Employees are provided access to the results of self-inspections and accident investigations.

Each employee must work to reduce potential hazards in the work environment. Employees have the following duties:

- Know and understand the information, instructions, and emergency response actions contained in the SHP
- Comply with all S&H requirements applicable to their work assignments
- Review the goals and objectives of the Safety and Health Program and provide feedback to the SSHO and the SHO
- Develop S&H goals that are appropriate to the work-site with the SSHO and the SHO
- Report all work-related injuries or illnesses to their management as early as possible and within 24 hours of the event or immediately if greater than three employees are involved or a suspected work-related death has occurred
- Actively participate in training, medical surveillance, and workplace monitoring programs applicable to their work assignments

- Provide feedback and communicate work-site conditions and operations to the SSHO and SHO, thereby ensuring S&H decisions are appropriate to the conditions at the site and incorporated into daily operations
- Report unsafe conditions observed to the SSHO, Project Manager, or the SHO
- Attend and participate in safety meetings communicating any concerns or issues regarding S&H
- Self-identify any known medical condition or medications if that information would be useful to individuals who render aid in an emergency; such self-identification is optional and at the sole discretion of the individual field team member
- Call a stop work if any field team member identifies a situation that could cause serious injury or harm to personnel, equipment, or the environment
- Review and understand this APP and any site-specific SHP
- Perform those tasks which can be accomplished safely and are within the field team member's physical capabilities

Each employee is responsible for reading, understanding, and following the program's rules and procedures. With regard to site-specific tasks, employees observed working in an unsafe manner will be warned of the dangers involved and must immediately correct their actions.

Employees are required to report all work-related accidents and injuries, no matter how minor; to the SSHO. Every employee shall be made aware of the locations of first aid supplies, fire extinguishers, and all safety equipment at a specific work site location and is not permitted to perform tasks that require training until they receive the applicable training. Employees are instructed to ask questions in situations where they are unsure of proper protocols involving S&H.

All personnel are expected to participate in any of the following activities: safety meetings, AHA Process (requirement), safety training at staff meetings, and other AGEISS or government-sponsored safety-related activities.

Site S&H procedures conform to specific project requirements, USACE S&H requirements, and AGEISS' Corporate S&H Program. Each team member must sign the SHP Review and Acceptance Form that confirms that they have read and understood the SHP (Attachment 1).

At the direction of the Contracting Officer's Technical Representative (COTR), AGEISS employees will perform reviews of specific standards identified under direct tasking in accordance with a task order documenting the request.

5.0 PRE-TASK SAFETY AND HEALTH ANALYSIS

Analysis of systems and operations to identify potential hazards is a primary element of the system safety process. Hazard analysis is a combined responsibility of the safety, facility engineering, and operations disciplines. The hierarchy of controls will be used, following standard industry practice and shall be fully compliant with EM 385-1-1: 1) Elimination of the hazard when able i.e., Substitution (generally used when a less hazardous chemical is available), 2) engineering controls, 3) administrative controls, and 4) selection of appropriate PPE.

Site-specific AHAs for high hazard operations are at the core of the AGEISS S&H Program. The AGEISS Team uses an AHA to identify hazards before employees initiate work efforts. This is a concerted effort that includes input from the employee who will perform the task, Project Manager, SSHO, and the SHO.

The AHA focuses on the relationship between the worker, the task, the tools, and the work environment. The AHA is a cooperative effort among the employees, supervisors, certified professionals, and management. The objectives of the AHA are the recognition and control of hazards before the occurrence of mishaps, close calls, or failures. The contract safety committee and all employees are required to participate in the AHA process.

Hazards identified as immediately dangerous to life or health will be reported immediately to the AGEISS Team management, the SHO, and COTR. The SHO, SSHO, Project Manager, or the employee noting the condition will take immediate steps to minimize or prevent employee exposure and then return the site to a safe condition.

The steps that AGEISS uses in developing the AHA are as follows:

- Conduct a preliminary job review by site walk and review of job plans
- Identify job steps
- Identify hazards associated with each job step, by asking what can go wrong in a task and the potential consequences
- Identify controls for each step, by analyzing what will eliminate and control each hazard
- Develop written procedures

The SSHO in cooperation with the PM and the SHO will produce an analysis worksheet that addresses high hazard activities and procedures with recommended controls to protect the S&H of the employee performing the activity or procedure. Hazard controls will consistently be implemented in all hazardous procedures. Employees working in the areas requiring AHAs shall be trained in accordance with the requirements included in the AHA, and any additional site-specific requirements prior to starting work.

The Project Manager and the SSHO shall review the AHA with each employee who will work in high-hazard areas and ensure that they demonstrate understanding of the precautions to employ during work operations.

AHAs developed for this contract will be available for government review upon request. An AHA Worksheet is provided in Attachment 2.

6.0 TRAINING

New personnel are provided S&H orientation training within five business days of hire and prior to working in areas beyond the general office environment. All personnel who will enter the worksites shall review the APP, SHP, AHA, and Agency for Toxic Substances and Disease Registry (ATSDR) ToxFAQs for the primary contaminants potentially encountered (Attachment 3). Specific training requirements are included in the AHAs for operations and tasks included in this plan. Equipment operators shall review and demonstrate understanding of manufacturer’s manual(s) that correspond to their assigned equipment.

At least two on-site personnel shall maintain Cardiopulmonary Resuscitation (CPR) and First Aid certification (either Red Cross or American Heart Association certificates are accepted). The SSHO shall maintain current Hazardous Waste Operations and Emergency Response (HAZWOPER) certification.

7.0 SAFETY AND HEALTH INSPECTIONS

Regular inspections will be conducted to identify and correct unsafe conditions and work practices. S&H procedures will be audited to ensure proper implementation, compliance with current requirements, and to identify opportunities for continuous improvement.

The SSHO, SHO, Project Manager, the AGEISS Team safety committee, and supervisors of each respective area will conduct a variety of inspections and audits.

If a regulatory entity such as OSHA or USEPA wishes to conduct a compliance inspection of contract facilities, the SHO and the Government COTR and/or Contracting Officer's Representative (COR) (as appropriate) will be contacted.

During the field sampling performance period, the SSHO will conduct daily inspections of all work areas. Corrective actions will be initiated to resolve findings identified during all inspections. These will be tracked to closure. Findings of conditions that present immediate danger to personnel or equipment will result in an immediate work stoppage until corrected. The AGEISS Team SSHO or qualified designee will conduct daily field inspections. A tailored checklist will be developed based upon the AHA.

8.0 ACCIDENT REPORTING

This section describes general accident reporting guidelines. The Project Manager and the SHO are responsible to provide the following:

- Exposure data (man-hours worked)
- Accident investigations, reports, and logs: all OSHA reportable accidents will be reported as soon as possible but not more than 24 hours afterwards to the Contracting Officer/Representative (CO/COR). AGEISS shall thoroughly investigate the accident and submit the findings of the investigation along with appropriate corrective actions to the COR as soon as possible; but no later than five (5) working days following the accident. Corrective actions shall be implemented as soon as reasonably possible.

The following require immediate accident notification:

1 A fatal injury

2 A permanent total disability

3 A permanent partial disability

4 The hospitalization of three or more people resulting from a single occurrence

5 Property damage of $200,000 or more

9.0 PLANS

Attachment 1 contains the SHP for performing environmental sampling services at LHAAP under Contract No. W912BV-10-D-2010, Task Order 0004.

ATTACHMENT C1

Site Safety and Health Plan

This page is intentionally left blank.

DRAFT FINAL

BASELINE ECOLOGICAL RISK ASSESSMENT ADDENDUM LONGHORN ARMY AMMUNITION PLANT, KARNACK, TEXAS

SITE SAFETY AND HEALTH PLAN

Contract No. W912BV-10-D-2010

Task Order 0004

PREPARED FOR:

U.S. Army Corps of Engineers, Tulsa District
1645 South 101 East Avenue
Tulsa, OK 74128

PREPARED BY:

AGEISS Inc.
1202 Bergen Parkway, Suite 310
Evergreen, CO 80439

September 2013
Revision 0

This page is intentionally left blank.

TABLE OF CONTENTS

Section **Page**

LIST OF TABLES

LIST OF FIGURES

ABBREVIATION / ACRONYM LIST

AGEISS	AGEISS Inc.
AHA	Activity Hazard Analysis
ANSI	American National Standards Institute
APP	Accident Prevention Plan
ATSDR	Agency for Toxic Substances and Disease Registry
BERA	Baseline Ecological Risk Assessment
CPR	cardiopulmonary resuscitation
HB	Harrison Bayou
ISA	Industrial Sub-Area
LEL	lower explosive limit
LISA	Low Impact Sub-Area
MC	munitions components
MEC	munitions and explosives of concern
MSDSs	material safety data sheets
OSHA	Occupational Safety and Health Administration
PID	photoionization detector
PPE	personal protective equipment
ppm	parts per million
SDSs	safety data sheets
SHO	Safety and Health Officer
SOP	standard operating procedure
SSHO	Site Safety and Health Officer
TCEQ	Texas Commission on Environmental Quality
TNT	trinitrotoluene
UFP-QAPP	Uniform Federal Policy for Quality Assurance Project Plan
USACE	U.S. Army Corps of Engineers
USEPA	U.S. Environmental Protection Agency
VOC	volatile organic compound
WSA	Waste Sub-Area

This page is intentionally left blank.

1.0 SITE DESCRIPTION

1.1 Contamination Characterization

The proposed field sampling locations may be found in the *Supplemental Baseline Ecological Risk Assessment Longhorn Army Ammunition Plant, Karnack, Texas, Uniform Federal Policy For Quality Assurance Project Plan* (UFP-QAPP), (AGEISS 2012; p. 41-49). The locations include the Waste Sub-Area (WSA; 12 samples), the Low Impact Sub-Area (LISA;16 samples), the Industrial Sub-Area (ISA;170 samples), and Harrison Bayou (HB; 6 samples). Section 2.4 contains primary chemical contaminants that may be encountered at these locations. The sampling methods described in the UFP-QAPP minimize potential for aerosolization during work activities. The proper wear of required personal protective equipment (PPE), decontamination procedures, and precautions included in sampling procedures further minimize potential exposure to soil, sediment, and surface water contaminants.

There is some, though remote, risk that isolated munitions and explosives of concern (MEC) or munitions components (MC) could be discovered during this project.

1.2 Dates of Work Operations

Dates of work operations are: beginning May 2013 **(**exact date to be determined) until completion of this contract.

1.3 Time of Work Operations

On-site work in support of this contract is generally completed Monday through Friday during an 8-hour shift between 7:00 am and 4:30 pm.

1.4 Site History/Description and Unusual Features

Longhorn Army Ammunition Plant (LHAAP) is located in central-east Texas, in Harrison County, between State Highway 43 at Karnack, Texas, and Caddo Lake. The former installation occupied nearly 8,500 acres. The nearest cities are Marshall, Texas, approximately 14 miles to the southwest, and Shreveport, Louisiana, approximately 40 miles to the east. The site is currently inactive.

The LHAAP was established in 1941 when the Army issued a contract to build a six-line production facility for manufacturing trinitrotoluene (TNT). From 1942 to 1945, the facility produced 414 million pounds of TNT. From 1952 to 1956, the facility produced 3.4 million pyrotechnic devices, photoflash bombs, simulators, hand signals, and 40-millimeter (mm) tracers. During the Vietnam conflict, pyrotechnic and illuminating ammunition was produced. From 1954 to 1980, solid-fuel rocket motors for tactical missiles were produced. During this period, the LHAAP manufactured approximately 50 million pounds of propellant and 200,000 rocket motors. From 1988 to 1991, LHAAP was also used for the static firing and elimination of Pershing I and II rocket motors.

Various media have been contaminated by past industrial operations and waste management practices at LHAAP. LHAAP was placed on the National Priorities List on August 9, 1990. A Federal Facility Agreement among the U.S. Environmental Protection Agency (USEPA), the Army, and the Texas Commission on Environmental Quality (TCEQ), became effective December 30, 1991 as described in the *Installation-Wide Work Plan Longhorn Army Ammunition Plan, Karnack, Texas* (Shaw, May 2011). In addition, MEC may be encountered on LHAAP.

LHAAP is also home to a variety of wildlife, to include arthropods and snakes. Weather extremes are experienced at this site and include lightning storms, tornadoes, ice storms, flash floods, droughts, high winds and extreme heat.

1.5 Temperature and Precipitation

Monthly average temperatures and precipitation for Karnack, Texas are shown below.

Table 1. Average Temperature and Precipitation in Karnack, Texas

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
High (°F)	51	61	71	78	84	90	93	93	87	78	67	58
Low (°F)	35	39	46	54	62	68	71	70	64	53	45	37
Precipitation (inches)	3.1	2.9	3.1	5.4	6.2	5.7	3.1	3.1	3.	3.8	6.	5.5

SOURCE: http://www.weather.com/weather/wxclimatology/monthly/graph/75661

2.0 HAZARD/RISK ANALYSIS

This section outlines the potential chemical and physical hazards that employees may be exposed to during work on this project. The assessment of chemical and physical hazards in this section is based on the information provided in the scope of work for this contract.

2.1 General Site Safety

Work under this contract requires the AGEISS Team to sample the following media on LHAAP: soil, sediment, and surface water. Personnel assigned field work have the potential to be exposed to the following hazards and are expected to incorporate the recommendations of this policy into their daily routines.

2.2 Motor Vehicle Safety

AGEISS Team employees will regularly operate privately owned or company leased motor vehicles while traveling between, to, in, and around LHAAP to perform environmental sampling tasks. While operating privately owned or company leased vehicles on official business, AGEISS Team employees will possess valid state licenses for the class of vehicle being operated, certifying license validity in writing annually. Employees must notify the Project Manager if their drivers' licenses are suspended, restricted, revoked, canceled, or if they have been otherwise disqualified from holding licenses, e.g., unable to pass medical screening.

- ♦ Check vehicle prior to each use to ensure that brakes, tires, horn, steering mechanism, seat belts, operating controls, safety devices, and windshield wipers are in safe operating condition and free from apparent damage.
- ♦ Wear seat belts while the vehicle is in motion.
- ♦ Do not operate a motor vehicle while under the influence of alcohol or drugs nor while sick or suffering from excessive fatigue or emotional stress, during the performance of official business.
- ♦ Stay alert and pay attention to wildlife and pedestrians. Yield the right-of-way to wildlife and pedestrians.
- ♦ Observe all Federal, State, local, and LHAAP traffic regulations. The posted speed limit on LHAAP ranges from 10-40 miles per hour.
- ♦ Do not exceed 10 hours of driving time (behind the wheel) during a 16-hour period. This 10-hour period includes rest and meal breaks.

- Restrict use of *electronic equipment* (cellular phone, blackberry, personal digital assistant, or pager) in AGEISS vehicles (owned, leased, or rented) as follows:
  - The driver of an AGEISS Team or a privately owned vehicle, while on official business, must not use personal or Government-supplied electronic equipment, inclusive of hands-free devices, while the vehicle is in motion.
  - When driving alone, incoming calls must be directed to voice mail or pager for answering until the vehicle can be safely pulled to the side of the road.
  - Text messaging is prohibited when driving while on official Government business and at all times when driving on LHAAP. While the State of Texas does not ban the use of electronic devices while driving (except in school zones during school hours); there is a law that prohibits distracted driving. AGEISS strongly encourages employees to devote their full time and attention to driving when operating a vehicle both on official business and during off-duty times.

2.3 Required Communication Method/Devices

All personnel performing field sampling or when working with hazardous materials, equipment, operations, or processes will be accompanied by either a Government representative or another AGEISS Team employee. Contact the Site Safety and Health Officer (SSHO) or qualified designee, as directed by the Project Manager, prior to departing and after returning from a site. Employees will have ready access to a working cell phone or a two-way radio that is monitored by an AGEISS Team employee or a Government representative.

2.4 Chemical Hazards

Skin and eye contact with hazardous materials shall be prevented. At a minimum, safety glasses with side shields, foot protection, and gloves will be worn when handling these materials. This PPE will meet the required appropriate American National Standards Institute (ANSI) standard. This is to be considered as minimum protection and must be upgraded if necessary. Additional PPE such as chemical goggles, face shields, chemical aprons, disposable coveralls, and chemical resistant gloves, must be worn if there is a greater chance of chemical exposure. Contact the AGEISS Safety and Health Officer (SHO) for assistance in selecting appropriate gloves and respiratory protection. The use of respiratory protection is not required for this work.

As there is no ANSI standard for gloves, select gloves on the basis of their chemical resistance to the material(s) being handled, their suitability for the procedures being conducted, and their resistance to wear as well as temperature extremes. Improper selection may degrade the gloves, allow the chemical to permeate the gloves and ultimately expose the wearer to the chemical. The AGEISS SHO may also be contacted for assistance in selecting appropriate gloves. The following link provides additional guidance for glove selection: http://www.lbl.gov/ehs/chsp/html/materials.shtml - Gloves

Historic sample analytical data provided indicate only remote or low potential for human exposure during soil, sediment, and surface water sampling activities. However, the AGEISS Team will ensure that Agency for Toxic Substances and Disease Registry (ATSDR) ToxFAQs for each of the primary contaminants and material safety data sheets/safety data sheets (MSDSs/SDSs) for any chemicals brought to the site are reviewed with our employees or visitor(s) prior to allowing them access to the work site.

Table 2 lists primary contaminants possibly present at this site, as provided by Shaw. A list and MSDSs for chemicals that may be brought to the site shall also be included in the Hazard Communication Plan (Attachment 4).

Table 2. List of Primary Contaminants associated with this Site

Chemical	Exposure Routes	PEL/TLV	Health Hazards/Physical Hazards
Lead	Inhalation, ingestion	0.050 mg/m^3	Weakness, insomnia; loss of appetite, loss of weight, abdominal pain; anemia; tremors; weakness of wrists/ankles; kidney damage; low blood pressure. Incompatible with strong oxidizers, hydrogen peroxide and acids.
Mercury	Inhalation, skin contact	0.025 mg/m^3 SKIN Alkyl compounds 0.01 mg/m^3	Cough, chest pain, shortness of breath; tremor, insomnia, irritability, headache, weakness, stomach pain, loss of appetite; kidney damage. Reacts with acetylene, ammonia, chlorine dioxide, copper and other metals.
Trichloroethene (Trichloroethylene)	Skin, eye, inhalation, ingestion	50 ppm NIOSH REL Listed as Carcinogen ACGIH TLV 10 ppm	A skin and eye irritant; dermatitis, headache, vertigo, visual distortion, fatigue, nausea, vomiting, irregular heart rhythm. A dangerous fire hazard, reacts with strong caustics and chemically reactive metals, will emit toxic phosgene gas when heated.
Trinitrotoluene	Skin, eye, inhalation, ingestion	0.5 mg/m^3	A skin and eye irritant; headache, weakness, anemia, liver injury, hallucinations, visual distortions, cyanosis. A severe explosion hazard, will explode on heating or strong shock; thermal decomposition will emit NOx gases and/or detonation.
Methylene Chloride	Skin, eye, inhalation, ingestion	50 ppm	A suspected human carcinogen; headache, narcosis, fatigue, tingling in the limbs, stupor; a strong skin, eye irritant. Can react violently with strong oxidizers, light metals, potassium hydroxide; low combustibility, flammable at elevated (>100°C) temperatures; emits toxic gases when burned
Ammonium Perchlorate	Skin, eye, inhalation, ingestion		Can irritate the nose causing coughing and wheezing and can interfere with the ability of the blood to carry oxygen causing headache, fatigue, dizziness, and a blue color to the skin and lips. Is a powerful oxidizer. Stable in pure form, but decomposes at a temperature 150°C or above. It becomes explosive when mixed with finely divided organic materials and can exhibit explosive sensitivity to shock and friction when contaminated with small amounts of some impurities such as sulfur, powdered metals and carbonaceous materials. May explode in fire.

SOURCE: *Installation-Wide Work Plan Longhorn Army Ammunition Plan, Karnack, Texas* (Shaw 2011)

°C degrees Celsius
ACGIH American Conference of Industrial Hygienists
mg/m^3 milligrams per cubic meter
NIOSH National Institute of Occupational Safety and Health
NOx nitrogen oxides
PEL permissible exposure limit
ppm parts per million
REL recommended exposure limit
TLV threshold limit value

2.5 Physical Hazards

2.5.1 Munitions and Explosives of Concern

If MEC is suspected or encountered, issue a STOP WORK ORDER immediately. Every employee has the authority to issue a STOP WORK ORDER, which shall immediately become binding for all AGEISS Team personnel. The employee calling the STOP WORK ORDER shall notify the Field Operations Leader immediately. The Field Operations Leader shall coordinate with U.S. Army Corps of Engineers (USACE) immediately. All instructions and orders will then be taken from USACE.

All AGEISS Team employees shall view the MEC safety video and read the MEC information pamphlet provided by USACE. The Field Operations Leader with the SSHO shall ensure that personnel demonstrate an understanding of the information presented in these MEC materials.

2.5.2 Slip/Trip/Fall

AGEISS Team employees will ensure electrical cords, ropes, and other items that can contribute to tripping hazards are removed or managed so that the hazard is eliminated. Extreme weather can contribute to slip, trip, and fall hazards. AGEISS employees will ensure that the government has provided reasonable measures to mitigate slip, trip, and fall hazards due to wet weather, ice, and snow before performing daily duties. See Section 5.0 for required PPE.

2.6 Biological Hazards

2.6.1 Ticks

Ticks are vectors of many different diseases, including Rocky Mountain spotted fever, Q fever, tularemia, Colorado tick fever, and Lyme disease. They attach to their host's skin and intravenously feed on blood, creating an opportunity for disease transmission. Covering exposed areas of the body and the use of tick repellent are two ways to prevent tick bites. Periodically during the workday, employees will inspect themselves for the presence of ticks. If a tick is discovered, the following procedure should be used to remove it:

- Do not try to detach a tick with bare fingers; bacteria from a crushed tick may be able to penetrate even unbroken skin. Fine-tipped tweezers should be used.
- Grip the tick as close to the skin as possible and gently pull it straight away from the skin until it releases its hold.
- Do not twist the tick while pulling, and do not squeeze its bloated body. That may actually inject bacteria into the skin.
- Thoroughly wash hands and the bite area with soap and water, and apply an antiseptic to the bite area.
- Save the tick in a small container and note the date, the body location of the bite, and where the tick came from.
- Notify the SSHO of tick bites as soon as possible.

Recently, Lyme disease has been the most prevalent type of disease transmitted by ticks in the United States.

2.6.2 Poisonous Plants

Toxic plants are found among trees, shrubs, vegetables, and vines. The largest number of plant poisonings occurs from ingestion. However, the largest concern for field workers comes from contact poisons that are most irritating to the skin: poison ivy, poison oak, and poison sumac.

Poison Ivy

Physical Description. Poison ivy is a woody shrub or vine that climbs high in trees or along the ground, having alternate leaves with three leaflets. Small greenish flowers hang in clusters and form globe-shaped, yellowish, berry-like fruits. The leaf margins may be smooth or finely-toothed, or may be variously lobed.

Habitat. Poison ivy is found growing in rocky fields, pastures, thickets, woods, and waste places, often climbing trees, fences, and dwellings.

Symptoms. Contact results in a burning, itching rash that develops into broken blisters; the rash and blisters spread rapidly when scratched.

Treatment. Blisters may be drained, but tops should not be removed. Topical medication may be applied to the infected area.

Poison Oak

Physical Description. Poison oak is a perennial shrub with slender stems that are erect and woody, with one or a few erect branches. It does not climb nor does it have aerial roots. The leaves are three-parted on long erect stems, and found mostly near the top. The leaflets are found to be elliptic, rhombic, or obviate, and are hairy on the top surface and velvety beneath, with three to seven deep teeth, suggesting oak leaves. The fruit is greenish to buff and approximately 5 millimeters in diameter.

Habitat. Poison oak grows in dry barrens, sandy wastes, pine woods, and sandy woods.

Symptoms. Contact results in a burning, itching rash that develops into broken blisters; the rash and blisters spread rapidly when scratched.

Treatment. Blisters may be drained, but tops should not be removed. Topical medication may be applied to the infected area.

Poison Sumac

Physical Description. Poison sumac is a shrub or tree growing to 25 feet. It has compound leaves with 7 to 11 pointed leaflets without marginal teeth, and the leaf and leaflet stalks are reddish with clustered whitish fruits that resemble poison ivy.

Habitat. Poison sumac is found growing in the swamps of eastern North America.

Symptoms. Contact results in a burning, itching rash that develops into broken blisters; the rash and blisters spread rapidly when scratched. In severe cases, the infection covers the entire body, producing swelling and fever.

Treatment. Blisters may be drained, but tops should not be removed. Topical medication may be applied to the infected area.

If the work sites are located in areas where poisonous plants may be encountered, personnel should wear long pants, long sleeves, and gloves to minimize the possibility of exposure. In some areas, the use of a Tyvek® or other protective suit may be advisable.

2.6.3 Venomous Arthropods

Many of the arthropods produce venomous bites. The black widow and brown recluse spiders are two of the most commonly encountered arthropods in Texas.

Black Widow Spider

Physical Description. The adult female is glossy black with short, almost microscopic hairs. Most female black widow spiders have a crimson hourglass marking on the underside of the abdomen. The spider reaches an overall length equal to 40 millimeters or 1.5 inches.

Habitat. The female spider is found with her web and egg sacs in protected places such as vacant rodent burrows and under stones, logs, long grass, hollow stumps, and brush piles. They are also found in dark corners of barns, stables, garages, and piles of boxes and crates.

Symptoms. After the bite, a dull, numbing pain in the affected extremity occurs. Also, pain and some muscular rigidity in the abdomen, back, and chest occur. The bite may also produce pain on inspiration (inhalation), headache, dizziness, skin rash, nausea, vomiting, anxiety, and weakness. Increased skin temperature over the affected area may be observed.

Treatment. Ice may be placed over the bite to reduce the pain. Seek immediate medical attention.

Brown Recluse Spider

Physical Description. The brown recluse is a spider of medium size (body 10 to 15 millimeters in length). It is brown in color, and the legs are long and lack unpaired claws.

Habitat. This spider is found outdoors under rocks and rubble.

Symptoms. After the bite, some localized pain develops within an hour. The bite area becomes swollen and skin temperature increases. The lesion has the appearance of a bull's eye and often becomes larger, ruptures, and leaves an ulcer that may involve underlying tissues, including muscle. Systemic symptoms and signs may develop, including nausea and vomiting.

Treatment. Ice may be placed over the bite to reduce the pain. Seek immediate medical attention.

Scorpions

Several species of scorpions are found in the south. Scorpions may be found under rocks, logs, and tree bark, outdoors and indoors (e.g. shoe, linens, etc.). Only one species, the Bark Scorpion, is regarded as life threatening. The Bark Scorpion may be distinguished from other less toxic species by its more slender tail segments and pincers. Reaching only 1.5 inches at maturity, it is a relatively small scorpion. Scorpions are relatively inactive during the daylight hours. The majority of scorpion bites occur at night during warm summer months. The most effective way to prevent scorpion bites is to avoid conducting work at night, visually inspect work areas prior to activities, and protect hands and legs by wearing the proper PPE.

Symptoms. Scorpion stings can cause immediate local pain with minimal swelling. Numbness and tingling are frequently reported. The injured area may be hypersensitive to touch, pressure, heat, and cold. Small children are at highest risk, as demonstrated by "roving eye" symptoms and hyperactivity.

Treatment. Most scorpion stings can be treated in the field. Clean the bitten area with soap and press a cool compress on the sting. Elevate the stricken limb to the approximate heart level. Take an analgesic to relieve minor pain, as needed. If symptoms are severe, seek immediate medical assistance at an emergency room or urgent care facility.

2.6.4 Snakes

The degree of toxicity resulting from snakebites depends on the potency of the venom, the amount of venom injected, and the size of the person bitten. Poisoning may occur from injection or absorption of venom through cuts or scratches. The most effective way to prevent snakebites is to avoid snakes. Personnel should avoid walking at night or in high grass and underbrush. Visual inspection of work areas should be performed prior to activities. The use of leather boots and long pants is recommended if snakes are spotted, as more than half of all bites are on the lower part of the leg. No attempts at killing snakes should be made; many people are bitten in these attempts. If someone is bitten by a potentially poisonous snake, the following treatment should be initiated:

- Keep patient calm
- Notify emergency medical services (EMS); provide description of snake if possible
- Wash the wound and keep the affected body part still
- Apply direct pressure to site of bite if bleeding is extreme
- Keep the affected area lower than the heart
- Carry a victim who must be transported, or have him/her walk slowly
- Transport to closest medical facility

All personnel should be cautioned to be alert because of the likelihood of encountering snakes at LHAAP. Should a snake bite occur, attempts should be made to identify the snake. The victim should be transported to the nearest hospital within 30 minutes. Snake venoms are complex and include proteins, some of which have enzymatic activity. The effects produced by venoms include neurotoxic effects with sensory, motor, cardiac, and respiratory difficulties; cytotoxic effects on red blood cells, blood vessels, heart muscle, kidneys, and lungs; defects in coagulation; and effects from local release of substances with enzymatic actions. Other noticeable effects of snake bites include swelling, edema, and pain around the bite, and the development of ecchymosis (the escape of blood into tissues from ruptured blood vessels).

2.6.5 Rodents

Rodents, such as rats and deer mice, can potentially carry hantavirus. Rats differ from related mice by their larger size and teeth. Deer mice, such as mesas, usually live at higher elevations, and can be distinguished from other rodents by their small body size (3 to 4 inches long) and by their bi-colored tail. However, the Centers for Disease Control believes that other rodents also have the potential to carry the virus, so precautions must be taken when dealing with any species of rodent. It is not possible to distinguish whether a rodent carries the hantavirus by observation.

Hantavirus affects the respiratory system in humans. The first symptoms of infection can occur at any time up to 45 days after exposure, and include one or more of the following: fever, muscle aches, headache, or coughing. These symptoms progress rapidly into a severe lung disease that often requires intensive care treatment. Hantavirus can be transferred to humans, primarily from breathing infected rodent excreta particles that have become airborne or ingesting excreta particles that cling to hands or clothing. It can also be contracted from rodent bites or transferred through broken skin. Though the illness caused by hantavirus is severe, it is relatively rare and can be prevented by simple precautions and common sense.

The best way to avoid contact with the hantavirus is to avoid contact with rodents, nesting materials, and their excreta. Do not leave food or garbage where rodents have access to them; this includes leaving food items and wrappers in vehicles. When possible, seal any opening greater than 1/4 inch diameter with steel wool to prevent rodent access in vehicles or structures.

3.0 STAFF ORGANIZATION, QUALIFICATIONS, AND RESPONSIBILITIES

For staff organization, qualifications, and responsibilities, refer to the Accident Prevention Plan.

4.0 GENERAL AND PROJECT-SPECIFIC TRAINING

All on-site project personnel must have completed at least 40 hours of hazardous waste operations-related training. All field employees receive a minimum of three days of actual field experience under the direct supervision of a trained, experienced supervisor. Personnel who completed the 40-hour training class more than 12 months prior to the start of the project must have completed an 8-hour refresher course within the past 12 months. The Field Operations Leader must have completed an additional 8 hours of health and safety training for supervisors and must have a current first aid/cardiopulmonary resuscitation (CPR) certificate.

4.1 Supervisor Course

Management and supervisors receive an additional eight hours of training, which typically includes general site safety and health procedures, PPE programs, and air monitoring techniques.

4.2 Site-Specific Training

Site-specific training will be accomplished through a review of this Safety and Health Plan and accompanying documents before work begins. All workers will review and sign the Safety and Health Plan acknowledgment form.

In addition, daily Safety Meetings will cover the work to be accomplished, the hazards anticipated, the protective clothing and procedures required to minimize site hazards, and emergency procedures. No work will be performed before the Daily Safety Meeting has been held and workers have signed an attendance sheet.

4.3 First Aid and CPR

All employees shall be current in first aid/CPR and will be on the site whenever operations are ongoing. Refresher training in first aid (biennially) and CPR (annually) is required to keep the certificate current. These individuals must also receive training regarding precautions and protective equipment necessary to protect against exposure to blood-borne pathogens, as required by Part 1910.1030. At a minimum, rubber gloves should be available for use by trained first-aiders for use when exposure to blood or other body fluids is a concern.

5.0 PERSONAL PROTECTIVE EQUIPMENT

When participating in work other than administrative office work: (a) Wear reflective vest and non-slip, steel-toed shoes at all times (b) where overhead injury potential exists wear the head protection; (c) wear hearing protection appropriate to the noise hazard at the site. Ensure ear plugs and ear muffs are selected and fitted for proper noise reduction.

AGEISS requires all employees to actively apply engineering controls, administrative controls, work practice controls, and emergency procedures in all activities involving potential exposure. All employees are required to wear PPE appropriate to their respective task in accordance with the recommended/required action or procedure in the task-specific Activity Hazard Analysis (AHA). PPE may include but is not limited to splash-proof eye protection, hearing protection, chemically resistant gloves when handling hazardous chemicals, foot protection meeting applicable ANSI standard(s), and head protection.

PPE includes devices and clothing designed to protect an individual in hazardous areas or performing hazardous operations. The AGEISS Team policy is that, appropriate PPE is supplied to employees engaged in hazardous activities. PPE is supplied and selected in accordance with standard operating procedure (SOP) HS-8, PPE Program Plan.

PPE may consist of Tyvek™ suits, safety boots, gloves and glasses, and hard hats. Respirators are not required for work conducted under this contract.

The SSHO will administer PPE requirements through work area hazard assessments, review and approval of procedures, equipment purchase and use approval, and training programs. Personnel requiring the use of PPE will be trained in selection, use, limitations, care, disposal, and replacement prior to use on the job. Managers and leads and SSHO will ensure that PPE is provided as specified in work procedures and specific job training, and is properly worn. PPE will be used only as a supplemental control measure where hazards cannot be totally eliminated. The PPE Program will implement best management practices required by the Occupational Safety and Health Administration (OSHA) and USACE including but not limited to PPE, hearing conservation, electrical safety, etc.).

The AGEISS Team will require the following practices to maintain PPE:

Hazard Assessment – OSHA Regulation 29 CFR 1910.132 requires an assessment of each workplace to determine if hazards are present for which level of PPE is needed. This assessment will be certified by the AGEISS Team SSHO; the assessment shall include the date of the assessment, and the name of the person performing the assessment. The responsible manager or lead will select PPE based on the results of this hazard assessment.

Training – Each employee who uses PPE will be trained and will demonstrate the ability to use the equipment properly. Training will cover donning, doffing, adjustment, use, limitations, proper care, maintenance, useful life, disposal, and when protective equipment is necessary. Retraining will be done when changes in the work place or types of PPE to be used render previous training obsolete, or if inadequacies in an employee's knowledge or use of equipment indicate the employee has not retained the requisite understanding or skill.

The AGEISS SSHO is responsible for ensuring the following is accomplished.

- Review ATSDR ToxFAQs or MSDSs/SDSs for each specific chemical (Attachment X).
- Limit exposure to as low as is reasonable through the implementation of engineering controls.
- Select and wear appropriate PPE to the hazard where potential exposure exists.
- Contact the AGEISS Program Manager and AGEISS Safety and Health Coordinator if assistance is needed.

6.0 MEDICAL SURVEILLANCE

Medical Surveillance requirements will be included in specific AHAs if required. An AHA Worksheet is provided in Attachment 2. When medical surveillance is required, the chemical inventory list should be provided to the Occupational Medicine Physician for evaluation of medical surveillance requirements. Medical surveillance of workers potentially exposed at or above the exposure limits for hazardous substances should be conducted (1) at least annually, (2) when a worker moves to a new worksite, (3) when a worker experiences exposure from unexpected or emergency release, and (4) at the end of employment. The Field Operations Leader is responsible for ensuring all personnel working on the project have the appropriate medical surveillance if required. A record of medical surveillance is maintained with personnel files at the AGEISS Evergreen office.

7.0 EXPOSURE MONITORING/AIR SAMPLING PROGRAM

7.1 Air Monitoring

The potential for inhalation exposure to hazardous or toxic materials is expected to be minimal for all proposed site activities. The potential for flammable atmospheres (in excess of 10 percent lower explosive limit [LEL]) is also highly unlikely. All work is expected to be conducted outdoors in open areas and exposure to flammable materials is not likely. Therefore, it is anticipated that routine air monitoring will not be required. However, the AGEISS Team will conduct air monitoring at the discretion of the SSHO, if site conditions or tasks warrant. If it is subsequently determined that air monitoring is required for specific task(s) then the contaminant(s)/ parameters to be monitored, action level(s), instrumentation to be used, monitoring frequency, and calibration procedures will be specified in an addendum for the affected site(s).

At each location, as a best practice, air monitoring will be performed during the sampling activities to obtain qualitative volatile organic compound (VOC) concentrations in order to protect worker safety. Air monitoring will be completed in the breathing zone during sampling and intrusive activities. If a detection of VOCs above the action level of five (5) parts per million (ppm) or greater is detected, the AGEISS Team will STOP WORK. The Field Operations Leader will notify the USACE site contact and the AGEISS Program Manager. The AGEISS Team will then obtain instructions from the Government on how to proceed. The Field Operations Leader shall ensure that any additional tasks are evaluated for potential hazards and the APP, SHP, AHA, and HAZCOM Plan updated to incorporate these changes. Any correlating controls and training requirements will be addressed with the AGEISS Team prior to re-initiating work.

No ionizing radiation hazards are anticipated. Therefore, it is not anticipated that radiation monitoring will be required.

7.2 Noise Monitoring

Noise monitoring will be conducted if required by the SSHO/Field Operations Leader. As a general rule of thumb, sound levels that cause speech interference at normal conversation distance should require the use of hearing protection. Hearing protection is mandatory for all employees in noise hazardous areas.

7.3 Monitoring Equipment Maintenance and Calibration (if required)

All direct reading instrumentation calibrations should be conducted under the approximate environmental conditions the instrument will be used. Instruments must be calibrated before and after use, noting the reading(s) and any adjustments that are necessary. All air monitoring equipment calibrations, including the standard used for calibration, must be documented on the Field Activity Daily Log, or the calibration log. All completed S&H documentation/forms must be reviewed by the SSHO and maintained by the Field Operations Leader.

A photoionization detector (PID) will be used to screen for the presence of VOCs in field personnel breathing space. Refer to the Field Equipment Calibration and Maintenance procedures in the UFP-QAPP. All air monitoring equipment will be maintained and calibrated in accordance with the specific manufacturers' instructions. Preventive maintenance and repairs will be conducted in accordance with the respective manufacturers' procedures. When applicable, only manufacturer-trained and/or authorized personnel will be allowed to perform instrument repairs or preventive maintenance. Field personnel shall conduct daily calibration checks.

8.0 HEAT AND COLD STRESS

8.1 Temperature Extremes

Heat and cold stress training is reviewed with field employees annually. The Field Operations Leader, with input from the SSHO, will keep aware of the Heat Index levels, cold temperatures, and wind speeds and shall adjust work efforts and schedules in accordance with potential heat, cold, and weather stressors.

8.2 Heat Injuries

Most heat-related health problems can be prevented, or the risk of developing them can be reduced. Current and forecasted ambient temperatures are available throughout the day at http://www.accuweather.com/en/us/Longhorn-ok/74501/weather-forecast/335180. To protect the safety and health of employees, follow the general work-site requirements below and the specific requirements included in Tables 3 and 4.

If a worker has signs of heat-related illness, seek proper medical attention. The closest hospital is 21 miles from LHAAP, Good Shepherd Medical Center in Marshall, Texas http://www.gsmc.org/ (see Figure 5 in Section 14.2).

All new employees shall be acclimatized (gradually build up exposure to heat), especially if that employee is new to working in the heat or has been away from work for a week or more. Gradually increase workloads and allow more frequent breaks during the first week of work.

Workers must have adequate potable (safe for drinking) water close to the work area, and should drink small amounts frequently.

Rather than being exposed to heat for extended periods of time, workers are, wherever possible, permitted to distribute the workload evenly over the day and incorporate work/rest cycles. Shorten work periods and increase rest periods:

- As temperature rises
- As humidity increases
- When sun gets stronger
- When there is no air movement
- When protective clothing or gear is worn
- For heavier work

If possible, physical demands shall be reduced during hot weather, or heavier work scheduled for cooler times of the day.

When necessary, rotate job functions among workers to help minimize overexertion and heat exposure.

AGEISS Team employees shall watch out for each other and others in the vicinity of work operations for symptoms of heat-related illness and administer appropriate first aid to anyone who is developing a heat-related illness.

If indicated, provide for physiological monitoring of employees working in conditions that could lead to a heat injury. http://www.osha.gov/SLTC/heatillness/heat_index/monitoring_workers.html

Field supervisory personnel shall maintain First Aid/CPR Certification.

Use the following Heat Index Charts to protect workers. This chart was obtained from OSHA and adjusted for use at the LHAAP (as recommended by OSHA) due to open and full sun exposure when working outdoors.

Table 3. Heat Index Chart

Heat Index	Risk Level	Protective Measures
Less than 81°F	Lower (Caution)	Basic heat safety and planning
81°F to 90°F	Moderate	Implement precautions and heighten awareness
91°F to 100°F	High	Additional precautions to protect employees
Greater than 100°F	Very High to Extreme	Triggers even more aggressive protective measures

Table 4. Using the Heat Index to Protect Employees

Heat Index	Risk Level	Protective Measures
<81°F	Lower (Caution)	Provide drinking water Ensure that adequate medical services are available Plan ahead for times when heat index is higher, including heat safety training Encourage workers to wear sunscreen Additional precautions are recommended if workers must wear heavy protective clothing
81°F to 90°F	Moderate	In addition to the steps listed above: Remind workers to drink water often (about 4 cups/hour)** Review heat-related illness topics with workers: how to recognize heat-related illness, how Schedule frequent breaks in cool, shaded area Use acclimated workers. Use the buddy system. Watch workers for signs of heat-related Additional precautions are recommended if workers must wear heavy protective clothing Schedule activities at a time when the heat index is lower Develop work/rest schedules Monitor workers closely
91°F to 100°F	High	In addition to the steps listed above: Alert workers of high risk conditions Actively encourage workers to drink plenty of water (about 4 cups/hour)** Limit physical exertion (e.g. use mechanical lifts) Only trained employees at the worksite who are able to determine appropriate work/rest Establish and enforce work/rest schedules and adjust work activities Use cooling techniques Watch/communicate with workers at all times When possible, reschedule activities to a time when heat index is lower
>100°F	Very High to Extreme	Reschedule non-essential activity for days with a reduced heat index or to a time when the Move essential work tasks to the coolest part of the work shift; consider earlier start times, If essential work must be done, in addition to the steps listed above: Alert workers of extreme heat hazards Establish water drinking schedule (about 4 cups/hour)** Develop and enforce protective work/rest schedules Conduct physiological monitoring (e.g., pulse, temperature, etc) Stop work if essential control methods are inadequate or unavailable.

*The heat index is a simple tool and a useful guide but does not account for certain conditions that contribute additional risk. Consider taking the steps at the next highest risk level to protect workers from the added risks posed by wearing heavy clothing or protective gear.

**Under most circumstances, fluid intake should not exceed 6 cups per hour or 12 quarts per day.

8.3 Cold Weather Illnesses and Injuries

Prolonged exposure to freezing or cold temperatures may cause serious health problems such as trench foot, frostbite and hypothermia. In extreme cases, including cold water immersion, exposure can lead to death. Danger signs include uncontrolled shivering, slurred speech, clumsy movements, fatigue and confused behavior. If these signs are observed, call for emergency help (911, tell the operator if you are on LHAAP).

The Field Operations Leader shall:

- Ensure AGEISS employees and any subcontractors (if applicable) are trained to recognize cold-induced illnesses and injuries.
- Encourage workers to wear proper clothing for cold, wet and windy conditions, including layers that can be adjusted to changing conditions.
- Be sure workers in extreme conditions take frequent short breaks in warm dry shelters to allow their bodies to warm up.
- Try to schedule work for the warmest part of the day.
- Consider that workers face increased risks if they take certain medications, are in poor physical condition, or suffer from illnesses such as diabetes, hypertension or cardiovascular disease. These personnel shall be provided sufficient oversight to ensure their safety and health.
- Monitor employees working in cold conditions for signs and symptoms of cold-induced illnesses and injuries and what to do to help workers. May be performed by qualified designee (SSHO)

Employees shall:

- Avoid exhaustion or fatigue because energy is needed to keep muscles warm.
- Use the buddy system – work in pairs so that one worker can recognize danger signs.
- Drink warm, sweet beverages (sugar water, sports-type drinks) and avoid drinks with caffeine (coffee, tea, sodas or hot chocolate) or alcohol.
- Ensure adequate nutrition; OSHA recommends warm, high-calorie foods, such as pasta dishes.

9.0 STANDARD OPERATING SAFETY PROCEDURES

AGEISS has a strong Corporate S&H Program. Table 5 lists the S&H SOPs that are part of the corporate program.

Table 5. AGEISS' Standard Operating Procedures

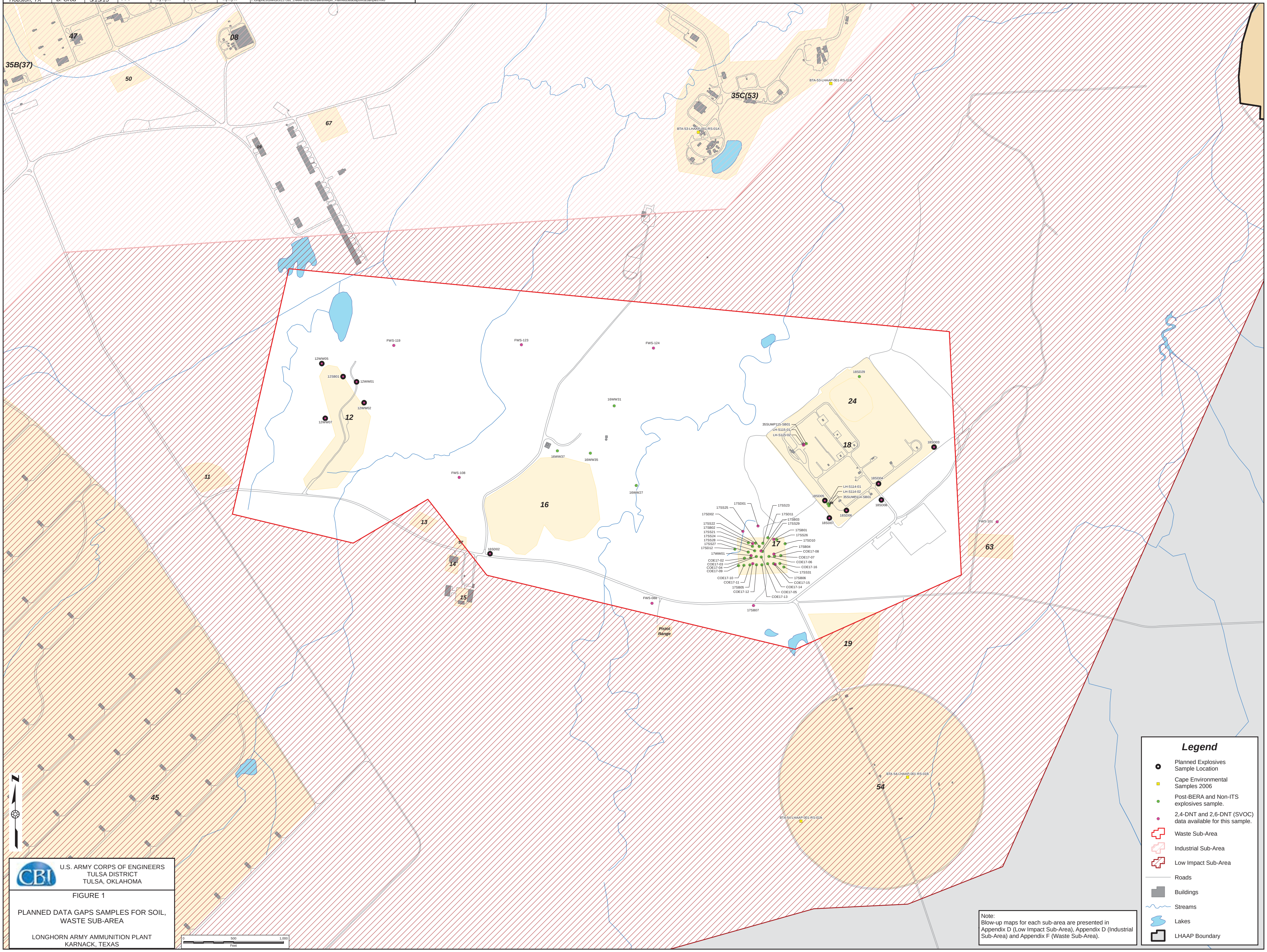
SOP #	TITLE
H&S Intro	Introduction to AGEISS Inc. Corporate Health and Safety Program
HS-1	Health and Safety Employee Compliance
HS-2	Meeting Occupational Safety and Health Administration (OSHA) Regulations
HS-3	Health and Safety Program Management
HS-4	Health and Safety Management of Subcontractors
HS-5	General Health and Safety Guidance
HS-6	Hazard Assessment and Control
HS-7	Respiratory Protection Program Plan
HS-8	Personal Protective Equipment Program Plan
HS-9	Health and Safety Training Program Plan
HS-10	Medical Surveillance Program Plan
HS-11	Bloodborne Pathogens Program Plan
HS-12	Hazard Communications Program Plan
HS-13	Site Health and Safety Plan
HS-14	Air Monitoring
HS-15	Confined-Space Program Plan
HS-16	Decontamination
HS-17	Site Control
HS-18	Emergency Preparedness
HS-19	Accident/Incident Investigation and Reporting
HS-20	Recordkeeping and Reporting
HS-21	Laboratory Audit Safety
HS-22	General Health and Safety Guidance for Natural Resource Projects
HS-23	Fall Protection
HS-24	Hearing Conservation and Noise Control

10.0 SITE CONTROL MEASURES

10.1 Site Maps

Site maps for the WSA (12 Samples), LISA (16 Samples), ISA (170 Samples), and HB (6 Samples), are provided below.

OFFICE	DRAWN BY		CHECKED BY		APPROVED BY		FILE PATH
Houston, TX	B. Grod	5/15/13	- - -	--/--/--	- - -	--/--/--	T:\Graphics\GIM\GIS\117591_LHAAP\Doc\Mxd\Bera\Wkpln_PlannedDataGapsWsaSamples.mxd



Note:
Blow-up maps for each sub-area are presented in Appendix D (Low Impact Sub-Area), Appendix D (Industrial Sub-Area) and Appendix F (Waste Sub-Area).

CBI

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

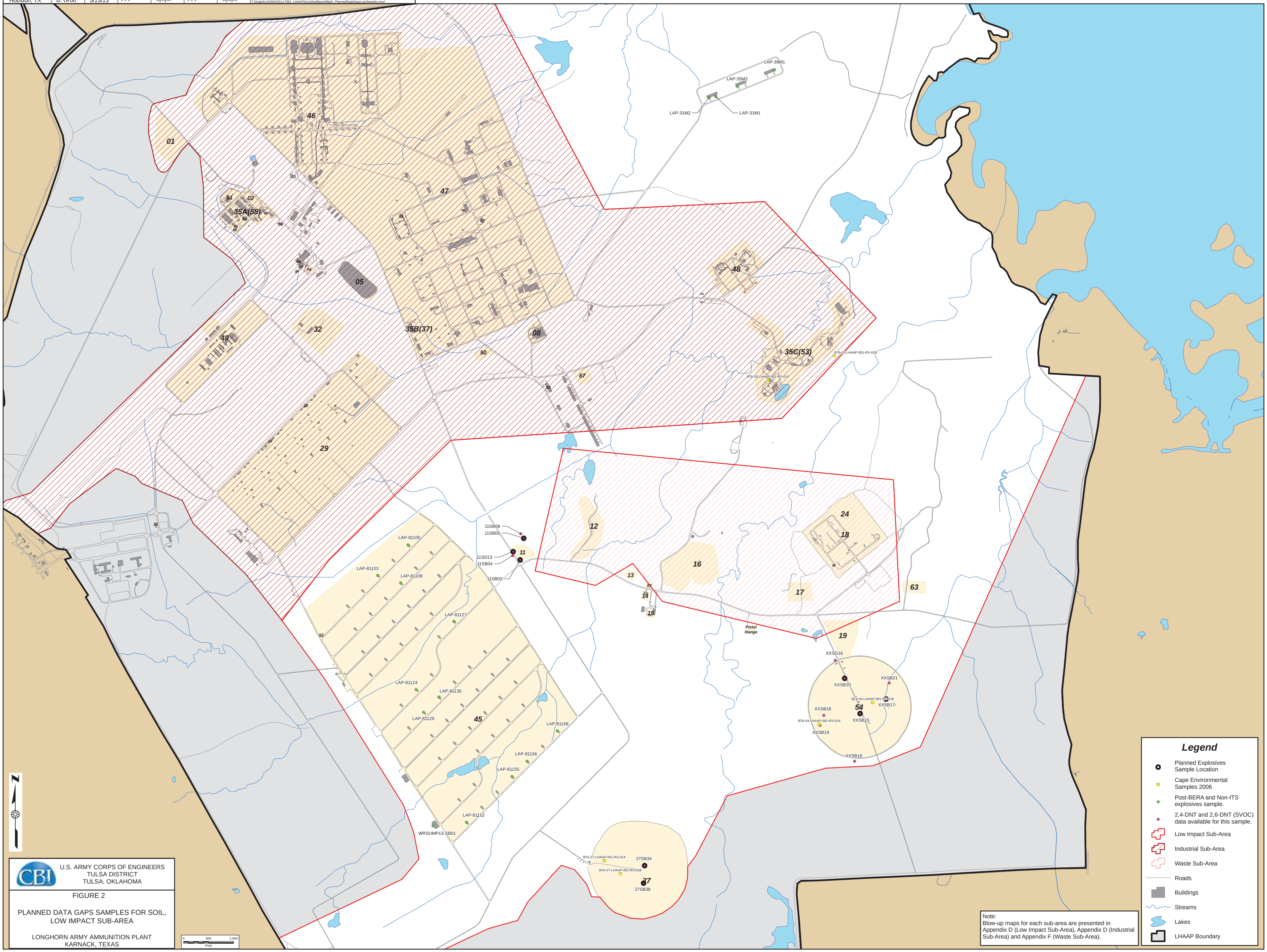
FIGURE 1

PLANNED DATA GAPS SAMPLES FOR SOIL, WASTE SUB-AREA

LONGHORN ARMY AMMUNITION PLANT
KARNACK, TEXAS

00188201

OFFICE	DRAWN BY		CHECKED BY		APPROVED BY		FILE PATH
Houston, TX	B. Grod	5/15/13	- - -	--/--/--	- - -	--/--/--	T:\Graphics\GIM\GIS\117591_LHAAP\Doc\Mxd\Bera\Wkpln_PlannedDataGapsLisaSamples.mxd



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

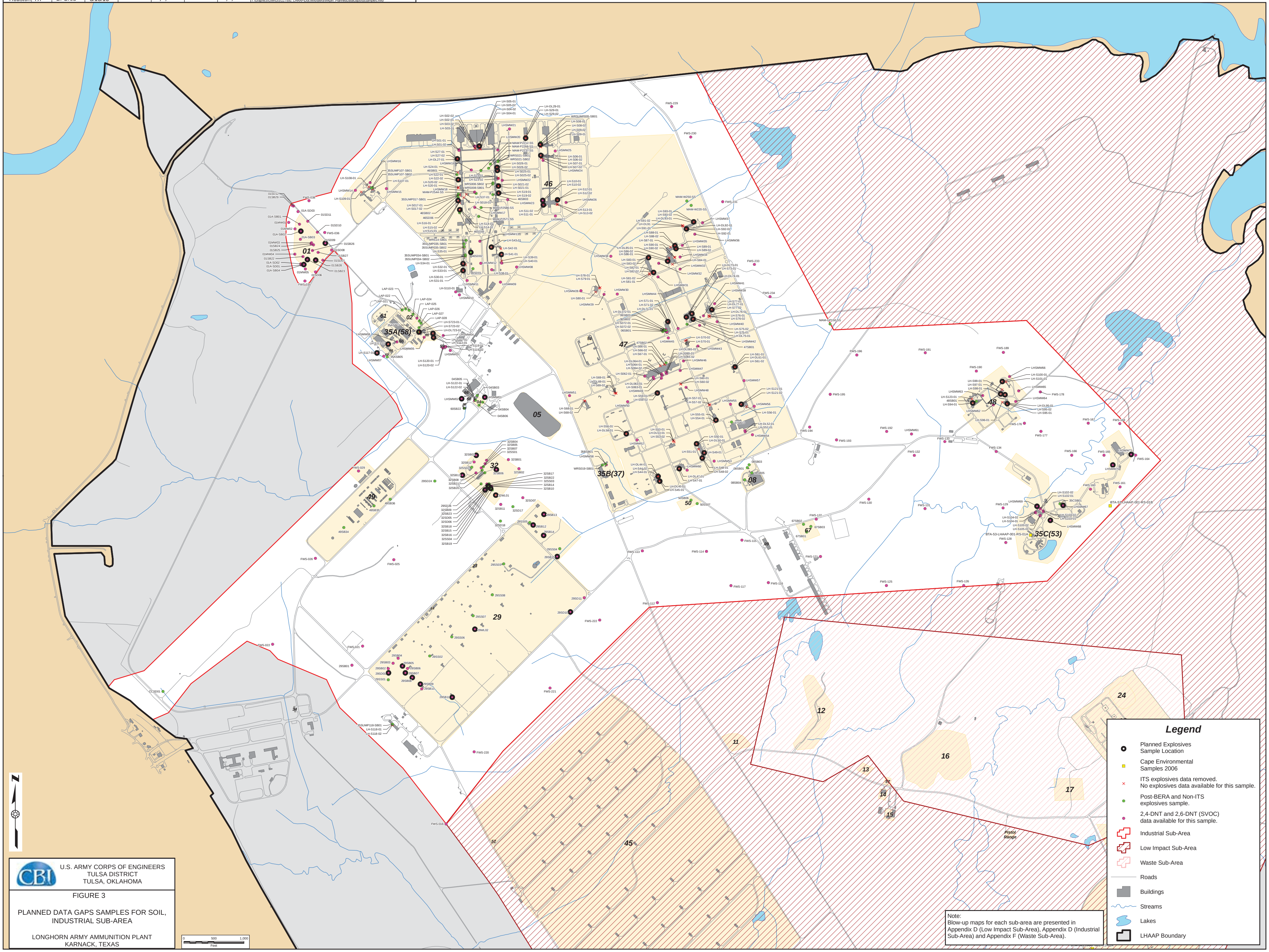
FIGURE 2

PLANNED DATA GAPS SAMPLES FOR SOIL, LOW IMPACT SUB-AREA

LONGHORN ARMY AMMUNITION PLANT
KARNACK, TEXAS

00188202

OFFICE	DRAWN BY		CHECKED BY		APPROVED BY		FILE PATH
Houston, TX	B. Grod	5/15/13	- - -	--/--/--	- - -	--/--/--	T:\Graphics\GIM\GIS\117591_LHAAP\Doc\Mxd\Bera\Wkpln_PlannedDataGapsIsaSamples.mxd



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

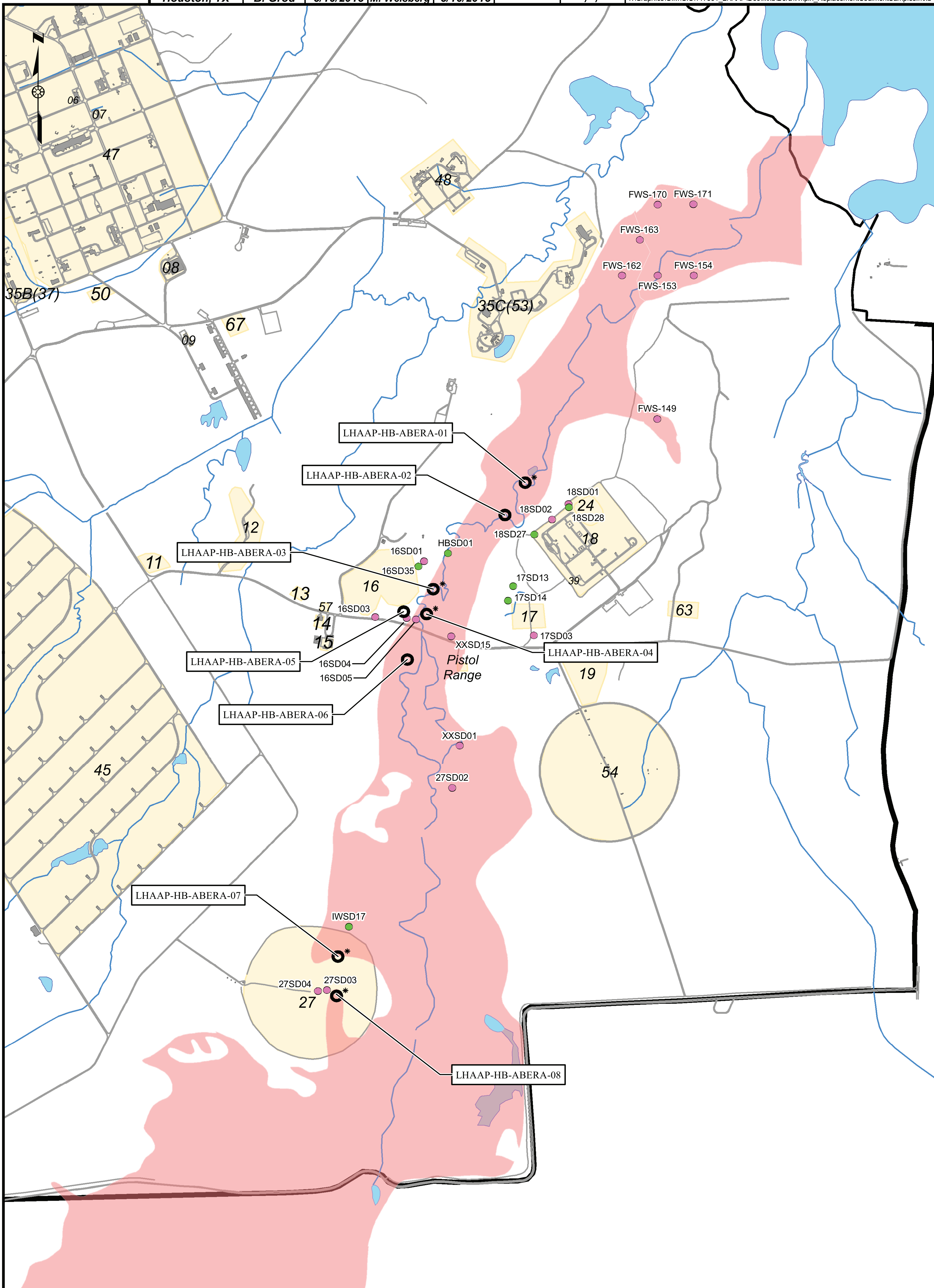
FIGURE 3

PLANNED DATA GAPS SAMPLES FOR SOIL, INDUSTRIAL SUB-AREA

LONGHORN ARMY AMMUNITION PLANT
KARNACK, TEXAS

This page is intentionally left blank.

OFFICE	DRAWN BY		CHECKED BY		APPROVED BY		FILE PATH
Houston, TX	B. Grod	5/16/2013	M. Weisberg	5/16/2013	---	--/--/--	T:\Graphics\GIM\GIS\117591_LHAAP\Doc\Mxd\Bera\Wkpln_ReplacementSedimentSamples.mxd



LEGEND

- Planned Explosives Sediment Sample Location
- Planned Explosives Surface Water Sample Location (if water present)
- Post-BERA and Non-ITS explosives Sample
- 2,4-DNT and 2,6-DNT (SVOC) data available for this sample
- Watershed
- Roads
- Buildings
- Streams
- Lakes
- LHAAP Boundary

0 650 1,300 2,600 Feet

CB&I

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

FIGURE 4

PLANNED REPLACEMENT SEDIMENT AND SURFACE WATER SAMPLES IN THE HARRISON BAYOU WATERSHED

LONGHORN ARMY AMMUNITION PLANT
KARNACK, TEXAS

10.2 Site Access

AGEISS shall gain access to the property from the Government through execution of a Right of Entry letter and/or coordination with the USACE – Tulsa District Project Manager and LHAAP Site Manager regarding proposed dates of field work. Gates to LHAAP are open during daylight hours and locked at night. Site 17 is within a locked area.

10.3 AGEISS Team Site Control Log

A log of personnel visiting, entering, or working on the site will be maintained at the site by the SSHO. The log will list the time, date, company or agency, and name of persons entering or exiting the site. Failure to comply with this site entry procedure will result in expulsion from the site. Visitors should check in immediately upon arrival. Each visitor will be required to provide and wear the necessary protective equipment during the visits and shall be escorted by AGEISS Team or official Government personnel. Visitors, subcontractors, and personnel entering the site area will be required to sign a safety plan acknowledgement form to certify that they have read, understand, and will comply with the APP and Safety and Health Plan.

10.4 Safe Behavior

The following items are requirements to protect the health and safety of workers and will be discussed in the safety briefing prior to initiating work on the site.

- Eating, drinking, chewing gum or tobacco, smoking, or any practice that increases the probability of hand-to-mouth transfer and ingestion of contaminants is prohibited in the site area.
- Hands and face must be washed upon leaving the site and before eating, drinking, chewing gum or tobacco, smoking, or other activities that may result in ingestion of contaminants.
- During site operations, each worker will consider himself as a safety backup to his partner. Off-site personnel provide emergency assistance. Site personnel will be aware of dangerous situations that may develop.
- Visual contact will be maintained between buddies on site when performing hazardous duties.
- No one will be admitted to the site without the proper safety equipment, training, and medical certification.
- Personnel must comply with established safety procedures. Any staff member who does not comply with safety policy as established by this plan, the SSHO or the Field Operations Leader, may be immediately dismissed from the site.
- Proper decontamination procedures must be followed before leaving the site.
- Employees and visitors must sign in and out of the site.

10.5 Buddy System

A “buddy system” will be implemented when conditions represent a risk to personnel that can be either physical or chemical. A buddy system requires that two or three people work as a team, each looking out for the other. “Buddies” must always be in each other’s line of sight and should maintain verbal or visual communication. No one must enter into the site area alone because hazards are likely to exist, which could render the employee helpless and prevent self-rescue.

10.6 Site Communication

TELEPHONES/RADIOS

While working away from the offices, AGEISS personnel will communicate with each other using personal cell phones or two-way radios. Emergency phone numbers are listed in this section.

HAND SIGNALS

Hand signals to be used in support of communications are as follows:

Hand gripping throat ....Out of air, can't breathe

Grip partners wrist or both hands around waist .... Leave area immediately

Hands on top of head...Need assistance

Thumbs up ....OK, I'm alright, I understand

Thumbs down...No Negative

10.7 Emergency Medical Assistance

Harrison County Emergency Phone Number: Dial 911 for all Emergency Services. Tell the 911 operator the emergency is on LHAAP.

11.0 PERSONAL HYGIENE AND DECONTAMINATION

Before eating, smoking, or drinking, personnel will wash hands, arms, neck, and face. The Field Operations Leader shall make washing facilities with soap and water available to employees performing sampling activities.

If contamination that poses a risk to human health is suspected, decontamination of personnel shall be performed to ensure that any material that personnel may have contacted is removed. Use the decontamination sequence listed below.

PPE removed will either be decontaminated or properly bagged to contain any contamination. All used disposable clothing will be placed in polyethylene bags, identified, dated, and stored at the property site pending disposal. Waterproof, non-disposable PPE will be properly decontaminated. Personnel exiting the site will utilize the following steps as appropriate to the specific work area:

Level D

Step 1: Remove gross contamination from boots. Remove and stack boots.
Step 2: Remove outer gloves.
Step 3: Remove hard hat.
Step 4: Thoroughly wash nitrile gloves to remove gross contamination.
Step 5: Wash hands, face, and neck before breaks and lunch.

12.0 EQUIPMENT DECONTAMINATION

Soiled or contaminated equipment will be cleaned between samples and prior to leaving.

13.0 EMERGENCY EQUIPMENT AND FIRST AID

First aid kits: First aid kits should be available in the vehicle carrying the sampling equipment. Personnel shall be trained in the proper use of the first aid supplies in the First Aid Kit. Inventory the kit monthly and replace expired items immediately. Carry a self-contained hand-held eye-wash bottle.

14.0 EMERGENCY RESPONSE PLAN

If there is an emergency that requires evacuation, take the following actions:

- No further entry of visitors, contractors, or trucks will be permitted. Vehicle traffic within the site will cease in order to allow safe exit of personnel and movement of emergency equipment.
- All on-site personnel assemble at the entrance to the site for accountability and await further instruction from the Field Operations Leader or Emergency Coordinator from the responding Emergency Response Services (e.g., Police or Fire Department).
- Persons in the site area will be accounted for by immediate supervisors. Leaders determine the safest exits and alternate exits for employees.
- Immediately after exiting, the Supervisor shall ensure that accountability has been conducted; then the supervisor or SSHO shall provide that information to the Emergency Coordinator.

14.1 Emergency Information

Harrison County Emergency Phone Number: *Dial 911* for all Emergency Services. Tell the 911 operator the emergency is on LHAAP

Harrison County Sheriff's Office ....(903)923-4000

County Fire Marshall ....(903) 935-4870

AGEISS – Denver Office (Patty Moonan) ....(303) 674-5059 X 125

AGEISS Program Manager – Melissa Russ ....(303) 300-9096 (Office)……..(303) 956-4171 (Cell)

AGEISS Assistant Program Manager – Garrett Smith ....(210) 863-1011 (Office/Cell)

AGEISS Project Manager – Jim Denier ....(303) 674-5059 X120 (Office) /(720) 201-5905 (Cell)

AGEISS Safety and Health Officer – Gina Agron .... (907) 726-1647/(907) 854-2333 (Cell)

AGEISS-CB&I Site Safety and Health Officer – ______________________________
[Insert Name and Contact Number]

Nearest Hospital Facility:

Good Shepherd Medical Center (20.8 miles from LHAAP)
811 South Washington Avenue
Marshall, TX 75670
(903) 927-6000

Other Resources:

TCEQ Spill-Reporting Hotline .... (800) 832-8224

National Response Center (oil and chemical spills) .... (800) 424-8802

Toxic Substances Control Act Hotline (TSCA) .... (202) 554-1404

Centers for Disease Control and Prevention .... (770) 488-7100

Pesticide Information Center .... (800) 858-7378

U.S. Environmental Protection Agency Emergency Response Team........ (800) 424-8802

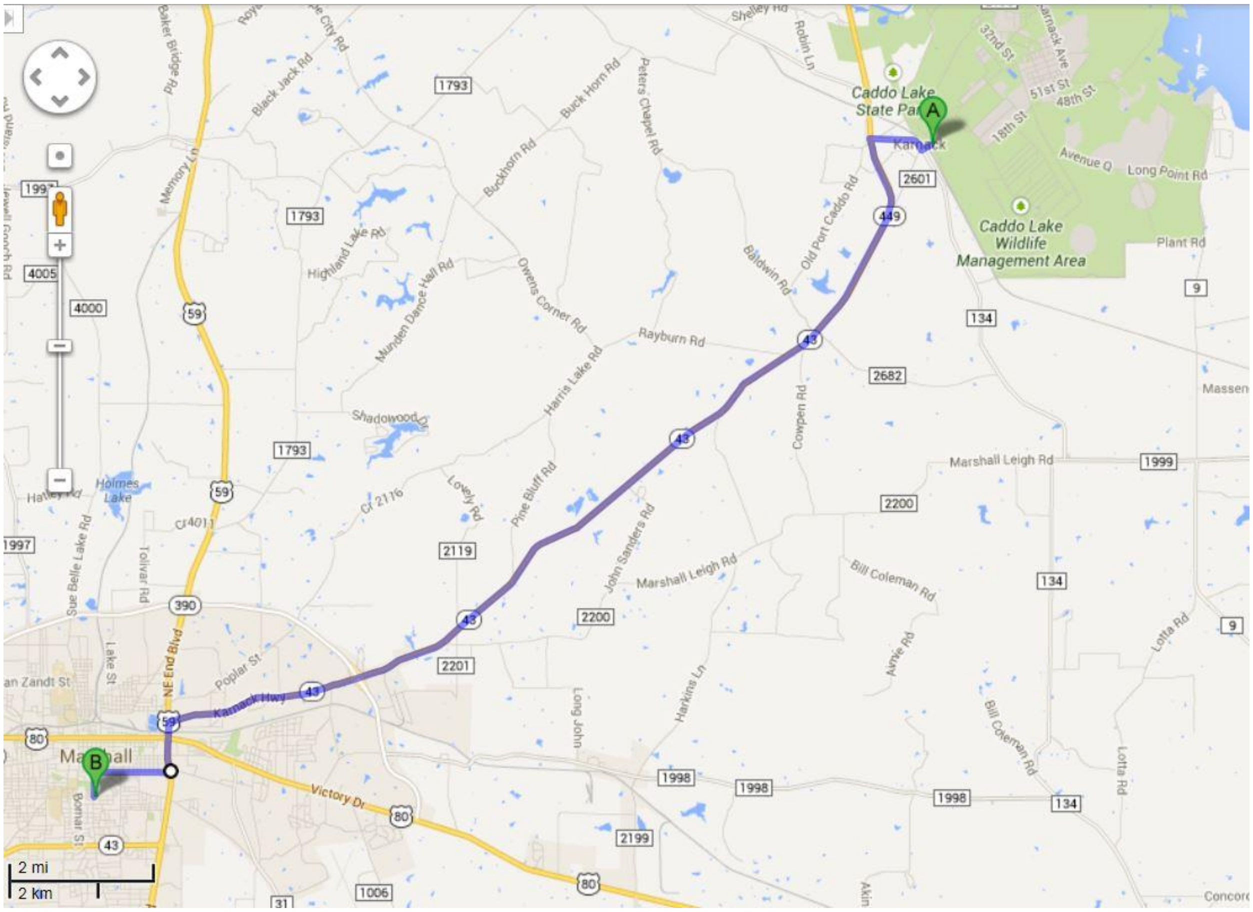
Bureau of Explosives .... (719) 584-7151

Poison Control Center (call from the local phone) .... (800) 222-1222

14.2 Emergency Routes

Emergency Routes: Route to Good Shepherd Medical Center (GSMC) in Marshall Texas is shown in Figure 5. Please note that the **GSMC is at least 35 minutes from the work site.**

Figure 5. Emergency Route to Good Shepherd Medical Center, Marshall, TX



Directions to Good Shepherd Medical Center from LHAAP:

1 Exit LHAAP (shown as Caddo Lake Wildlife Management Area on the map) and turn right on Farm to Market (FM) Road 134; drive 0.8 mile to intersection with TX-43 South.

2 Turn left onto TX-43 South toward Marshall; drive 13.9 miles south to intersection with US-59 South (NE End Boulevard).

3 Turn left onto US-59 South (NE End Boulevard); drive 0.7 mile to E Travis Street.

4 Turn right onto E Travis Street; drive 1.0 mile to S Washington Avenue.

5 Turn left onto S Washington Avenue; Good Sheperd Medical Center will be on the right.

15.0 SIGNATURE SHEETS

15.1 Hazardous Materials Review

D. ATSDR ToxFAQS and MSDS Review

All team members MUST have ample opportunity to review ATSDR ToxFAQs and MSDSs. These contain health and safety information that is important to every employee at AGEISS as cross-support is possible. By signing this form, you are certifying that you have read and understand the hazards and controls associated with the chemicals with which you work. AGEISS will support PPE requirements associated with potential hazards in the workplace. For additional information on hazards in the workplace, refer questions to the AGEISS SHO.

Team Member	Signature	Date

Program Manager Approval:		**AGEISS Site Safety and Health Officer Approval:**	
(Signature)	(Date)	(Signature)	(Date)

AGEISS Inc.

SAFETY AND HEALTH PLAN ACKNOWLEDGEMENT

September 2013

This Safety and Health Plan is generated to ensure AGEISS employees, associated government personnel, contractors, and customers and equipment/missions are protected. Through the implementation of this plan and the implementation of controls included in the Activity Hazard Analysis employees are provided operating procedures to protect themselves and equipment/missions; processes to obtain necessary safety training and report hazardous conditions; and information concerning their rights and responsibilities relative to AGEISS' occupational safety and health program.

____

AGEISS Project Manager

____

AGEISS Program Manager

____

AGEISS Safety and Health Coordinator

____

CB&I Project Manager

____

Tulsa Corps of Engineers Contracting Officer's Representative (COR)

____

Tulsa Corps of Engineers
Contracting Officer's Technical Representative (COTR)

This page is intentionally left blank.

ATTACHMENT C2

Activity Hazard Analysis

This page is intentionally left blank.

ACTIVITY HAZARD ANALYSIS

Date Prepared: 03/28/2013

AHA Number: 2013-01

Project Name: BERA Addendum, LHAAP, Karnack, TX

Activity/Work Task: Soil, Sediment and Surface Water Sampling

Dept./Div./Section: Safety and Health

Prepared by: Gina Agron, Jennifer Loos

Task Start Date:

Task Duration:

Task Supervisor: Site Project Manager

Reviewed by:

AGEISS INC. ENGINEERING & ENVIRONMENTAL SERVICES

Overall Risk Assessment Code (RAC): E

Risk Assessment Code Matrix

E=Extremely High Risk H=High Risk M=Moderate Risk L=Low Risk		Probability				
		Frequent	Likely	Occasional	Seldom	Unlikely
Severity	Catastrophic	E	E	H	H	M
	Critical	E	H	H	M	L
	Marginal	H	M	M	L	L
	Negligible	M	L	L	L	L

Job Steps	Identified Hazards	Actions to Eliminate or Minimize Hazards	RAC
Pre-mobilization for project site work	Presence of untrained/unqualified personnel on-site Lack of appropriate emergency equipment at the site.	All personnel actively participate in on-site APP, SHP, AHA, and HAZCOM training. Provide copy of SHP to subcontractors prior to arrival at site. Review LHAAP site-specific Munitions and Explosives of Concern (MEC)[1] safety video and pamphlet prior to arrival at site. Ensure all personnel can demonstrate proper wear of assigned PPE and know the location of replacement PPE. Ensure first aid supplies are readily available to site personnel and that personnel know the location of first aid supplies; replace supplies as needed. Ensure potable drinking water is available for all personnel for the duration of each day's planned activities. Advise personnel who are allergic to bees or wasps to bring emergency supplies in accordance with physician recommendations. Allergic personnel should notify SSHO of specific allergies and treatments.	L
Mobilize personnel, materials, equipment, and on-site communications to the job site	Eye Injuries, foot injuries, and hand injuries (struck by, caught between, pinch points, etc.)	All personnel attend daily site safety meeting; Follow APP, SHP, and AHA recommendations.	

Job Steps	Identified Hazards	Actions to Eliminate or Minimize Hazards	RAC
	Back strain	Follow safe lifting practices: use correct lifting postures, get help for large or awkward items, two-person lift for heavy items. Before departing, walk around the vehicle to be sure all equipment is secure. Use steel-toed boots and leather gloves.	
	Slips, trips, falls	Follow good housekeeping practices; remove trash. No tailgate riders.	
	Heat exposure	Ensure adequate water and rest breaks are provided. SSHO ensures first aid supplies are available and prepared for the site.	
	Potential for injury, bite, or sting.	SSHO ensures those requiring emergency supplies for stinging insects are properly equipped.	
Travel in vehicles (automobiles and light trucks) to, from, and at project site	Injuries, vehicle accident/damage	Inspect vehicles before driving for safe mechanical and operating condition, tire inflation, etc. Employ defensive driving procedures, wear seat belts when vehicles are in motion. Maintain a safe distance from people, other vehicles, and equipment when driving. Obey posted speed limits. Do not use handheld electronic devices while driving. Reduce speed during adverse driving conditions such as rain, fog, etc. Check line of sight; use a spotter to move vehicle when people, other vehicles, or equipment are in the immediate area. Walk around vehicle prior to moving between work areas to identify hazards such as equipment, obstacles, etc. Do not operate vehicles while under the influence of drugs or alcohol, or when fatigued. In the event of an accident call 911 for immediate assistance. Contact the SSHO. The SSHO shall contact the Project Manager and AGEISS Safety and Health on (907)854-2 333 once immediate assistance is rendered.	M
Work around moving vehicles or adjacent to roadways	Potential for personnel to be struck or run over by moving vehicles.	Ensure all personnel working in or near roadway or near moving vehicles wear reflective vests to maintain visibility. Ensure back-up alarms are working properly. Use traffic cones or safety tape to mark off work areas.	M

Job Steps	Identified Hazards	Actions to Eliminate or Minimize Hazards	RAC
		Always make eye-contact with equipment operators prior to approaching.	
Conduct site reconnaissance, visual site inspections, etc.	Presence of untrained/unqualified personnel on-site	Review site APP, SHP, and AHA prior to arrival at site; conduct/participate in site orientation meeting. Review USACE's MEC[1] safety video and pamphlet prior to arrival at site. Conduct/participate in daily safety or tail-gate meeting.	L
	Slips, trips and falls	Do not jump from elevated surfaces such as the bed of a pickup truck. Maintain three points of contact when exiting the bed of a pickup truck.	
	Heat stress related conditions such as: • Heat Cramps • Heat Exhaustion • Heat Stroke	Provide heat stress training to exposed employees. Allow personnel to gradually acclimate to hot environment. Provide access to shade. Provide potable drinking water for all personnel for the duration of each day's planned activities. Visually monitor personnel for signs of heat related stress. Take frequent breaks in shade or in air conditioned areas such as a vehicle. Rotate physically demanding tasks. Save most demanding work for cooler times of day. Use and employ the heat index chart to determine exposure risk. Use shade canopy over work area during hot weather.	
	• Sunburn	Use sunscreen and sun protective clothing; protect back of neck with hard hat liner.	
Perform soil, sediment, and surface water sampling using hand tools and petite ponar sampling device	Slips, trips and falls	Visually survey work areas prior to entering and select approach that avoids obstacles, slippery or uneven surfaces, etc.; remove or note locations of obstacles. Erect barricades or wrap safety tape around immovable obstacles in close proximity to sampling location. *DO NOT wrap safety tape around electrical support structures or conduits.* Keep work areas clear. Use caution when walking on wet, slippery, or uneven terrain.	L
	Hand injuries sustained from using hand tools such as knives, shovels, scoops, hand augers, hand auger buckets	Review soil and sediment sampling Task Hazard Analysis (THA) prior to performing sampling activity. Inspect tools before use for sharp edges, dull blades, pinch points, etc. Train employees on the proper use of the hand auger.	

Job Steps	Identified Hazards	Actions to Eliminate or Minimize Hazards	RAC
		Use properly wear assigned Level D PPE as appropriate, including:	
		- Foot protection (steel-toed boots) meeting ASTM F2413.05 standards	
		- Head protection - hard hat meeting ANSI Z89.1-1986 standards	
		- Hand protection - inner gloves: nitrile for chemical resistance; outer gloves: puncture/tear resistant	
		- Eye protection - glasses/goggles with side shields meeting ANSI Z87.1-2003, ANSI Z87.1-1989 (R-1998), or ANSI Z87.1-1989 standards	
		Choose an efficient hand auger, suited to the job, that can be managed easily; choose an ergonomically designed handle.	
		Employ hand movements that exert minimum pressure on wrist bones.	
		Adhere to sampling procedures described in the LHAAP SOPs.	
	Contact with contaminated soil and sediment and sampling equipment	Follow procedures described in the SHP. Use disposable gloves when handling sampling materials and equipment.	
		Follow equipment decontamination procedures described in the LHAAP SOPs.	
		Always wash hands after handling sampling equipment and before eating or drinking.	
	Strains due to handling heavy equipment and materials	Use safe lifting techniques, request assistance for heavy loads.	
		Bend at the knees.	
		Avoid twisting at the waist while handling a load.	
	Inclement weather - lightning, high wind, snow, rain, sleet, tornadoes	The SSHO will monitor weather conditions each day and plan site operations accordingly.	
		Identify/communicate locations of tornado shelters and evacuation routes.	
		Suspend outdoor activities when lightning/thunder are present; seek shelter inside vehicles, buildings, etc.	
	Biological: • Reptile bites (snakes) • Insect bites or stings (mosquitoes, bees, ticks, spiders)	Conduct an inspection of the site to identify stinging insect nests and mounds, and for the presence of snakes.	
		Look for reptiles, insects, spiders, etc. before reaching into holes, under rocks, or under wood piles, etc.	
		Use tick and insect repellents.	
		Check skin and clothing for ticks periodically throughout the work day and before showering.	
		Avoid walking through heavy brush.	
		Wear PPE; tape sleeve and trouser openings as necessary.	
		Consult professional exterminating companies if required.	

Job Steps	Identified Hazards	Actions to Eliminate or Minimize Hazards	RAC
		Keep first aid supplies readily available. Personnel who are allergic to bees or wasps shall bring emergency supplies in accordance with physician recommendations and notify SSHO of specific allergies and treatments.	
	Dermatitis arising from contact with poisonous plants (poison ivy, oak, and/or sumac)	Check work areas for poison ivy; avoid contact with poisonous plants.	
		Wear long sleeves and long pants.	
		Susceptible individuals may consider using protective skin creams.	
	Heat stress related conditions such as: • Heat Cramps	Provide potable drinking water for all personnel for the duration of each day's planned activities.	
	• Heat Exhaustion	Provide heat stress training to exposed employees in accordance with the site specific SHP.	
	• Heat Stroke	Allow personnel to gradually acclimate to hot environment.	
		Provide access to shade.	
		Visually monitor personnel for signs of heat related stress.	
		Take frequent breaks in shade or in air conditioned areas such as a vehicle.	
		Rotate physically demanding tasks.	
		Save most demanding work for cooler times of day.	
		Use and employ the heat index chart in the SHP to determine exposure risk.	
		Use shade canopy over work area during hot weather.	
	• Sunburn	Use sunscreen and sun protective clothing; protect back of neck with hard hat liner.	
	Injuries incurred while working around, in, and/or over water	Ensure at least three people are on-site ("buddy-team"; one person shall remain out of the water at all times) during sampling.	
		Select sampling sites with safe access and where stable footing may be maintained.	
		Wear foot protection.	
		Use a rod to check water depth and for obstacles prior to wading into water body.	
		Check water for snakes and wildlife.	
		Do not wade into water greater than knee depth.	
		Where possible, use dipper with extendable rod or handle to collect water samples.	
		Read and demonstrate understanding of Manufacturer's Instructions.	
		Inspect device for sharp edges; use work gloves when handling the device.	

Job Steps	Identified Hazards	Actions to Eliminate or Minimize Hazards	RAC
	Cuts, pinches, lifting from use of petite ponar device	Identify and avoid pinch points; use work gloves when handling device. Ensure the safety locking pin is in place prior to deploying. Lift properly, seek assistance if necessary. Take extra care to ensure stable footing.	
	Contact with contaminated surface water and sampling equipment	Follow procedures described in the SHP and QAPP for handling contaminated media and sampling equipment. Use disposable gloves when handling sampling materials and equipment. Follow equipment decontamination procedures described in the LHAAP SOPs. Wash hands after handling sampling equipment and before eating or drinking.	
Perform subsurface soil sampling using direct push drilling techniques at pre-cleared and previously sampled sites.	Striking overhead or underground obstructions, utilities, etc., while conducting intrusive drilling activities	The SSHO shall review the Environmental Remediation Drilling Safety Guideline http://www.ngwa.org/documents/erdsg.pdf Conduct utility clearance at least 48 hours and up to two weeks in advance of intrusive activity by contacting a Texas one-call system such as Texas 811. Visually survey work areas for the potential presence of underground power lines, cables, telephone lines, pipelines, sprinkler lines, sewer lines or other utilities. Maintain a minimum distance of 10 feet from underground lines. Visually survey work areas for overhead power lines, trees, or other features that could contact the drill rig mast. Maintain a minimum horizontal distance of 10 feet from overhead features.	M
	Drill rig positioning	Ensure the Drill Rig is equipped with a backup alarm that alerts workers to moving vehicles. When approaching operating equipment, approach from the front and within view of the operator, make eye contact.	

Job Steps	Identified Hazards	Actions to Eliminate or Minimize Hazards	RAC
	Injuries sustained while working around direct push drill rig such as: • Crushing when equipment is lowered • Rough edges or spaces on cables, cylinders may cause cuts and abrasions • Clothing could get entangled in cables or rotating parts • Eye injury due to flying particles, object	Use and properly wear assigned Level D PPE as appropriate, including: • Foot protection (steel-toed boots) meeting ASTM F2413.05 standards • Head Protection – Hard hat meeting ANSI Z89.1-1986 standards • Hand protection - inner gloves: nitrile for chemical resistance; outer gloves: puncture/tear resistant • Eye protection - glasses/goggles with side shields meeting ANSI Z87.1-2003, ANSI Z87.1-1989 (R-1998), or ANSI Z87.1-1989 standards Clarify the use of hand signals with the Drill Rig Operator. Establish a work zone radius of 10 feet around the drill rig. Set up work tables, decontamination areas, etc., outside the drill rig work zone. Personnel who are not operating the drill rig will not enter the work zone while it is in operation. Identify and communicate procedures for emergency shutdown of drill rig to on-site personnel (i.e., know location of emergency shutoff switch). Test and confirm proper functioning of drill rig emergency shutoff switch. Use safety glasses when the drill is actively in use. General prescription and sunglasses are not safety glasses. All safety glasses shall meet the requirements of ANSI.	
	• Damage to hearing from elevated noise levels	When appropriate, wear hearing protection such as ear plugs and ear muffs as required when the noise exposure is 85 dBA or greater over an 8-hour workday. Hearing protection shall meet the requirements of ANSI. SSHO shall coordinate with the Drilling Company Subcontractor to evaluate hearing protection requirements and implement appropriate hearing protection based on subcontractor recommendations. The project manager shall ensure appropriate hearing protection is available to personnel on-site.	
	Hazardous Energy	The SSHO shall ensure lockout/tagout procedures are implemented in accordance with the Drilling Subcontractor's site-specific SHP.	
	Slips, trips and falls	Visually survey work areas prior to entering and select approach that avoids obstacles, slippery or uneven surfaces, etc.; remove or note location of obstacles. Erect barricades or wrap safety tape around immovable obstacles in close proximity to sampling location. Keep work areas clear. Use caution when walking on wet, slippery, or uneven terrain.	

Job Steps	Identified Hazards	Actions to Eliminate or Minimize Hazards	RAC
Use of air monitoring equipment: photoionization detector (PID)	Injury due to misuse	Read and understand the Manufacturer's Operating Instructions, Operator Instructions, and Safety Precautions/Warnings.	L
	Electrical shock	Use ground fault circuit interrupter on power cord.	
		Regularly clean and maintain the instrument and accessories per manufacturer's instructions.	
		Clean the instrument only with a damp cloth; do not immerse in water.	
	Cuts from sharp edges	Inspect device for sharp edges; use work gloves when handling device as appropriate.	
	Burns from contact with PID lamp	Allow lamp to cool before replacing.	
	Exposure to volatile organic vapors during monitoring	If 5 ppm or greater is detected in the breathing zone, STOP WORK and immediately notify the AGEISS Project Manager.	
Use of water quality meters	Injury due to misuse	Read and understand the Manufacturer's Operating Instructions, Operator Instructions, and Safety Precautions/Warnings.	L
		Use the correct battery charger.	
	Electrical shock	Use ground fault circuit interrupter on power cord; avoid use in wet areas.	
		Regularly clean and maintain the instrument and accessories per manufacturer's instructions.	
		Clean the instrument only with a damp cloth; do not immerse in water.	
	Burns or skin irritation from contact with calibration solution	Read and understand the Manufacturer's Operating Instructions, Operator Instructions, and Safety Precautions/Warnings.	
		Use gloves when checking calibration or calibrating equipment.	
		Use minimum amount of calibration solution required.	
Field Equipment Cleaning and Decontamination	Contact with contaminated materials and sampling equipment	Perform decontamination activities in Level D PPE.	L
		Avoid splashing or spraying personnel during decontamination activities.	
		Manage decontamination wastewater in accordance with the project's Waste Management Plan for Investigation Derived Waste.	
	Slips, trips and falls	Avoid splashing/spilling water onto ground surface and creating slippery conditions.	
		Keep work areas clear.	
Use of Global Positioning System (GPS) hand-held units (e.g., Trimble Juno or GeoXH)	Injury due to misuse	Read and demonstrate understanding of the Manufacturer's Manual, including all safety precautions.	L
		Use the correct battery and battery charger.	

Job Steps	Identified Hazards	Actions to Eliminate or Minimize Hazards	RAC
	Burns or skin irritation from contact with battery fluid	Do not use or recharge battery if it appears to be damaged. Do not leave the GPS in a closed vehicle where it can overheat and damage the battery. Avoid contact with the rechargeable Lithium-ion battery if it appears to be leaking fluid.	
Sample handling, labeling, and packaging for shipment	Burns or skin irritation from contact with sample preservatives. Back strain from lifting sample coolers	Use disposable gloves when handling sample bottles. Use safe lifting techniques, request assistance for heavy loads. Bend at the knees. Avoid twisting while handling a load.	L

[1]As discussed at the August 23, 2012 Project Planning Meeting, there is no record of MEC at LHAAP sites 17 and 19 and it is not expected to be present.

Equipment and Supplies to Be Used	Inspection Requirements	Training Requirements
Air Monitoring Equipment (PID)	Before each use	Normal operations training – Competent Person
Decontamination Supplies	Daily	Normal operations training
GPS	Before each use	Normal operations training – Qualified Person
Hand Tools	Before each use	Normal operations training
Ice Chests	Before each use	Normal operations training
Potable water	Daily	Normal operations training
PPE	Daily	HAZWOPER – Competent Person

Involved Personnel: all on-site personnel

AHA	Activity Hazard Analysis
ANSI	American National Standards Institute
APP	Accident Prevention Plan
ASTM	American Society for Testing and Materials
BERA	Baseline Ecological Risk Assessment
CFR	Code of Federal Regulations
GPS	Global Positioning System
HAZCOM	Hazard Communication
HAZWOPER	Hazardous Waste Operations and Emergency Response Standard
L	Low Risk
LHAAP	Longhorn Army Ammunition Plant
M	Moderate Risk
OSHA	Occupational Safety and Health Administration
PID	photoionization detector
PPE	personal protective equipment
ppm	parts per million
RAC	Risk Assessment Code

SHP	Safety and Health Plan
SOP	Standard Operating Procedure
SSHO	Site Safety and Health Officer
THA	Task Hazard Analysis
UFP-QAPP	Uniform Federal Policy for Quality Assurance Project Plan
USACE	U.S. Army Corps of Engineers

ATTACHMENT C3

Hazardous Materials

This page is intentionally left blank.

ATSDR
AGENCY FOR TOXIC SUBSTANCES AND DISEASE REGISTRY

2,4,6-TRINITROTOLUENE (TNT) CAS # 118-96-7

Agency for Toxic Substances and Disease Registry ToxFAQs September 1996

This fact sheet answers the most frequently asked health questions (FAQs) about 2,4,6-trinitrotoluene. For more information, call the ATSDR Information Center at 1-888-422-8737. This fact sheet is one in a series of summaries about hazardous substances and their health effects. It's important you understand this information because this substance may harm you. The effects of exposure to any hazardous substance depend on the dose, the duration, how you are exposed, personal traits and habits, and whether other chemicals are present.

SUMMARY: Exposure to 2,4,6-trinitrotoluene occurs through eating, drinking, touching, or inhaling contaminated soil, water, food, or air. Health effects reported in people exposed to 2,4,6-trinitrotoluene include anemia, abnormal liver function, skin irritation, and cataracts. This substance has been found in at least 20 of the 1,430 National Priorities List sites identified by the Environmental Protection Agency.

What is 2,4,6-trinitrotoluene?

(Pronounced 2,4,6-trī′ nī′trō-tŏl′ yo͞o ēn)

2,4,6-Trinitrotoluene is a yellow, odorless solid that does not occur naturally in the environment. It is commonly known as TNT and is an explosive used in military shells, bombs, and grenades, in industrial uses, and in underwater blasting.

2,4,6-Trinitrotoluene production in the United States occurs solely at military arsenals.

What happens to 2,4,6-trinitrotoluene when it enters the environment?

- 2,4,6-Trinitrotoluene enters the environment in waste waters and solid wastes resulting from the manufacture of the compound, the processing and destruction of bombs and grenades, and the recycling of explosives.
- It moves in surface water and through soils to ground-water.
- In surface water, it is rapidly broken down into other chemical compounds by sunlight.
- It is broken down more slowly by microorganisms in water and sediment.
- Small amounts of it can accumulate in fish and plants.

How might I be exposed to 2,4,6-trinitrotoluene?

- Drinking contaminated water that has migrated from chemical waste disposal sites.
- Breathing contaminated air.
- Eating contaminated foods such as fruits and vegetables.
- Eating contaminated soil.

How can 2,4,6-trinitrotoluene affect my health?

Workers involved in the production of explosives who were exposed to high concentrations of 2,4,6-trinitrotoluene in workplace air experienced several harmful health effects, including anemia and abnormal liver function.

Similar blood and liver effects, as well as spleen enlargement and other harmful effects on the immune system, have been observed in animals that ate or breathed 2,4,6-trinitrotoluene.

Other effects in humans include skin irritation after prolonged skin contact, and cataract development after long-term (365 days or longer) exposure.

ToxFAQs Internet address via WWW is http://www.atsdr.cdc.gov/toxfaq.html

It is not known whether 2,4,6-trinitrotoluene can cause birth defects in humans. However, male animals treated with high doses of 2,4,6-trinitrotoluene have developed serious reproductive system effects.

How likely is 2,4,6-trinitrotoluene to cause cancer?

The EPA has determined that 2,4,6-trinitrotoluene is a possible human carcinogen. This assessment was based on a study in which rats that ate 2,4,6-trinitrotoluene for long periods developed tumors of the urinary bladder.

Is there a medical test to show whether I've been exposed to 2,4,6-trinitrotoluene?

Laboratory tests can detect 2,4,6-trinitrotoluene or its breakdown products in blood or urine. Detection of its breakdown products in urine is a clear indication of exposure. This test isn't available at most doctors' offices, but can be done at special laboratories that have the right equipment.

A simpler, but less specific test of 2,4,6-trinitrotoluene exposure is a change in the color of urine to amber or deep red due to the presence of its breakdown products. However, none of these tests can predict whether a person will experience any health effects.

Has the federal government made recommendations to protect human health?

Since 2,4,6-trinitrotoluene is explosive, flammable, and toxic, EPA has designated it as a hazardous waste.

The Department of Transportation (DOT) specifies that when 2,4,6-trinitrotoluene is shipped, it must be wet with at least 10% water (by weight) and it must be clearly labeled as a flammable solid.

The Occupational Safety and Health Administration (OSHA) set a maximum level of 1.5 milligrams of 2,4,6-trinitrotoluene per cubic meter of workplace air (1.5 mg/m^3) for an 8-hour workday for a 40-hour workweek.

The National Institute for Occupational Safety and Health (NIOSH) and the American Conference of Governmental Industrial Hygienists (ACGIH) recommend an exposure limit of 0.5 mg/m^3 in workplace air for a 40-hour workweek.

Glossary

Anemia: A decreased ability of the blood to transport oxygen.

Breakdown product: A substance that is formed when a chemical breaks down in the body.

Carcinogen: A substance that can cause cancer.

CAS: Chemical Abstracts Service.

Cataract: Clouding of the lens or capsule of the eye, causing partial or total blindness.

Milligram (mg): One thousandth of a gram.

References

Agency for Toxic Substances and Disease Registry (ATSDR). 1995. Toxicological profile for 2,4,6-trinitrotoluene (update). Atlanta, GA: U.S. Department of Health and Human Services, Public Health Service.

Where can I get more information? For more information, contact the Agency for Toxic Substances and Disease Registry, Division of Toxicology, 1600 Clifton Road NE, Mailstop F-32, Atlanta, GA 30333. Phone:1-888-422-8737, FAX: 770-488-4178. ToxFAQs Internet address via WWW is http://www.atsdr.cdc.gov/toxfaq.html ATSDR can tell you where to find occupational and environmental health clinics. Their specialists can recognize, evaluate, and treat illnesses resulting from exposure to hazardous substances. You can also contact your community or state health or environmental quality department if you have any more questions or concerns.

ATSDR
AGENCY FOR TOXIC SUBSTANCES AND DISEASE REGISTRY

LEAD

CAS # 7439-92-1

Division of Toxicology and Environmental Medicine ToxFAQs™ August 2007

This fact sheet answers the most frequently asked health questions (FAQs) about lead. For more information, call the ATSDR Information Center at 1-800-232-4636. This fact sheet is one in a series of summaries about hazardous substances and their health effects. It is important you understand this information because this substance may harm you. The effects of exposure to any hazardous substance depend on the dose, the duration, how you are exposed, personal traits and habits, and whether other chemicals are present.

HIGHLIGHTS: Exposure to lead can happen from breathing workplace air or dust, eating contaminated foods, or drinking contaminated water. Children can be exposed from eating lead-based paint chips or playing in contaminated soil. Lead can damage the nervous system, kidneys, and reproductive system. Lead has been found in at least 1,272 of the 1,684 National Priority List sites identified by the Environmental Protection Agency (EPA).

What is lead?

Lead is a naturally occurring bluish-gray metal found in small amounts in the earth's crust. Lead can be found in all parts of our environment. Much of it comes from human activities including burning fossil fuels, mining, and manufacturing.

Lead has many different uses. It is used in the production of batteries, ammunition, metal products (solder and pipes), and devices to shield X-rays. Because of health concerns, lead from paints and ceramic products, caulking, and pipe solder has been dramatically reduced in recent years. The use of lead as an additive to gasoline was banned in 1996 in the United States.

What happens to lead when it enters the environment?

- ❏ Lead itself does not break down, but lead compounds are changed by sunlight, air, and water.
- ❏ When lead is released to the air, it may travel long distances before settling to the ground.
- ❏ Once lead falls onto soil, it usually sticks to soil particles.
- ❏ Movement of lead from soil into groundwater will depend on the type of lead compound and the characteristics of the soil.

How might I be exposed to lead?

- ❏ Eating food or drinking water that contains lead. Water pipes in some older homes may contain lead solder. Lead can leach out into the water.
- ❏ Spending time in areas where lead-based paints have been used and are deteriorating. Deteriorating lead paint can contribute to lead dust.
- ❏ Working in a job where lead is used or engaging in certain hobbies in which lead is used, such as making stained glass.
- ❏ Using health-care products or folk remedies that contain lead.

How can lead affect my health?

The effects of lead are the same whether it enters the body through breathing or swallowing. Lead can affect almost every organ and system in your body. The main target for lead toxicity is the nervous system, both in adults and children. Long-term exposure of adults can result in decreased performance in some tests that measure functions of the nervous system. It may also cause weakness in fingers, wrists, or ankles. Lead exposure also causes small increases in blood pressure, particularly in middle-aged and older people and can cause anemia. Exposure to high lead levels can severely damage the brain and kidneys in adults or children and ultimately cause death. In pregnant women, high levels of exposure to lead may cause miscarriage. High-level exposure in men can damage the organs responsible for sperm production.

How likely is lead to cause cancer?

We have no conclusive proof that lead causes cancer in humans. Kidney tumors have developed in rats and mice that had been given large doses of some kind of lead compounds. The Department of Health and Human Services

(DHHS) has determined that lead and lead compounds are reasonably anticipated to be human carcinogens and the EPA has determined that lead is a probable human carcinogen. The International Agency for Research on Cancer (IARC) has determined that inorganic lead is probably carcinogenic to humans and that there is insufficient information to determine whether organic lead compounds will cause cancer in humans.

How can lead affect children?

Small children can be exposed by eating lead-based paint chips, chewing on objects painted with lead-based paint, or swallowing house dust or soil that contains lead.

Children are more vulnerable to lead poisoning than adults. A child who swallows large amounts of lead may develop blood anemia, severe stomachache, muscle weakness, and brain damage. If a child swallows smaller amounts of lead, much less severe effects on blood and brain function may occur. Even at much lower levels of exposure, lead can affect a child's mental and physical growth.

Exposure to lead is more dangerous for young and unborn children. Unborn children can be exposed to lead through their mothers. Harmful effects include premature births, smaller babies, decreased mental ability in the infant, learning difficulties, and reduced growth in young children. These effects are more common if the mother or baby was exposed to high levels of lead. Some of these effects may persist beyond childhood.

How can families reduce the risks of exposure to lead?

❑ Avoid exposure to sources of lead.

❑ Do not allow children to chew or mouth surfaces that may have been painted with lead-based paint.

❑ If you have a water lead problem, run or flush water that has been standing overnight before drinking or cooking with it.

❑ Some types of paints and pigments that are used as make-up or hair coloring contain lead. Keep these kinds of products away from children

❑ If your home contains lead-based paint or you live in an area contaminated with lead, wash children's hands and faces often to remove lead dusts and soil, and regularly clean the house of dust and tracked in soil.

Is there a medical test to determine whether I've been exposed to lead?

A blood test is available to measure the amount of lead in your blood and to estimate the amount of your recent exposure to lead. Blood tests are commonly used to screen children for lead poisoning. Lead in teeth or bones can be measured by X-ray techniques, but these methods are not widely available. Exposure to lead also can be evaluated by measuring erythrocyte protoporphyrin (EP) in blood samples. EP is a part of red blood cells known to increase when the amount of lead in the blood is high. However, the EP level is not sensitive enough to identify children with elevated blood lead levels below about 25 micrograms per deciliter (μg/dL). These tests usually require special analytical equipment that is not available in a doctor's office. However, your doctor can draw blood samples and send them to appropriate laboratories for analysis.

Has the federal government made recommendations to protect human health?

The Centers for Disease Control and Prevention (CDC) recommends that states test children at ages 1 and 2 years. Children should be tested at ages 3–6 years if they have never been tested for lead, if they receive services from public assistance programs for the poor such as Medicaid or the Supplemental Food Program for Women, Infants, and Children, if they live in a building or frequently visit a house built before 1950; if they visit a home (house or apartment) built before 1978 that has been recently remodeled; and/or if they have a brother, sister, or playmate who has had lead poisoning. CDC considers a blood lead level of 10 μg/dL to be a level of concern for children.

EPA limits lead in drinking water to 15 μg per liter.

References

Agency for Toxic Substances and Disease Registry (ATSDR). 2007. Toxicological Profile for lead (Update). Atlanta, GA: U.S. Department of Public Health and Human Services, Public Health Service.

Where can I get more information? For more information, contact the Agency for Toxic Substances and Disease Registry, Division of Toxicology and Environmental Medicine, 1600 Clifton Road NE, Mailstop F-32, Atlanta, GA 30333. Phone: 1-800-232-4636, FAX: 770-488-4178. ToxFAQs Internet address via WWW is http://www.atsdr.cdc.gov/toxfaq.html. ATSDR can tell you where to find occupational and environmental health clinics. Their specialists can recognize, evaluate, and treat illnesses resulting from exposure to hazardous substances. You can also contact your community or state health or environmental quality department if you have any more questions or concerns.

ATSDR
AGENCY FOR TOXIC SUBSTANCES AND DISEASE REGISTRY

MERCURY
CAS # 7439-97-6

Agency for Toxic Substances and Disease Registry ToxFAQs **April 1999**

This fact sheet answers the most frequently asked health questions (FAQs) about mercury. For more information, call the ATSDR Information Center at 1-888-422-8737. This fact sheet is one in a series of summaries about hazardous substances and their health effects. It's important you understand this information because this substance may harm you. The effects of exposure to any hazardous substance depend on the dose, the duration, how you are exposed, personal traits and habits, and whether other chemicals are present.

HIGHLIGHTS: Exposure to mercury occurs from breathing contaminated air, ingesting contaminated water and food, and having dental and medical treatments. Mercury, at high levels, may damage the brain, kidneys, and developing fetus. This chemical has been found in at least 714 of 1,467 National Priorities List sites identified by the Environmental Protection Agency.

What is mercury?
(Pronounced mŭ̃r′kyə-rē)

Mercury is a naturally occurring metal which has several forms. The metallic mercury is a shiny, silver-white, odorless liquid. If heated, it is a colorless, odorless gas.

Mercury combines with other elements, such as chlorine, sulfur, or oxygen, to form inorganic mercury compounds or "salts," which are usually white powders or crystals. Mercury also combines with carbon to make organic mercury compounds. The most common one, methylmercury, is produced mainly by microscopic organisms in the water and soil. More mercury in the environment can increase the amounts of methylmercury that these small organisms make.

Metallic mercury is used to produce chlorine gas and caustic soda, and is also used in thermometers, dental fillings, and batteries. Mercury salts are sometimes used in skin lightening creams and as antiseptic creams and ointments.

What happens to mercury when it enters the environment?

- ❑ Inorganic mercury (metallic mercury and inorganic mercury compounds) enters the air from mining ore deposits, burning coal and waste, and from manufacturing plants.
- ❑ It enters the water or soil from natural deposits, disposal of wastes, and volcanic activity.
- ❑ Methylmercury may be formed in water and soil by small organisms called bacteria.
- ❑ Methylmercury builds up in the tissues of fish. Larger and older fish tend to have the highest levels of mercury.

How might I be exposed to mercury?

- ❑ Eating fish or shellfish contaminated with methylmercury.
- ❑ Breathing vapors in air from spills, incinerators, and industries that burn mercury-containing fuels.
- ❑ Release of mercury from dental work and medical treatments.
- ❑ Breathing contaminated workplace air or skin contact during use in the workplace (dental, health services, chemical, and other industries that use mercury).
- ❑ Practicing rituals that include mercury.

How can mercury affect my health?

The nervous system is very sensitive to all forms of mercury. Methylmercury and metallic mercury vapors are more harmful than other forms, because more mercury in these forms reaches the brain. Exposure to high levels of metallic, inorganic, or organic mercury can permanently damage the brain, kidneys, and developing fetus. Effects on brain functioning may result in irritability, shyness, tremors, changes in vision or hearing, and memory problems.

Short-term exposure to high levels of metallic mercury vapors may cause effects including lung damage, nausea, vomiting, diarrhea, increases in blood pressure or heart rate, skin rashes, and eye irritation.

How likely is mercury to cause cancer?

There are inadequate human cancer data available for all forms of mercury. Mercuric chloride has caused increases in several types of tumors in rats and mice, and methylmercury has caused kidney tumors in male mice. The EPA has determined that mercuric chloride and methylmercury are possible human carcinogens.

How can mercury affect children?

Very young children are more sensitive to mercury than adults. Mercury in the mother's body passes to the fetus and may accumulate there. It can also can pass to a nursing infant through breast milk. However, the benefits of breast feeding may be greater than the possible adverse effects of mercury in breast milk.

Mercury's harmful effects that may be passed from the mother to the fetus include brain damage, mental retardation, incoordination, blindness, seizures, and inability to speak. Children poisoned by mercury may develop problems of their nervous and digestive systems, and kidney damage.

How can families reduce the risk of exposure to mercury?

Carefully handle and dispose of products that contain mercury, such as thermometers or fluorescent light bulbs. Do not vacuum up spilled mercury, because it will vaporize and increase exposure. If a large amount of mercury has been spilled, contact your health department. Teach children not to play with shiny, silver liquids.

Properly dispose of older medicines that contain mercury. Keep all mercury-containing medicines away from children.

Pregnant women and children should keep away from rooms where liquid mercury has been used.

Learn about wildlife and fish advisories in your area from your public health or natural resources department.

Is there a medical test to show whether I've been exposed to mercury?

Tests are available to measure mercury levels in the body. Blood or urine samples are used to test for exposure to metallic mercury and to inorganic forms of mercury. Mercury in whole blood or in scalp hair is measured to determine exposure to methylmercury. Your doctor can take samples and send them to a testing laboratory.

Has the federal government made recommendations to protect human health?

The EPA has set a limit of 2 parts of mercury per billion parts of drinking water (2 ppb).

The Food and Drug Administration (FDA) has set a maximum permissible level of 1 part of methylmercury in a million parts of seafood (1 ppm).

The Occupational Safety and Health Administration (OSHA) has set limits of 0.1 milligram of organic mercury per cubic meter of workplace air (0.1 mg/m^3) and 0.05 mg/m^3 of metallic mercury vapor for 8-hour shifts and 40-hour work weeks.

References

Agency for Toxic Substances and Disease Registry (ATSDR). 1999. Toxicological profile for mercury. Atlanta, GA: U.S. Department of Health and Human Services, Public Health Service.

Where can I get more information? For more information, contact the Agency for Toxic Substances and Disease Registry, Division of Toxicology, 1600 Clifton Road NE, Mailstop F-32, Atlanta, GA 30333. Phone: 1-888-422-8737, FAX: 770-488-4178. ToxFAQs Internet address via WWW is http://www.atsdr.cdc.gov/toxfaq.html ATSDR can tell you where to find occupational and environmental health clinics. Their specialists can recognize, evaluate, and treat illnesses resulting from exposure to hazardous substances. You can also contact your community or state health or environmental quality department if you have any more questions or concerns.

ATSDR
AGENCY FOR TOXIC SUBSTANCES AND DISEASE REGISTRY

METHYLENE CHLORIDE
CAS # 75-09-2

Division of Toxicology ToxFAQs™ **February 2001**

This fact sheet answers the most frequently asked health questions (FAQs) about methylene chloride. For more information, call the ATSDR Information Center at 1-888-422-8737. This fact sheet is one in a series of summaries about hazardous substances and their health effects. It's important you understand this information because this substance may harm you. The effects of exposure to any hazardous substance depend on the dose, the duration, how you are exposed, personal traits and habits, and whether other chemicals are present.

HIGHLIGHTS: Exposure to methylene chloride occurs mostly from breathing contaminated air, but may also occur through skin contact or by drinking contaminated water. Breathing in large amounts of methylene chloride can damage the central nervous system. Contact of eyes or skin with methylene chloride can result in burns. Methylene chloride has been found in at least 882 of 1,569 National Priorities List sites identified by the Environmental Protection Agency (EPA).

What is methylene chloride?

Methylene chloride is a colorless liquid with a mild, sweet odor. Another name for it is dichloromethane. Methylene chloride does not occur naturally in the environment.

Methylene chloride is used as an industrial solvent and as a paint stripper. It may also be found in some aerosol and pesticide products and is used in the manufacture of photographic film.

What happens to methylene chloride when it enters the environment?

❑ Methylene chloride is mainly released to the environment in air. About half of the methylene chloride in air disappears in 53 to 127 days.

❑ Methylene chloride does not easily dissolve in water, but small amounts may be found in drinking water.

❑ We do not expect methylene chloride to build up in plants or animals.

How might I be exposed to methylene chloride?

❑ The most likely way to be exposed to methylene chloride is by breathing contaminated air.

❑ Breathing the vapors given off by products containing methylene chloride. Exposure to high levels of methylene chloride is likely if methylene chloride or a product containing it is used in a room with inadequate ventilation.

How can methylene chloride affect my health?

If you breathe in large amounts of methylene chloride you may feel unsteady, dizzy, and have nausea and a tingling or numbness of your finger and toes. A person breathing smaller amounts of methylene chloride may become less attentive and less accurate in tasks requiring hand-eye coordination. Skin contact with methylene chloride causes burning and redness of the skin.

How likely is methylene chloride to cause cancer?

We do not know if methylene chloride can cause cancer in humans. An increased cancer risk was seen in mice breathing large amounts of methylene chloride for a long time.

The World Health Organization (WHO) has determined that methylene chloride may cause cancer in humans.

The Department of Health and Human Services (DHHS) has determined that methylene chloride can be reasonably anticipated to be a cancer-causing chemical.

The EPA has determined that methylene chloride is a probable cancer-causing agent in humans.

How can methylene chloride affect children?

It is likely that health effects seen in children exposed to high amounts of methylene chloride will be similar to the effects seen in adults. We do not know if methylene chloride can affect the ability of people to have children or if it causes birth defects. Some birth defects have been seen in animals inhaling very high levels of methylene chloride.

How can families reduce the risk of exposure to methylene chloride?

❑ Families may be exposed to methylene chloride while using products such as paint removers. Such products should always be used in well-ventilated areas and skin contact should be avoided.
❑ Children should not be allowed to remain near indoor paint removal activities.

Is there a medical test to show whether I've been exposed to methylene chloride?

❑ Several tests can measure exposure to methylene chloride. These tests are not routinely available in your doctor's office.
❑ Methylene chloride can be detected in the air you breathe out and in your blood. These tests are only useful for detecting exposures that have occurred within a few days.
❑ It is also possible to measure carboxyhemoglobin (a chemical formed in the blood as methylene chloride breaks down in the body) in the blood or formic acid (a breakdown product of methylene chloride) in the urine. These tests are not specific for methylene chloride.

Has the federal government made recommendations to protect human health?

❑ The EPA requires that releases of methylene chloride of 1,000 pounds or more be reported to the federal government.
❑ The EPA recommends that exposure of children to methylene chloride be limited to less than 10 milligrams per liter of drinking water (10 mg/L) for 1 day or 2 mg/L for 10 days.
❑ The Food and Drug Administration (FDA) has established limits on the amounts of methylene chloride that can remain after processing of spices, hops extract, and decaffeinated coffee.
❑ The Occupational Safety and Health Administration (OSHA) has set limits of 25 parts methylene chloride per million parts of workplace air (25 ppm) for 8-hour shifts and 40-hour work weeks.

References

Agency for Toxic Substances and Disease Registry (ATSDR). 2000. Toxicological Profile for methylene chloride. Atlanta, GA: U.S. Department of Health and Human Services, Public Health Service.

Where can I get more information? For more information, contact the Agency for Toxic Substances and Disease Registry, Division of Toxicology, 1600 Clifton Road NE, Mailstop F-32, Atlanta, GA 30333. Phone: 1-888-422-8737, FAX: 770-488-4178. ToxFAQs™ Internet address is http://www.atsdr.cdc.gov/toxfaq.html . ATSDR can tell you where to find occupational and environmental health clinics. Their specialists can recognize, evaluate, and treat illnesses resulting from exposure to hazardous substances. You can also contact your community or state health or environmental quality department if you have any more questions or concerns.

ATSDR
AGENCY FOR TOXIC SUBSTANCES AND DISEASE REGISTRY

PERCHLORATES

CAS # 10034-81-8, 7778-74-7, 7790-98-9, 7601-89-0, 7791-03-9

Division of Toxicology and Environmental Medicine ToxFAQs™ **September 2008**

This fact sheet answers the most frequently asked health questions (FAQs) about perchlorates. For more information, call the ATSDR Information Center at 1-800-232-4636. This fact sheet is one in a series of summaries about hazardous substances and their health effects. It is important you understand this information because these substances may harm you. The effects of exposure to any hazardous substance depend on the dose, the duration, how you are exposed, personal traits and habits, and whether other chemicals are present.

HIGHLIGHTS: Solid perchlorates can be very reactive chemicals that are used mainly in fireworks, explosives, and rocket motors. Consumption of food and water containing perchlorates are the most relevant routes of exposure for the general population. Efforts are being made to determine the relative contribution of perchlorate from food and water. High levels of perchlorates can affect the thyroid gland, which in turn can alter the function of many organs in the body. The fetus and young children can be especially susceptible. Perchlorates have been found in at least 49 of the 1,581 National Priorities List sites identified by the Environmental Protection Agency (EPA).

What are perchlorates?

Perchlorates are colorless salts that have no odor. There are five perchlorate salts that are manufactured in large amounts: magnesium perchlorate, potassium perchlorate, ammonium perchlorate, sodium perchlorate, and lithium perchlorate. Perchlorate salts are solids that dissolve easily in water.

One place where perchlorates occur naturally is in western Texas and in saltpeter deposits in Chile, where the saltpeter is used to make fertilizer. Perchlorates can also form naturally in the atmosphere, leading to trace levels of perchlorate in precipitation. Perchlorates can be very reactive chemicals that are used mainly in explosives, fireworks, road flares, and rocket motors. The solid booster rocket of the space shuttle is almost 70% ammonium perchlorate.

Perchlorates are also used for making other chemicals. Many years ago, perchlorates were used as a medication to treat an overactive thyroid gland.

What happens to perchlorates when they enter the environment?

❏ Perchlorates entered the environment where rockets were made, tested, and taken apart.

❏ Perchlorates also enter the environment from fireworks, road safety flares, and through the use and disposal of consumer products such as bleach where perchlorate may be contained as an impurity. There is also evidence that there are natural sources of perchlorates in the environment.

❏ Factories that make or use perchlorates may also release them to soil and water.

❏ Perchlorates will not stay in soil and will wash away with rain water.

❏ Perchlorates will eventually end up in ground water.

❏ We do not know exactly how long perchlorates will last in water and soil, but the information available indicates that it is a very long time.

❏ Efforts to clean up the contamination of soil and water have been and continue to be made.

❏ Perchlorates have been found in many foods and in some drinking water supplies.

How might I be exposed to perchlorates?

❏ Eating food, milk, or drinking water contaminated with perchlorates. Recent studies have shown widespread exposure to low levels of perchlorate by the general population. Efforts are being made to determine the relative contribution of perchlorate from food and water.

❏ Living near factories that make fireworks, flares, or other explosive devices.

❏ Exposure before and after fireworks shows, or exposure during use of certain cleaning products and pool chemicals.

❏ Chewing tobacco may expose you to perchlorates because a variety of tobacco products contain perchlorates.

❏ Living near a waste site or a rocket manufacturing or testing facility that contains high levels of perchlorate in the soil or groundwater may expose you to higher levels.

ToxFAQs™ Internet address is http://www.atsdr.cdc.gov/toxfaq.html

How can perchlorates affect my health?

The health effects of perchlorate salts are due to the perchlorate itself and not to the other component (i.e., magnesium, ammonium, potassium, etc.). Perchlorate affects the ability of the thyroid gland to take up iodine. Iodine is needed to make hormones that regulate many body functions after they are released into the blood. Perchlorate's inhibition of iodine uptake must be great enough to affect the thyroid before it is considered harmful. Healthy volunteers who took about 35 milligrams (35 mg) of perchlorate every day for 14 days or 3 mg for 6 months showed no signs of abnormal functioning of their thyroid gland or any other health problem. Studies of workers exposed for years to approximately the same amount of perchlorates found no evidence of alterations in the worker's thyroids, livers, kidneys, or blood. However, there is concern that people exposed to higher amounts of perchlorate for a long time may develop a low level of thyroid activity; the name of this medical condition is hypothyroidism. Low levels of thyroid hormones in the blood may lead to adverse effects on the skin, cardiovascular system, pulmonary system, kidneys, gastrointestinal tract, liver, blood, neuromuscular system, nervous system, skeleton, male and female reproductive system, and numerous endocrine organs. Studies in animals also have shown that the thyroid gland is the main target of toxicity for perchlorate. Perchlorate did not affect reproduction in a study in rats.

Other chemicals such as thiocyanate (in food and cigarette smoke) and nitrate (in some food), are known to inhibit iodide uptake.

How likely are perchlorates to cause cancer?

There are no studies of exposure to perchlorates and cancer in humans. Long-term exposure to perchlorates induced thyroid cancer in rats and mice, but there are reasons to believe that humans are less likely than rodents to develop this type of cancer. The National Academy of Sciences (NAS) concluded that it is unlikely that perchlorates pose a risk of thyroid cancer in humans. Perchlorates have not been classified for carcinogenic effects by the Department of Health and Human Services (DHHS) or the International Agency for Research on Cancer (IARC). The EPA determined that perchlorate is not likely to be carcinogenic to humans, at least at doses below those necessary to alter thyroid hormone homeostasis.

How can perchlorates affect children?

The most sensitive population is fetuses of pregnant women who might have hypothyroidism or iodide deficiency

Infants and developing children may be more likely to be affected by perchlorates than adults because thyroid hormones are essential for normal growth and development.

Perchlorate has been found in breast milk. Studies of thyroid function of babies and young children whose mothers were exposed to perchlorate in their drinking water have not provided convincing evidence of thyroid abnormalities associated with perchlorate.

Studies in animals have shown that perchlorate can alter the thyroid gland in the newborn animals.

How can families reduce the risk of exposure to perchlorates?

- ❏ Although perchlorate is present in food, milk and drinking water, it is very unlikely that it will be present in the air of the average home or apartment.
- ❏ Use bottled water if you have concerns about the presence of perchlorates in your tap water.
- ❏ You may also contact local drinking water authorities and follow their advice.
- ❏ Prevent children from playing in dirt or eating dirt if you live near a waste site that has perchlorates.

Is there a medical test to show whether I've been exposed to perchlorates?

Perchlorate can be measured in the blood, urine, and breast milk with special tests. In a CDC study, perchlorate was found in urine of all the people who were sampled across the country. Because perchlorate leaves the body fairly rapidly, perchlorate in urine only indicates recent exposure, but as perchlorate is present in some foods and in some drinking water supplies, exposure to perchlorate may be frequent for some people.

Has the federal government made recommendations to protect human health?

EPA adopted a Reference Dose (RfD) for perchlorate in 2005, and issued guidance regarding the cleanup of perchlorate at Superfund sites in 2006. EPA is currently evaluating whether there is a meaningful opportunity to reduce health risk through national drinking water regulation for perchlorate.

Reference

Agency for Toxic Substances and Disease Registry (ATSDR). 2008. Toxicological Profile for Perchlorates. Atlanta, GA: U.S. Department of Health and Human Services, Public Health Service.

Where can I get more information? For more information, contact the Agency for Toxic Substances and Disease Registry, Division of Toxicology and Environmental Medicine, 1600 Clifton Road NE, Mailstop F-32, Atlanta, GA 30333. Phone: 1-800-232-4636, FAX: 770-488-4178. ToxFAQs Internet address via WWW is http://www.atsdr.cdc.gov/toxfaq.html. ATSDR can tell you where to find occupational and environmental health clinics. Their specialists can recognize, evaluate, and treat illnesses resulting from exposure to hazardous substances. You can also contact your community or state health or environmental quality department if you have any more questions or concerns.

ATSDR
AGENCY FOR TOXIC SUBSTANCES AND DISEASE REGISTRY

TRICHLOROETHYLENE

CAS # 79-01-6

Division of Toxicology ToxFAQs™ July 2003

This fact sheet answers the most frequently asked health questions (FAQs) about trichloroethylene. For more information, call the ATSDR Information Center at 1-888-422-8737. This fact sheet is one in a series of summaries about hazardous substances and their health effects. This information is important because this substance may harm you. The effects of exposure to any hazardous substance depend on the dose, the duration, how you are exposed, personal traits and habits, and whether other chemicals are present.

HIGHLIGHTS: Trichloroethylene is a colorless liquid which is used as a solvent for cleaning metal parts. Drinking or breathing high levels of trichloroethylene may cause nervous system effects, liver and lung damage, abnormal heartbeat, coma, and possibly death. Trichloroethylene has been found in at least 852 of the 1,430 National Priorities List sites identified by the Environmental Protection Agency (EPA).

What is trichloroethylene?

Trichloroethylene (TCE) is a nonflammable, colorless liquid with a somewhat sweet odor and a sweet, burning taste. It is used mainly as a solvent to remove grease from metal parts, but it is also an ingredient in adhesives, paint removers, typewriter correction fluids, and spot removers.

Trichloroethylene is not thought to occur naturally in the environment. However, it has been found in underground water sources and many surface waters as a result of the manufacture, use, and disposal of the chemical.

What happens to trichloroethylene when it enters the environment?

- Trichloroethylene dissolves a little in water, but it can remain in ground water for a long time.
- Trichloroethylene quickly evaporates from surface water, so it is commonly found as a vapor in the air.
- Trichloroethylene evaporates less easily from the soil than from surface water. It may stick to particles and remain for a long time.
- Trichloroethylene may stick to particles in water, which will cause it to eventually settle to the bottom sediment.
- Trichloroethylene does not build up significantly in plants and animals.

How might I be exposed to trichloroethylene?

- Breathing air in and around the home which has been contaminated with trichloroethylene vapors from shower water or household products such as spot removers and typewriter correction fluid.
- Drinking, swimming, or showering in water that has been contaminated with trichloroethylene.
- Contact with soil contaminated with trichloroethylene, such as near a hazardous waste site.
- Contact with the skin or breathing contaminated air while manufacturing trichloroethylene or using it at work to wash paint or grease from skin or equipment.

How can trichloroethylene affect my health?

Breathing small amounts may cause headaches, lung irritation, dizziness, poor coordination, and difficulty concentrating.

Breathing large amounts of trichloroethylene may cause impaired heart function, unconsciousness, and death. Breathing it for long periods may cause nerve, kidney, and liver damage.

Drinking large amounts of trichloroethylene may cause nausea, liver damage, unconsciousness, impaired heart function, or death.

Drinking small amounts of trichloroethylene for long periods may cause liver and kidney damage, impaired immune system function, and impaired fetal development in pregnant women, although the extent of some of these effects is not yet clear.

Skin contact with trichloroethylene for short periods may cause skin rashes.

How likely is trichloroethylene to cause cancer?

Some studies with mice and rats have suggested that high levels of trichloroethylene may cause liver, kidney, or lung cancer. Some studies of people exposed over long periods to high levels of trichloroethylene in drinking water or in workplace air have found evidence of increased cancer. Although, there are some concerns about the studies of people who were exposed to trichloroethylene, some of the effects found in people were similar to effects in animals.

In its 9th Report on Carcinogens, the National Toxicology Program (NTP) determined that trichloroethylene is "reasonably anticipated to be a human carcinogen." The International Agency for Research on Cancer (IARC) has determined that trichloroethylene is "probably carcinogenic to humans."

Is there a medical test to show whether I've been exposed to trichloroethylene?

If you have recently been exposed to trichloroethylene, it can be detected in your breath, blood, or urine. The breath test, if it is performed soon after exposure, can tell if you have been exposed to even a small amount of trichloroethylene.

Exposure to larger amounts is assessed by blood and urine tests, which can detect trichloroethylene and many of its breakdown products for up to a week after exposure. However, exposure to other similar chemicals can produce the same breakdown products, so their detection is not absolute proof of exposure to trichloroethylene. This test isn't available at most doctors' offices, but can be done at special laboratories that have the right equipment.

Has the federal government made recommendations to protect human health?

The EPA has set a maximum contaminant level for trichloroethylene in drinking water at 0.005 milligrams per liter (0.005 mg/L) or 5 parts of TCE per billion parts water.

The EPA has also developed regulations for the handling and disposal of trichloroethylene.

The Occupational Safety and Health Administration (OSHA) has set an exposure limit of 100 parts of trichloroethylene per million parts of air (100 ppm) for an 8-hour workday, 40-hour workweek.

Glossary

Carcinogenicity: The ability of a substance to cause cancer.
CAS: Chemical Abstracts Service.
Evaporate: To change into a vapor or gas.
Milligram (mg): One thousandth of a gram.
Nonflammable: Will not burn.
ppm: Parts per million.
Sediment: Mud and debris that have settled to the bottom of a body of water.
Solvent: A chemical that dissolves other substances.

References

This ToxFAQs information is taken from the 1997 Toxicological Profile for Trichloroethylene (update) produced by the Agency for Toxic Substances and Disease Registry, Public Health Service, U.S. Department of Health and Human Services, Public Health Service in Atlanta, GA.

Where can I get more information? For more information, contact the Agency for Toxic Substances and Disease Registry, Division of Toxicology, 1600 Clifton Road NE, Mailstop F-32, Atlanta, GA 30333. Phone: 1-888-422-8737, FAX: 770-488-4178. ToxFAQs™ Internet address is http://www.atsdr.cdc.gov/toxfaq.html . ATSDR can tell you where to find occupational and environmental health clinics. Their specialists can recognize, evaluate, and treat illnesses resulting from exposure to hazardous substances. You can also contact your community or state health or environmental quality department if you have any more questions or concerns.

ATTACHMENT C4

Hazard Communication Plan

This page is intentionally left blank.

00188242

DRAFT FINAL

BASELINE ECOLOGICAL RISK ASSESSMENT ADDENDUM LONGHORN ARMY AMMUNITION PLANT, KARNACK, TEXAS

HAZARD COMMUNICATION PLAN

Contract No. W912BV-10-D-2010

Task Order 0004

PREPARED FOR:

U.S. Army Corps of Engineers, Tulsa District
1645 South 101 East Avenue
Tulsa, OK 74128

PREPARED BY:

AGEISS Inc.
1202 Bergen Parkway, Suite 310
Evergreen, CO 80439

September 2013
Revision 0

This page is intentionally left blank.

TABLE OF CONTENTS

Section **Page**

ABBREVIATION / ACRONYM LIST

AGEISS	AGEISS Inc.
ATSDR	Agency for Toxic Substances and Disease Registry
CB&I	Chicago Bridge and Iron, Inc.
HAZCOM	Hazard Communication
LHAAP	Longhorn Army Ammunition Plant
MSDS	material safety data sheet
OSHA	Occupational Safety and Health Administration
S&H	safety and health
SDS	safety data sheet
Shaw	Shaw Environmental & Infrastructure Group
SHO	Safety and Health Officer
SSHO	Site Safety and Health Officer

1.0 INTRODUCTION

This Hazard Communication Plan (HAZCOM Plan) is developed to prevent injuries and protect the health of AGEISS Inc. (AGEISS) and CB&I (formerly Shaw Environmental & Infrastructure Group [Shaw]) employees, referred to as the AGEISS Team, and of those personnel the AGEISS Team may encounter while conducting sampling activities.

2.0 HAZARD COMMUNICATION STANDARD

The following model Hazard Communication Program is based on the requirements of the Occupational Safety and Health Administration (OSHA) Hazard Communications Standard, 29 CFR 1910.1200.

3.0 COMPANY POLICY

To ensure that information about the dangers of all hazardous chemicals used by the AGEISS Team is known by all affected employees, the following hazardous information program has been established. Under this program, you will be informed of the contents of the OSHA Hazard Communications standard, the hazardous properties of chemicals with which you work, safe handling procedures and measures to take to protect yourself from these chemicals.

This program applies to all work operations under Contract Number W912BV-10-D-2010, Task Order 0004 at Longhorn Army Ammunition Plant (LHAAP) where you may be exposed to hazardous chemicals under normal working conditions or during an emergency situation. All AGEISS Team employees will participate in the Hazard Communication Program. Copies of the Hazard Communication Program are available on-site for review by any interested employee. The Site Project Manager has overall responsibility for the program, including reviewing and updating this plan as necessary.

4.0 CONTAINER LABELING

The Site Safety and Health Officer (SSHO) will verify that any and all containers received for use will be clearly labeled as to the contents, note the appropriate hazard warning, and list the manufacturer's name and address.

The SSHO will ensure that all secondary containers are labeled with either an extra copy of the original manufacturer's label or with labels marked with the identity and the appropriate hazard warning.

The SSHO will review the company labeling procedures every month and will update labels as required.

5.0 MATERIAL SAFETY DATA SHEETS/SAFETY DATA SHEETS/ATSDR ToxFAQs

The SSHO is responsible for establishing and monitoring the company material safety data sheet/safety data sheet (MSDS/SDS) program. He/she will ensure that procedures are developed to obtain the necessary MSDSs and will review incoming MSDSs for new or significant health and safety information. He/she will see that any new information is communicated to affected employees.

Copies of MSDSs for all hazardous chemicals to which employees are exposed or are potentially exposed will be maintained on-site for review. MSDSs will be readily available to all employees during each work shift. If an MSDS is not available, contact the AGEISS Safety and Health Officer (SHO).

Hazardous materials information will be readily available to employees in each work area in hard (paper) copy provided by Manufacturer or Agency for Toxic Substances and Disease Registry (ATSDR).

When revised MSDSs are received, old MSDSs shall be replaced and employees made aware during daily safety meetings.

6.0 EMPLOYEE TRAINING AND INFORMATION

The Project Manager is responsible for the Hazard Communication Program and will ensure that all program elements are carried out.

Everyone who works with or is potentially exposed to hazardous chemicals will receive initial training on the hazard communication standard and this plan before starting work. Each new employee will attend a safety and health (S&H) orientation that includes the following information and training:

- An overview of the OSHA hazard communication standard
- The hazardous chemicals present at his/her work area
- The physical and health risks of the hazardous chemicals
- Symptoms of overexposure
- How to determine the presence or release of hazardous chemicals in the work area
- How to reduce or prevent exposure to hazardous chemicals through use of control procedures, work practices, and personal protective equipment
- Steps the company has taken to reduce or prevent exposure to hazardous chemicals
- Procedures to follow if employees are overexposed to hazardous chemicals
- How to read labels and MSDSs to obtain hazard information
- Location of the MSDS file and written Hazard Communication program

Prior to introducing a new chemical hazard, each employee will be given information and training as outlined above for the new chemical hazard.

7.0 HAZARDOUS NON-ROUTINE TASKS

Periodically, employees are required to perform non-routine tasks that are hazardous. Prior to starting work on such projects, each affected employee will be given information by their immediate supervisor and/or the SSHO about the hazardous chemicals he or she may encounter during such activity. This information will include specific chemical hazards, protective and safety measures the employee should use, and steps the company is taking to reduce the hazards, including ventilation, respirators, the presence of another employee (buddy systems), and emergency procedures.

8.0 INFORMING OTHER EMPLOYERS/CONTRACTORS

It is the responsibility of the Project Manager to provide other employers and contractors with information about hazardous chemicals that their employees may be exposed to on a job site and suggested precautions for employees. It is the responsibility of SSHO to obtain information about hazardous chemicals used by other employers to which employees of this company may be exposed.

Other employers and contractors will be provided with MSDSs for hazardous chemicals possibly encountered or used by the AGEISS Team.

In addition to providing a copy of an MSDS to other employers, other employers will be informed of necessary precautionary measures to protect employees exposed to operations performed by this company.

9.0 LIST OF HAZARDOUS CHEMICALS

The primary contaminants that may be encountered on-site are lead, mercury, trichloroethene, trinitrotoluene, methylene chloride, and ammonium perchlorates. The ATSDR ToxFAQs are attached to this Work Plan as Attachment 3. A current MSDS/SDS for chemicals used by our employees and brought to the site will be attached to this plan with a cover sheet that includes the name of the chemical, the manufacturer, the work area in which the chemical is used, dates of use, and quantity used.

10.0 PROGRAM AVAILABILITY

A copy of this program will be made available, upon request, to employees and their representatives.

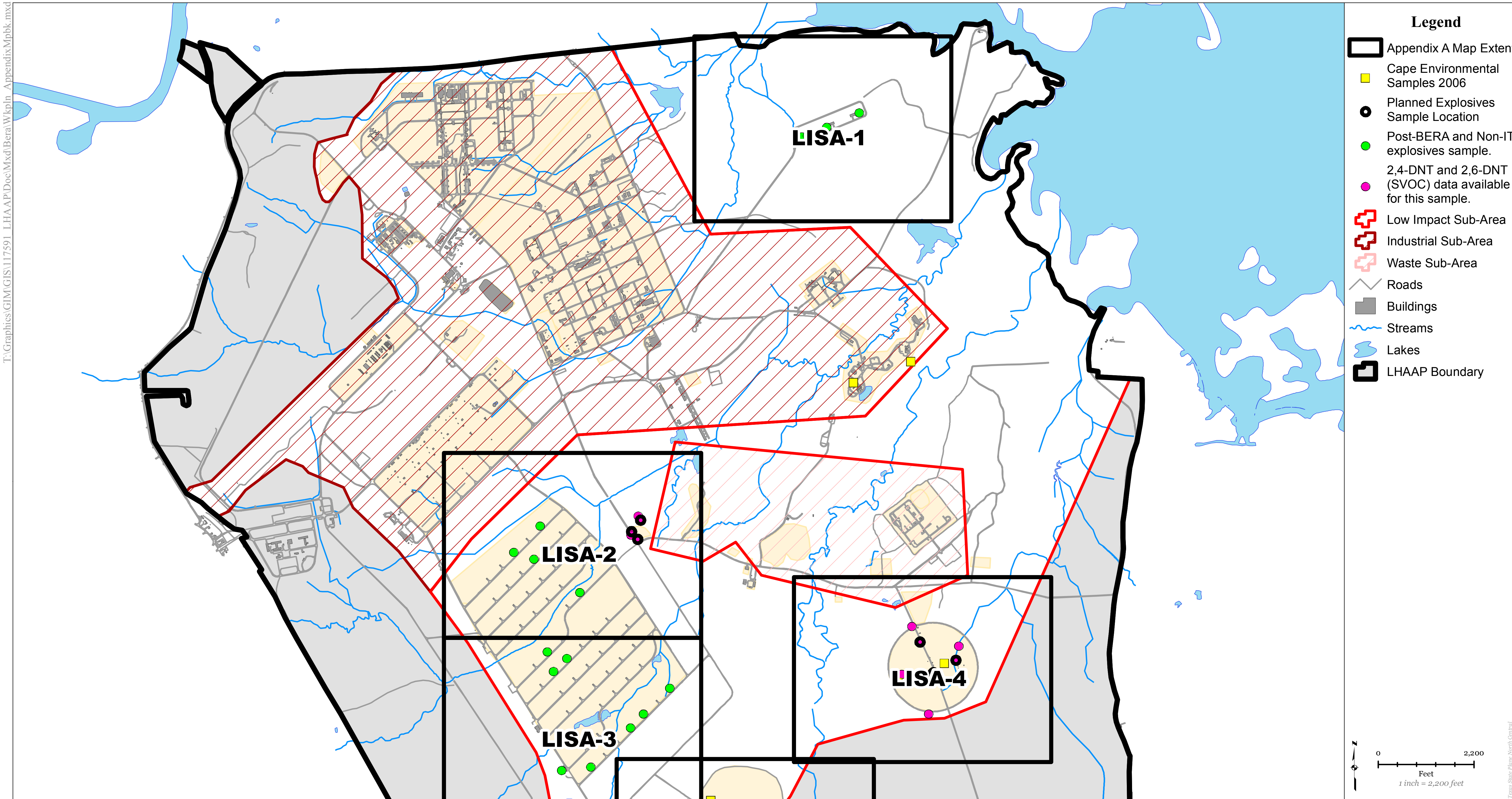
This page is intentionally left blank.

APPENDIX D

Large Scale Maps of Low Impact Sub-Area Sample Locations

This page is intentionally left blank.

00188252



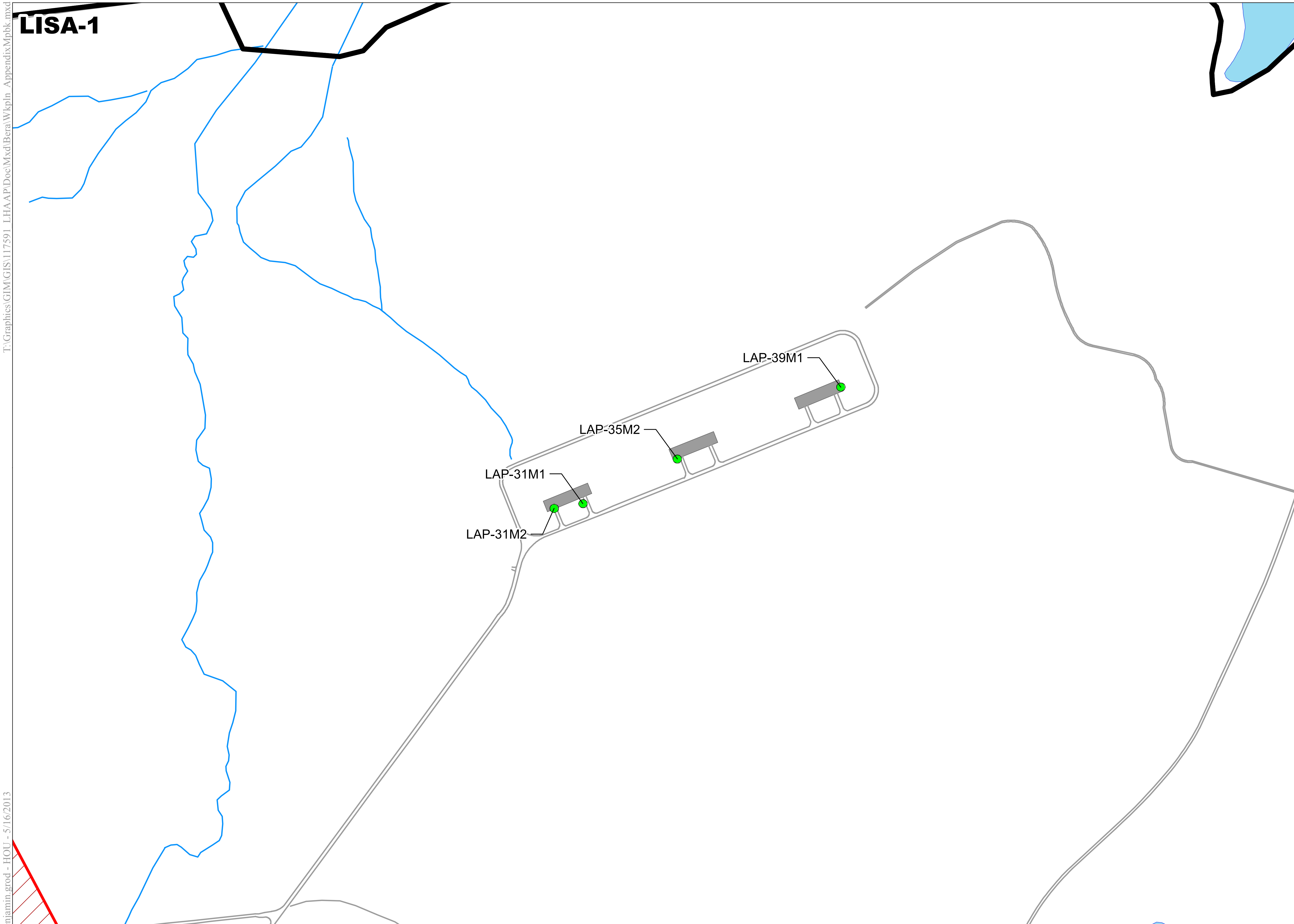
U.S. ARMY CORPS OF ENGINEERS
TULSA DISTRICT
TULSA, OKLAHOMA

APPENDIX D
FIGURE 1
OVERVIEW MAP
PLANNED DATA GAPS SAMPLES FOR SOIL, LOW IMPACT SUB-AREA

LONGHORN ARMY AMMUNITION PLANT
KARNACK, TEXAS

T:\Graphics\GIM\GIS\117591 LHAAP\Doc\Mxd\Bera\Wkpln AppendixMpbk.mxd

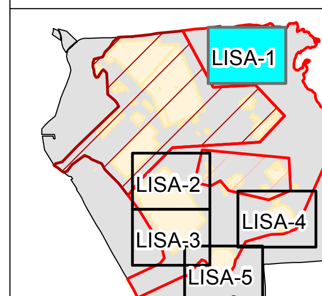
benjamin.grod - HOU - 5/16/2013



Legend

- Cape Environmental Samples 2006
- Planned Explosives Sample Location
- Post-BERA and Non-ITS explosives sample.
- 2,4-DNT and 2,6-DNT (SVOC) data available for this sample.
- Roads
- Buildings
- Streams
- Lakes
- Low Impact Sub-Area
- Industrial Sub-Area
- Waste Sub-Area
- LHAAP Boundary

0 425
Feet
1 inch = 425 feet



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

APPENDIX D - FIGURE 2
AREA LISA-1

PLANNED DATA GAPS SAMPLES FOR SOIL, LOW IMPACT SUB-AREA

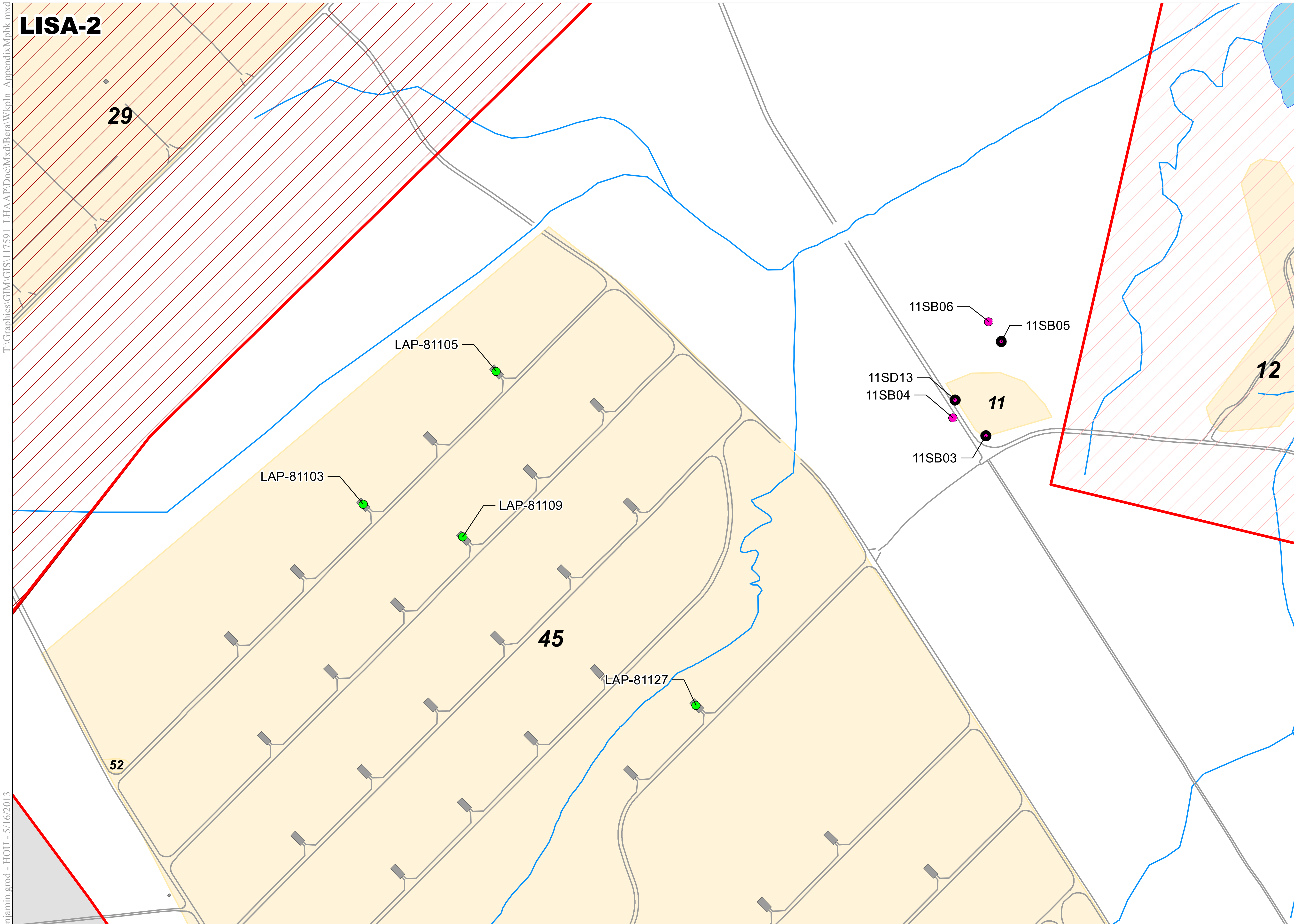
LONGHORN ARMY AMMUNITION PLANT
KARNACK, TEXAS

T:\Graphics\GIM\GIS\117591_LHAAP\Doc\Mxd\Bera\Wkpln_AppendixMpbk.mxd

benjamin.grod - HOU - 5/16/2013

00188255

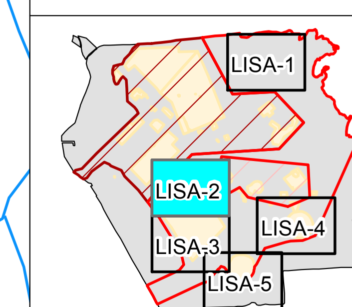
00188256



Legend

- Cape Environmental Samples 2006
- Planned Explosives Sample Location
- Post-BERA and Non-ITS explosives sample.
- 2,4-DNT and 2,6-DNT (SVOC) data available for this sample.
- Roads
- Buildings
- Streams
- Lakes
- Low Impact Sub-Area
- Industrial Sub-Area
- Waste Sub-Area
- LHAAP Boundary

0 425
Feet
1 inch = 425 feet



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

APPENDIX D - FIGURE 3
AREA LISA-2

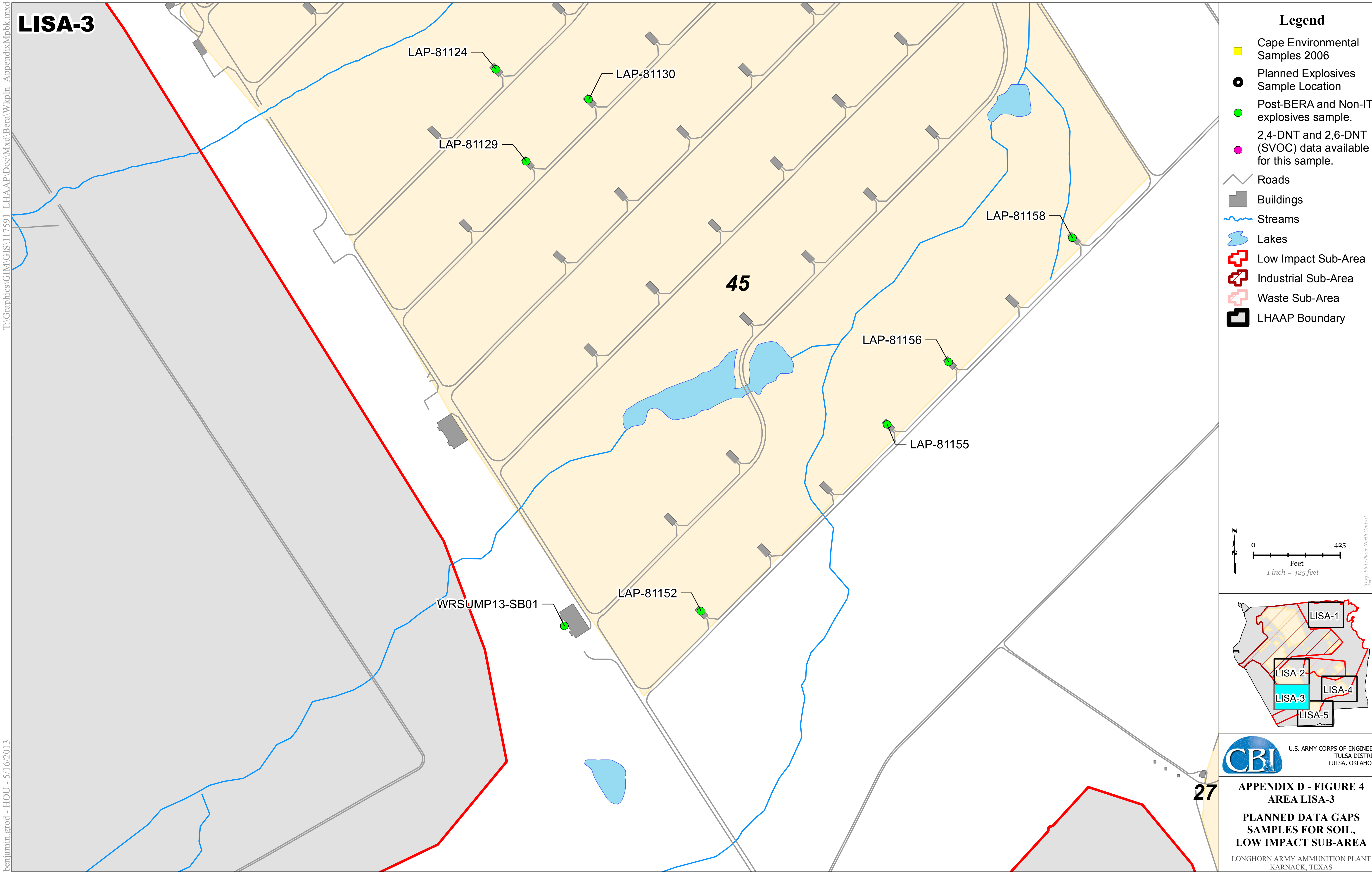
PLANNED DATA GAPS SAMPLES FOR SOIL, LOW IMPACT SUB-AREA

LONGHORN ARMY AMMUNITION PLANT
KARNACK, TEXAS

T:\Graphics\GIM\GIS\117591_LHAAP\Doc\Mxd\Bera\Wkpln_AppendixMpbk.mxd

benjamin.grod - HOU - 5/16/2013

00188258



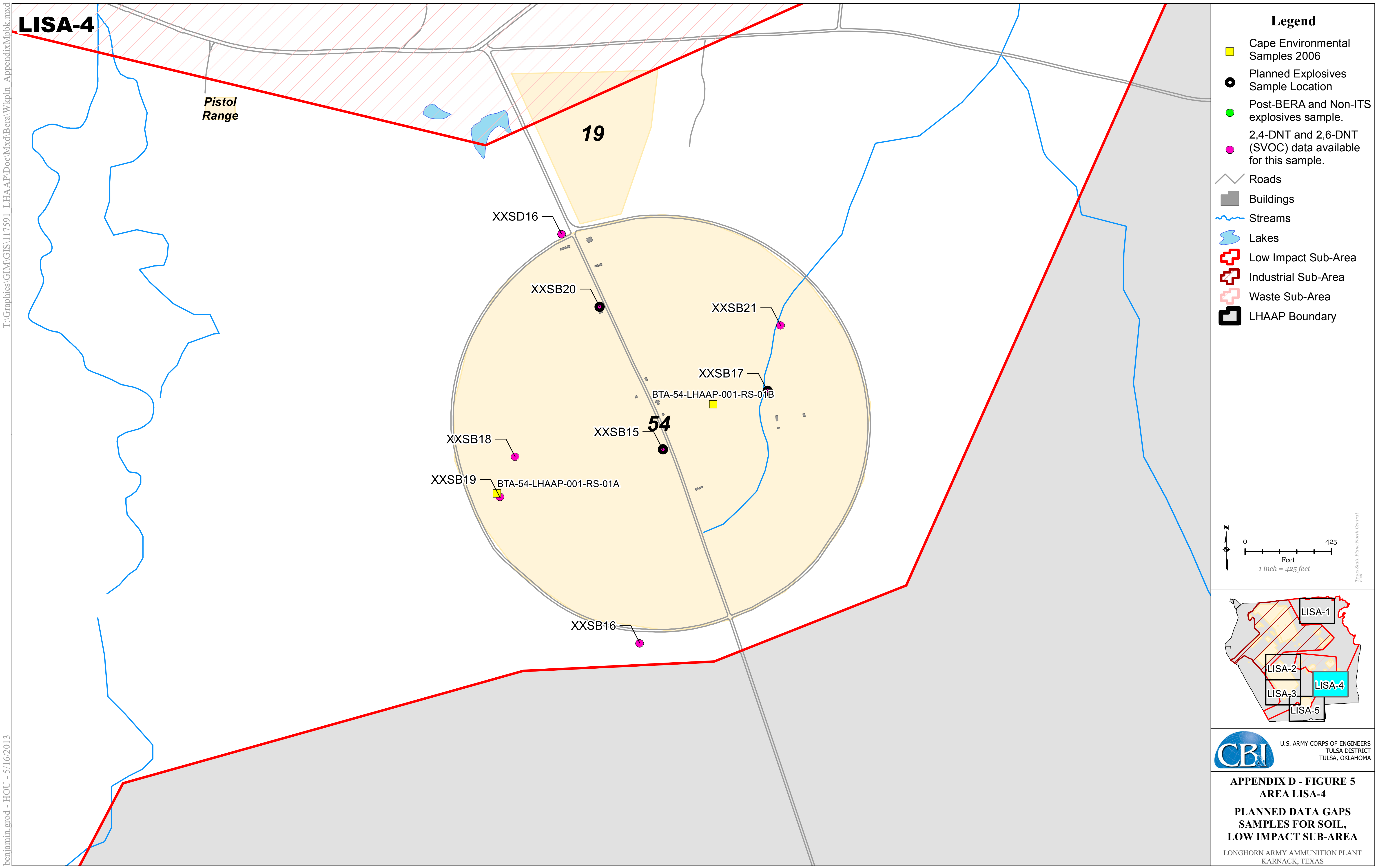
APPENDIX D - FIGURE 4
AREA LISA-3

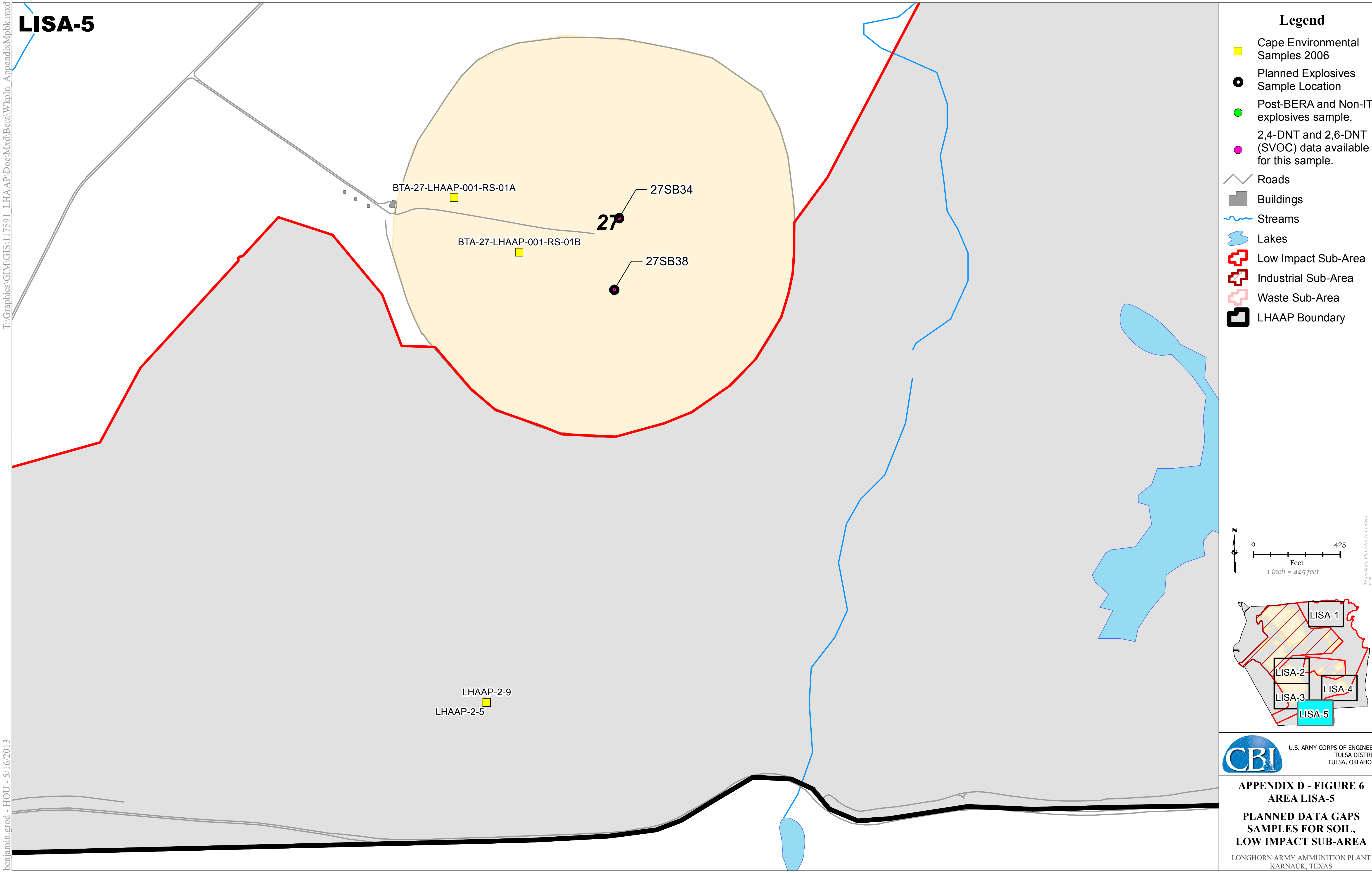
PLANNED DATA GAPS SAMPLES FOR SOIL, LOW IMPACT SUB-AREA

LONGHORN ARMY AMMUNITION PLANT
KARNACK, TEXAS

T:\Graphics\GIM\GIS\117591_LHAAP\Doc\Mxd\Bera\Wkpln_AppendixMpbk.mxd

benjamin.grod - HOU - 5/16/2013


LISA-4
Pistol Range
19
54
XXSD16
XXSB20
XXSB21
XXSB17
BTA-54-LHAAP-001-RS-01B
XXSB15
XXSB18
XXSB19
BTA-54-LHAAP-001-RS-01A
XXSB16
Legend
Cape Environmental Samples 2006
Planned Explosives Sample Location
Post-BERA and Non-ITS explosives sample.
2,4-DNT and 2,6-DNT (SVOC) data available for this sample.
Roads
Buildings
Streams
Lakes
Low Impact Sub-Area
Industrial Sub-Area
Waste Sub-Area
LHAAP Boundary
0
425
Feet
1 inch = 425 feet
LISA-1
LISA-2
LISA-3
LISA-4
LISA-5
CB&I
U.S. ARMY CORPS OF ENGINEERS
TULSA DISTRICT
TULSA, OKLAHOMA
APPENDIX D - FIGURE 5
AREA LISA-4
PLANNED DATA GAPS
SAMPLES FOR SOIL,
LOW IMPACT SUB-AREA
LONGHORN ARMY AMMUNITION PLANT
KARNACK, TEXAS
benjamin.grod - HOU - 5/16/2013



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

APPENDIX D - FIGURE 6
AREA LISA-5

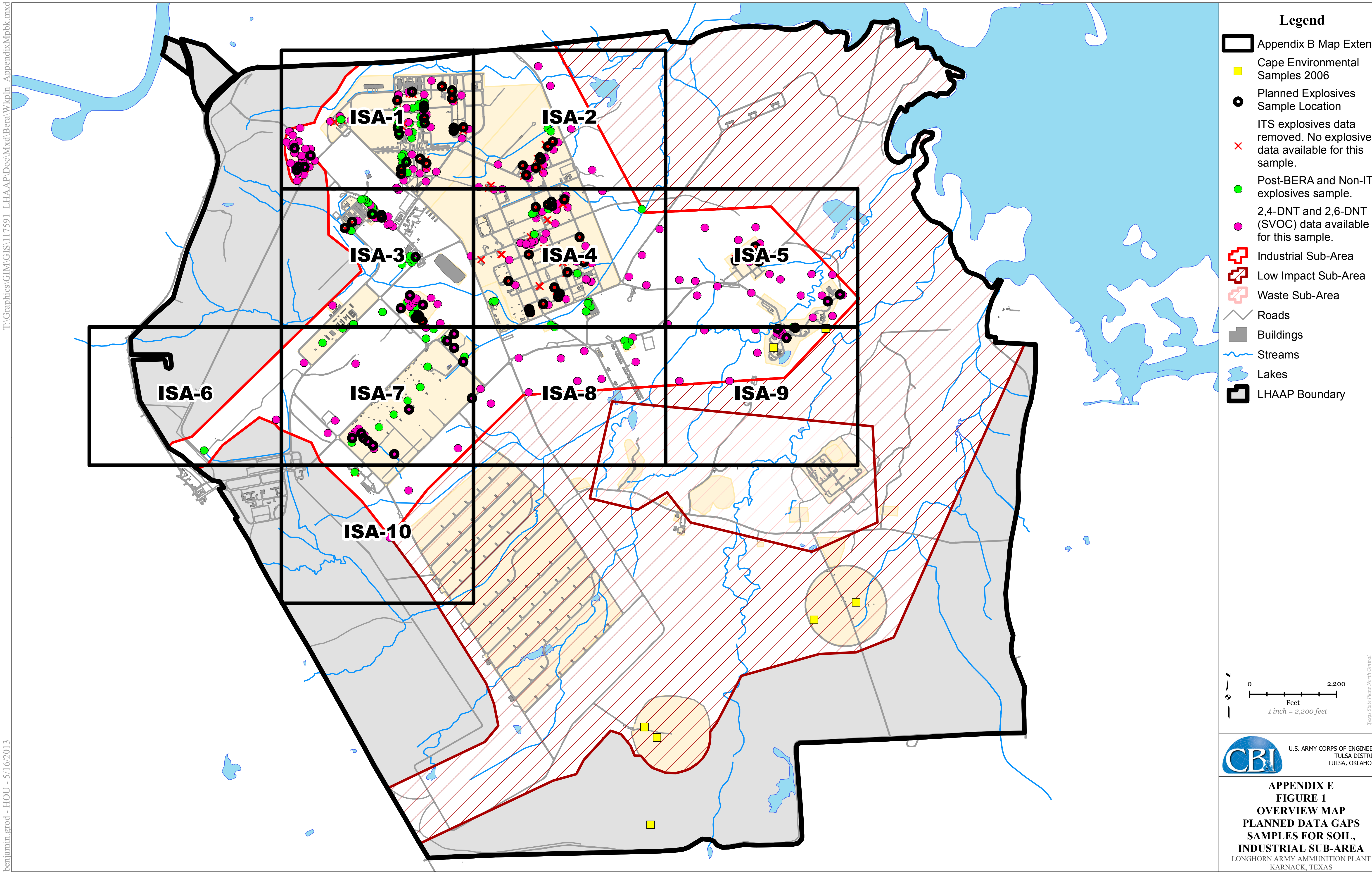
PLANNED DATA GAPS SAMPLES FOR SOIL, LOW IMPACT SUB-AREA

LONGHORN ARMY AMMUNITION PLANT
KARNACK, TEXAS

APPENDIX E

Large Scale Maps of Industrial Sub-Area
Sample Locations

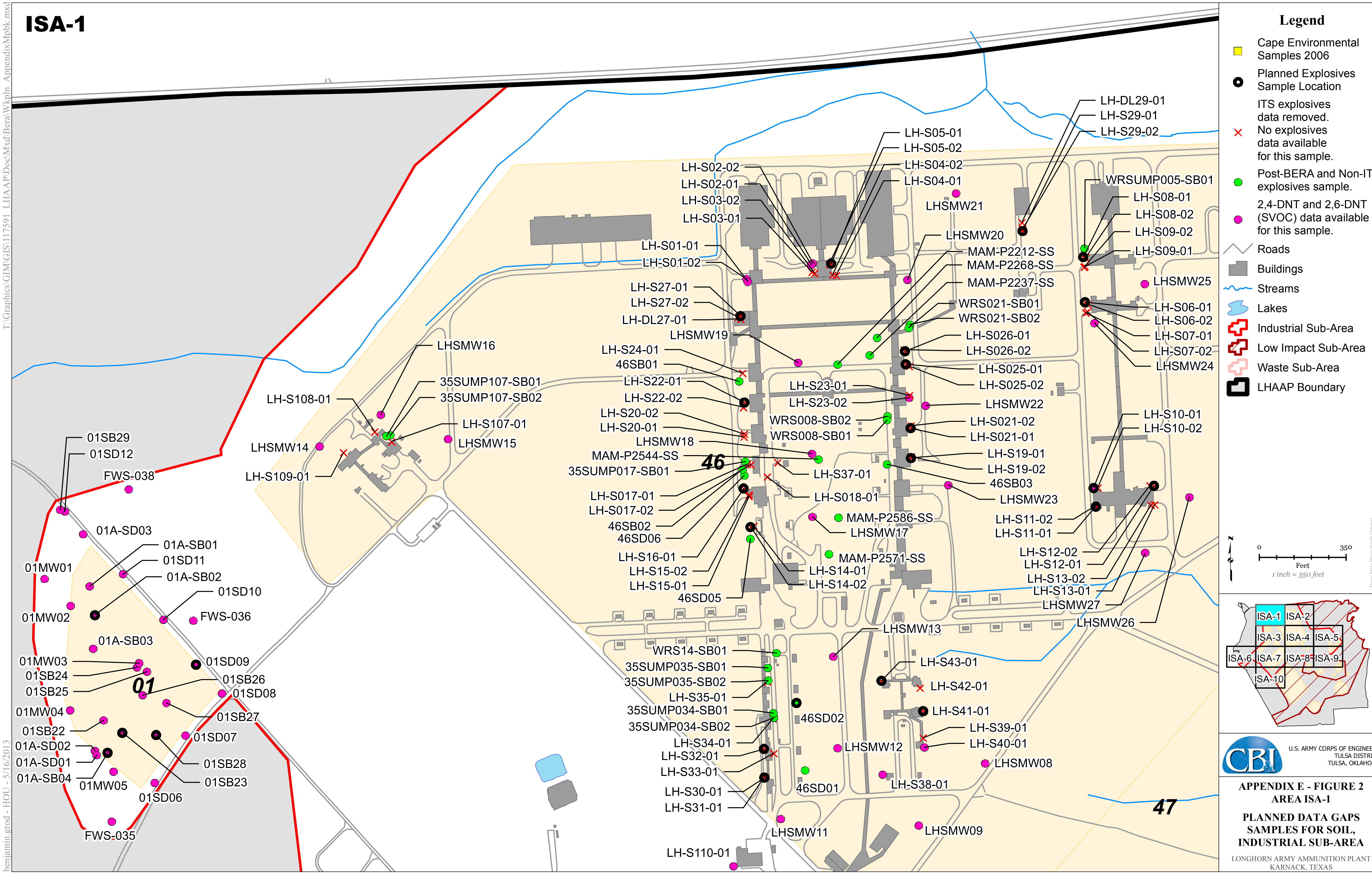
This page is intentionally left blank.



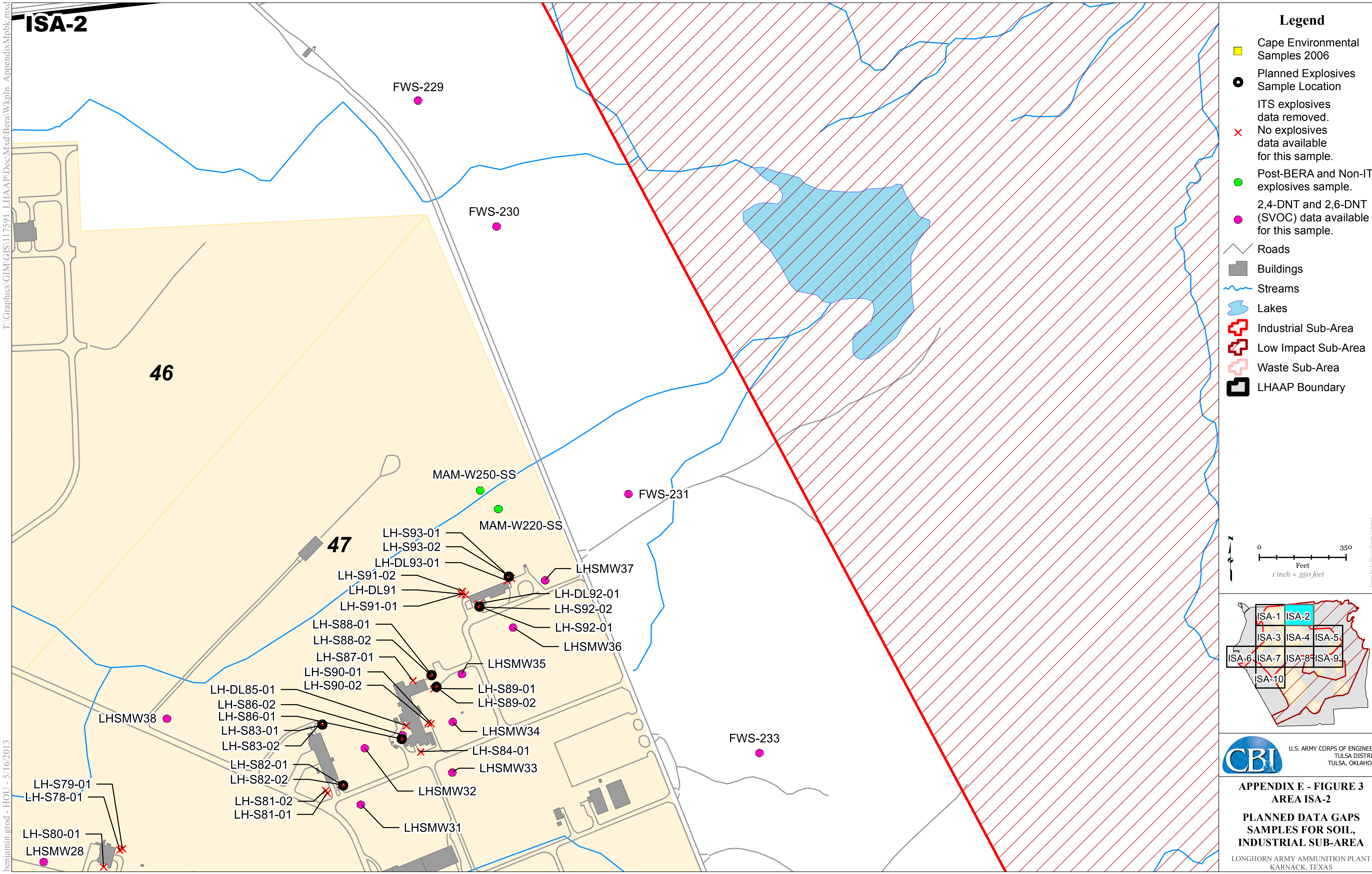
APPENDIX E
FIGURE 1
OVERVIEW MAP
PLANNED DATA GAPS
SAMPLES FOR SOIL,
INDUSTRIAL SUB-AREA
LONGHORN ARMY AMMUNITION PLANT
KARNACK, TEXAS

T:\Graphics\GIM\GIS\117591_LHAAP\Doc\Mxd\Bera\Wkpln_AppendixMpbk.mxd

benjamin.grod - HOU - 5/16/2013


ISA-1
Legend
Cape Environmental Samples 2006
Planned Explosives Sample Location
ITS explosives data removed. No explosives data available for this sample.
Post-BERA and Non-ITS explosives sample.
2,4-DNT and 2,6-DNT (SVOC) data available for this sample.
Roads
Buildings
Streams
Lakes
Industrial Sub-Area
Low Impact Sub-Area
Waste Sub-Area
LHAAP Boundary
0
350
Feet
1 inch = 350 feet
ISA-1
ISA-2
ISA-3
ISA-4
ISA-5
ISA-6
ISA-7
ISA-8
ISA-9
ISA-10
U.S. ARMY CORPS OF ENGINEERS
TULSA DISTRICT
TULSA, OKLAHOMA
46
47
01
LH-DL29-01
LH-S29-01
LH-S29-02
LH-S05-01
LH-S05-02
LH-S04-02
LH-S04-01
LH-S02-02
LH-S02-01
LH-S03-02
LH-S03-01
LHSMW21
LHSMW20
LH-S01-01
LH-S01-02
MAM-P2212-SS
MAM-P2268-SS
MAM-P2237-SS
WRS021-SB01
WRS021-SB02
LH-S026-01
LH-S026-02
LH-S025-01
LH-S025-02
LH-S27-01
LH-S27-02
LH-DL27-01
LHSMW19
LH-S24-01
46SB01
LH-S22-01
LH-S22-02
LH-S20-02
LH-S20-01
LHSMW18
MAM-P2544-SS
35SUMP017-SB01
LH-S017-01
LH-S017-02
46SB02
46SD06
LH-S16-01
LH-S15-02
LH-S15-01
46SD05
LH-S23-01
LH-S23-02
LHSMW22
WRS008-SB02
WRS008-SB01
LH-S021-02
LH-S021-01
LH-S19-01
LH-S19-02
46SB03
LHSMW23
LH-S37-01
LH-S018-01
MAM-P2586-SS
LHSMW17
MAM-P2571-SS
LH-S14-01
LH-S14-02
WRSUMP005-SB01
LH-S08-01
LH-S08-02
LH-S09-02
LH-S09-01
LHSMW25
LH-S06-01
LH-S06-02
LH-S07-01
LH-S07-02
LHSMW24
LH-S10-01
LH-S10-02
LH-S11-02
LH-S11-01
LH-S12-02
LH-S12-01
LH-S13-02
LH-S13-01
LHSMW27
LHSMW26
LHSMW16
35SUMP107-SB01
35SUMP107-SB02
LH-S108-01
LH-S107-01
LHSMW15
LHSMW14
LH-S109-01
01SB29
01SD12
FWS-038
01A-SD03
01A-SB01
01SD11
01A-SB02
01SD10
FWS-036
01MW01
01MW02
01A-SB03
01SD09
01MW03
01SB24
01SB25
01SB26
01SD08
01MW04
01SB27
01SB22
01SD07
01A-SD02
01A-SD01
01A-SB04
01SB28
01SB23
01MW05
01SD06
FWS-035
LHSMW13
WRS14-SB01
35SUMP035-SB01
35SUMP035-SB02
LH-S35-01
35SUMP034-SB01
35SUMP034-SB02
46SD02
LH-S34-01
LH-S32-01
LH-S33-01
LH-S30-01
LH-S31-01
46SD01
LH-S43-01
LH-S42-01
LH-S41-01
LH-S39-01
LH-S40-01
LHSMW12
LHSMW08
LH-S38-01
LHSMW11
LHSMW09
LH-S110-01
APPENDIX E - FIGURE 2
AREA ISA-1
PLANNED DATA GAPS
SAMPLES FOR SOIL,
INDUSTRIAL SUB-AREA
LONGHORN ARMY AMMUNITION PLANT
KARNACK, TEXAS
T:\Graphics\GIM\GIS\117591 LHAAP\Doc\Mxd\Bera\Wkpln_AppendixMpbk.mxd
benjamin.grod - HOU - 5/16/2013

00188270



APPENDIX E - FIGURE 3
AREA ISA-2

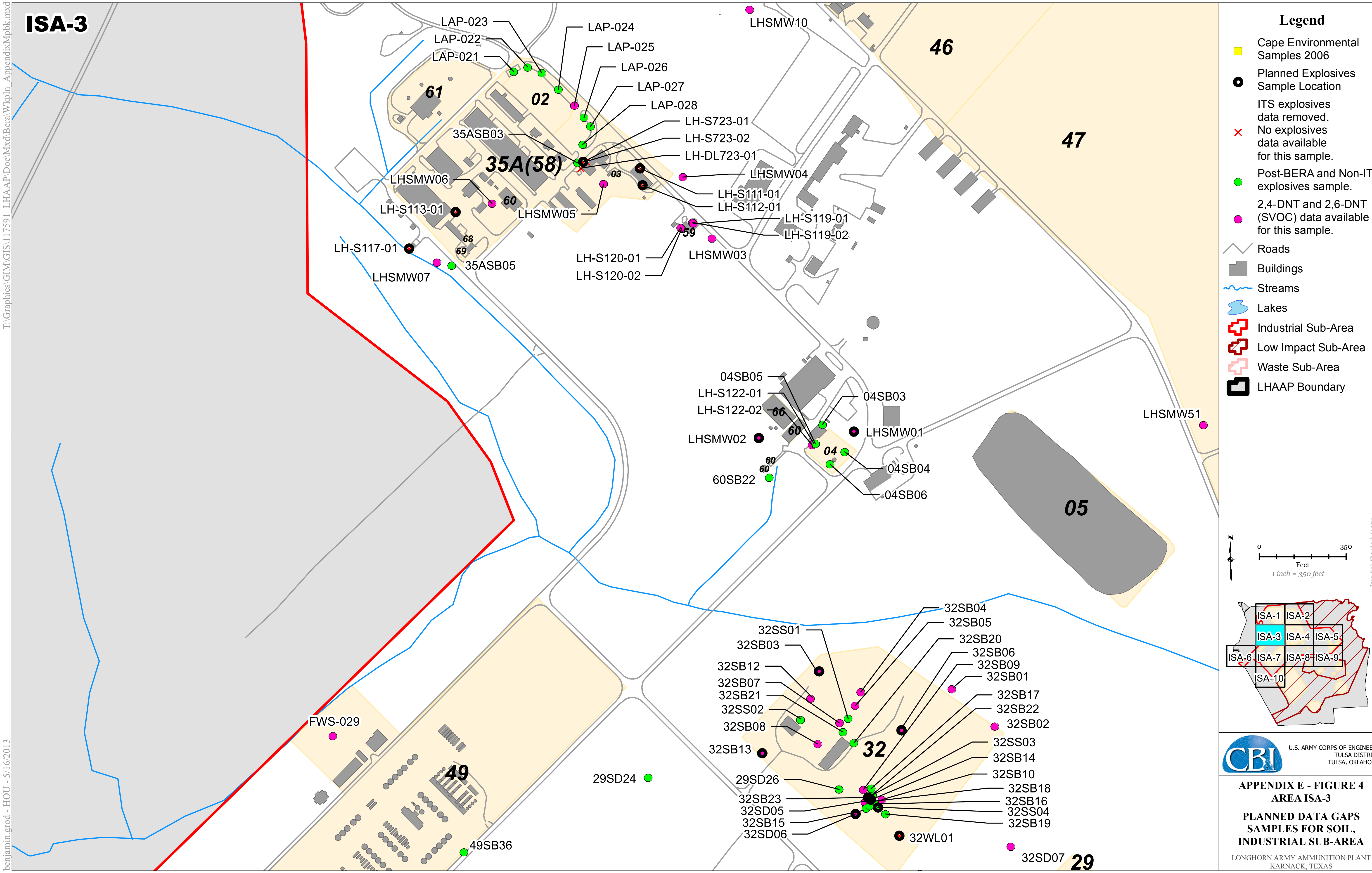
PLANNED DATA GAPS SAMPLES FOR SOIL, INDUSTRIAL SUB-AREA

LONGHORN ARMY AMMUNITION PLANT
KARNACK, TEXAS

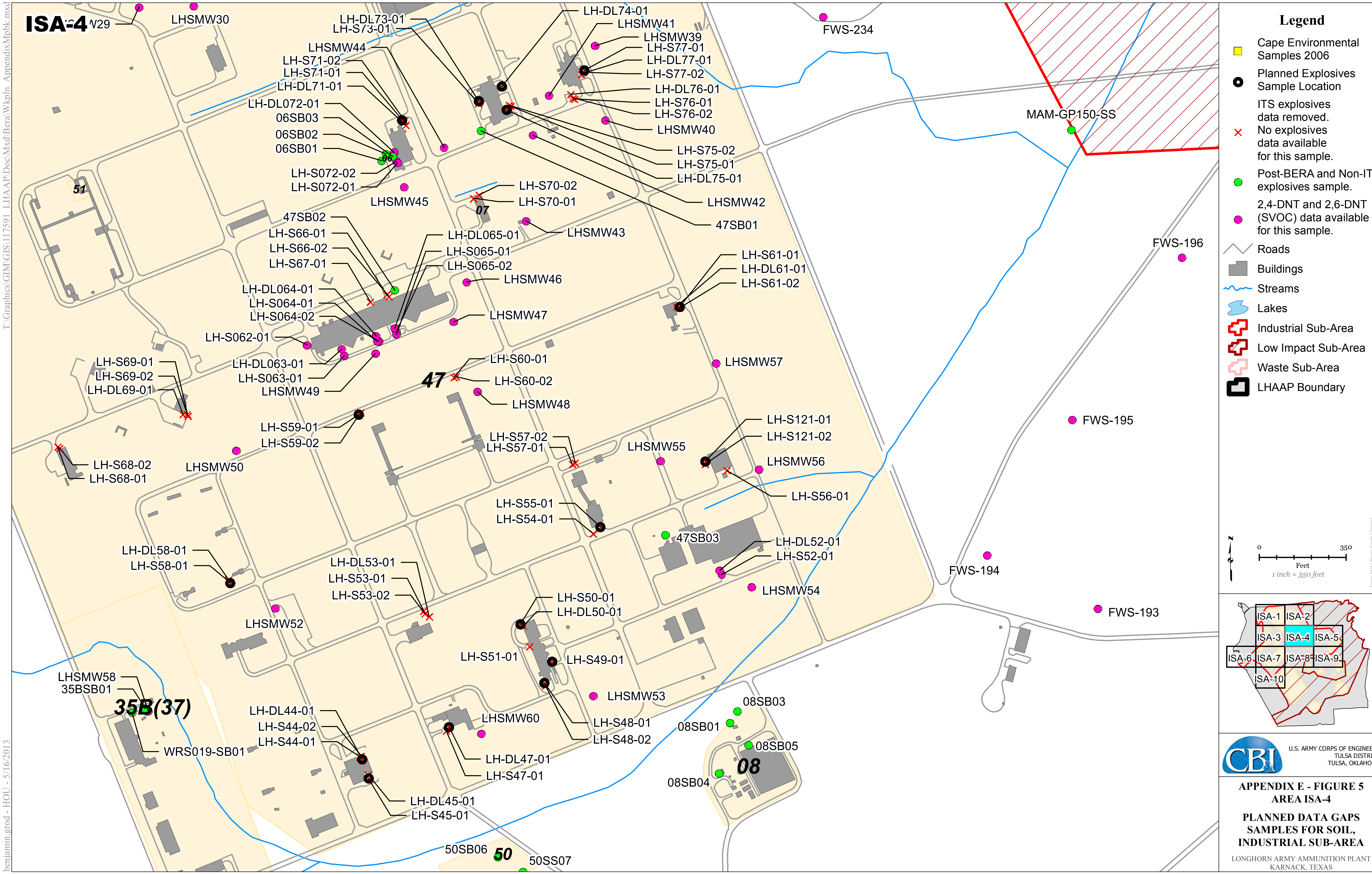
T:\Graphics\GIM\GIS\117591_LHAAP\Doc\Mxd\Bera\Wkpln_AppendixMpbk.mxd

benjamin.grod - HOU - 5/16/2013

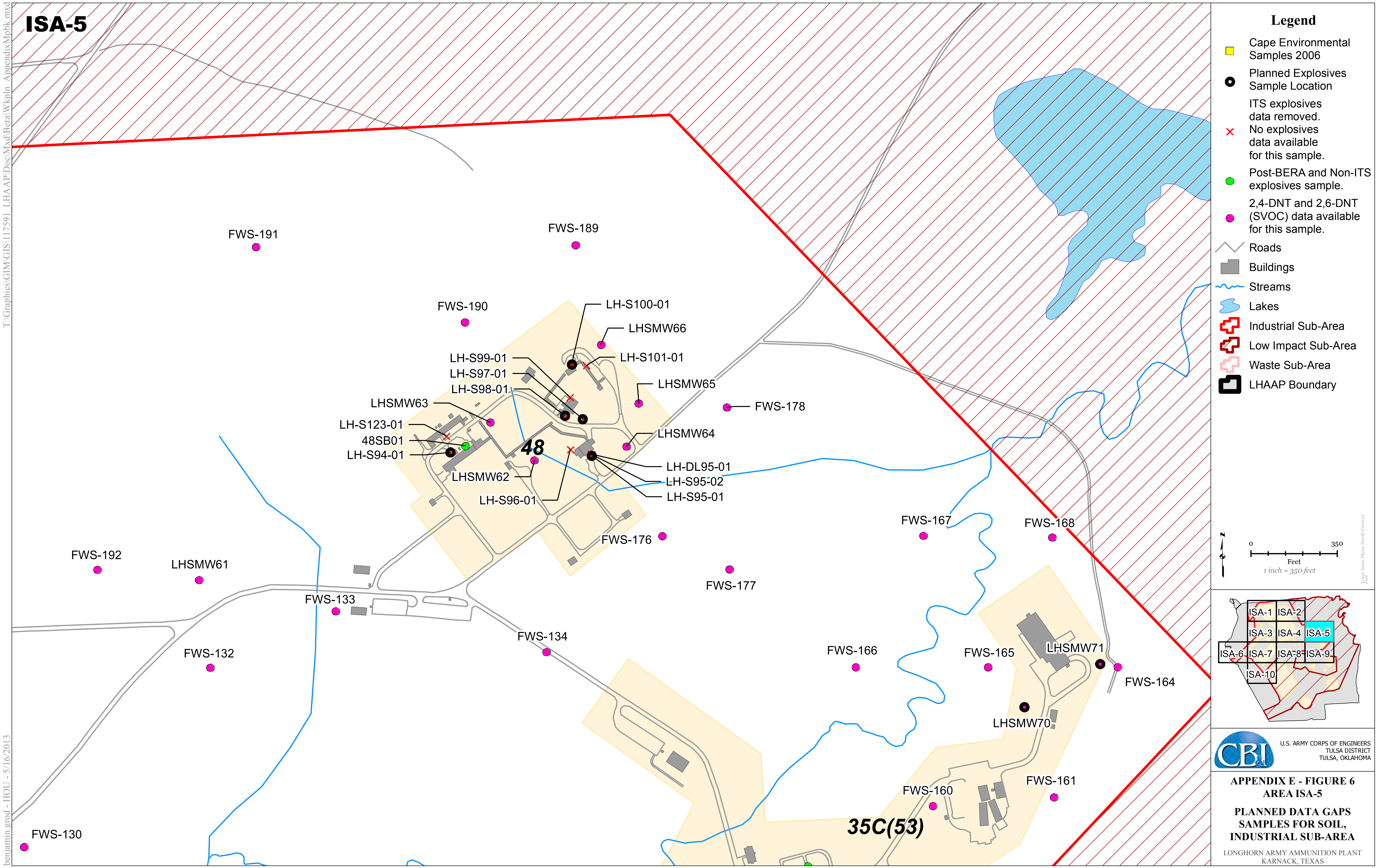
00188272


ISA-3
LAP-023
LAP-022
LAP-021
LAP-024
LAP-025
LAP-026
LAP-027
LAP-028
LH-S723-01
LH-S723-02
LH-DL723-01
LHSMW04
LH-S111-01
LH-S112-01
LH-S119-01
LH-S119-02
LHSMW03
LH-S120-01
LH-S120-02
LHSMW10
35ASB03
35A(58)
LHSMW06
LH-S113-01
LHSMW05
LH-S117-01
35ASB05
LHSMW07
61
02
03
60
68
69
59
46
47
04SB05
LH-S122-01
LH-S122-02
04SB03
LHSMW01
LHSMW02
04SB04
04SB06
60SB22
66
60
04
LHSMW51
05
32SS01
32SB03
32SB12
32SB07
32SB21
32SS02
32SB08
32SB13
29SD26
32SB23
32SD05
32SB15
32SD06
32SB04
32SB05
32SB20
32SB06
32SB09
32SB01
32SB17
32SB22
32SB02
32SS03
32SB14
32SB10
32SB18
32SB16
32SS04
32SB19
32WL01
32SD07
32
29
29SD24
FWS-029
49
49SB36
Legend
Cape Environmental Samples 2006
Planned Explosives Sample Location
ITS explosives data removed. No explosives data available for this sample.
Post-BERA and Non-ITS explosives sample.
2,4-DNT and 2,6-DNT (SVOC) data available for this sample.
Roads
Buildings
Streams
Lakes
Industrial Sub-Area
Low Impact Sub-Area
Waste Sub-Area
LHAAP Boundary
0
350
Feet
1 inch = 350 feet
ISA-1
ISA-2
ISA-3
ISA-4
ISA-5
ISA-6
ISA-7
ISA-8
ISA-9
ISA-10
CB&I
U.S. ARMY CORPS OF ENGINEERS
TULSA DISTRICT
TULSA, OKLAHOMA
APPENDIX E - FIGURE 4
AREA ISA-3
PLANNED DATA GAPS
SAMPLES FOR SOIL,
INDUSTRIAL SUB-AREA
LONGHORN ARMY AMMUNITION PLANT
KARNACK, TEXAS
T:\Graphics\GIM\GIS\117591_LHAAP\Doc\Mxd\Bera\Wkpln_AppendixMpbk.mxd
benjamin.grod - HOU - 5/16/2013

00188274

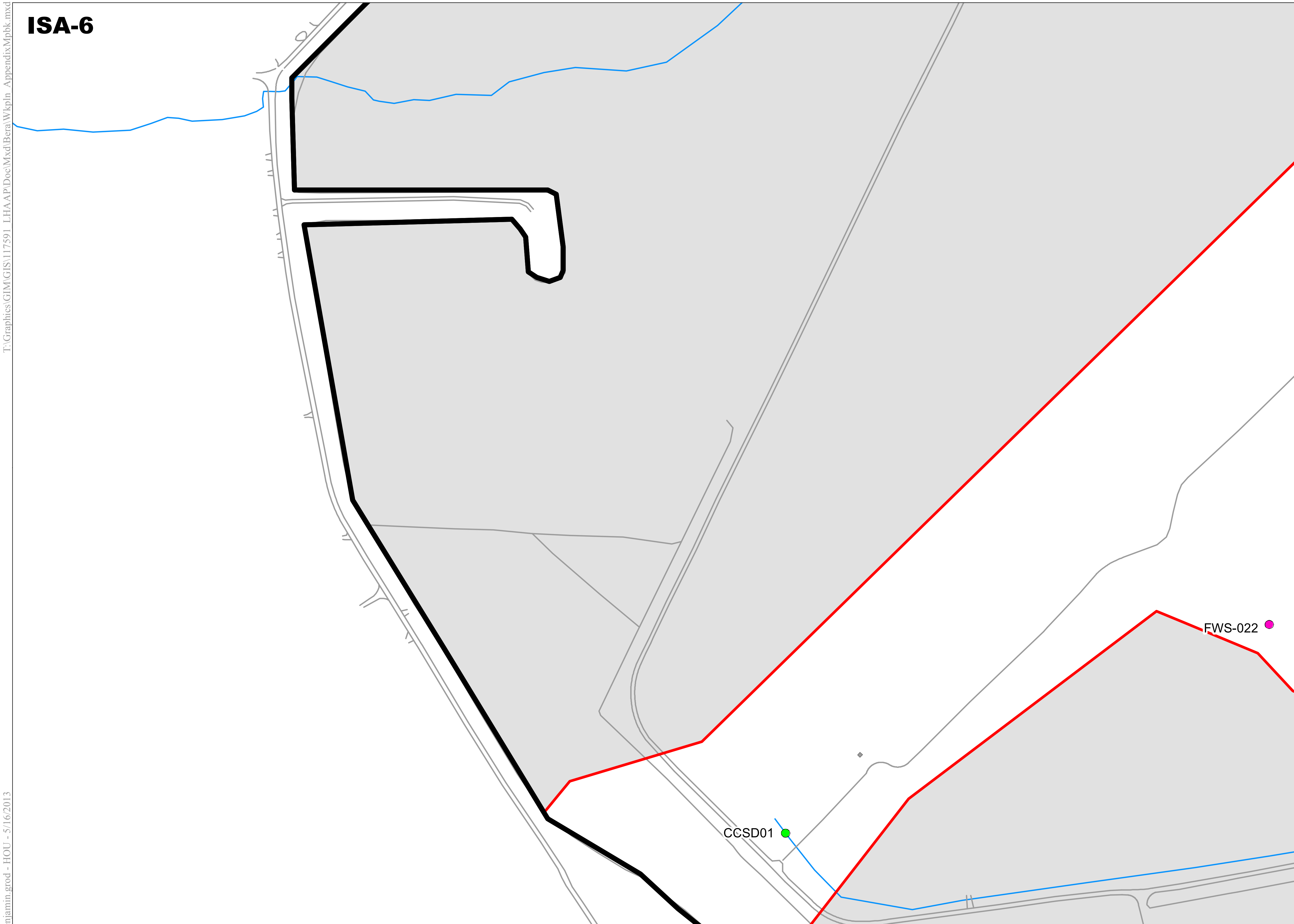

ISA-4
LHSMW30
LH-DL73-01
LH-S73-01
LH-DL74-01
LHSMW41
LHSMW39
LH-S77-01
LH-DL77-01
LH-S77-02
LH-DL76-01
LH-S76-01
LH-S76-02
LHSMW40
LH-S75-02
LH-S75-01
LH-DL75-01
LHSMW42
47SB01
LHSMW44
LH-S71-02
LH-S71-01
LH-DL71-01
LH-DL072-01
06SB03
06SB02
06SB01
LH-S072-02
LH-S072-01
LHSMW45
LH-S70-02
LH-S70-01
07
51
47SB02
LH-S66-01
LH-S66-02
LH-S67-01
LH-DL065-01
LH-S065-01
LH-S065-02
LHSMW43
LHSMW46
LH-DL064-01
LH-S064-01
LH-S064-02
LHSMW47
LH-S062-01
LH-S61-01
LH-DL61-01
LH-S61-02
LH-S69-01
LH-S69-02
LH-DL69-01
LH-DL063-01
LH-S063-01
LHSMW49
LH-S60-01
47
LH-S60-02
LHSMW48
LHSMW57
LH-S59-01
LH-S59-02
LH-S68-02
LH-S68-01
LHSMW50
LH-S57-02
LH-S57-01
LHSMW55
LH-S121-01
LH-S121-02
LHSMW56
LH-S56-01
LH-S55-01
LH-S54-01
47SB03
LH-DL52-01
LH-S52-01
LH-DL58-01
LH-S58-01
LH-DL53-01
LH-S53-01
LH-S53-02
LHSMW54
LH-S50-01
LH-DL50-01
LHSMW52
LH-S51-01
LH-S49-01
LHSMW58
35BSB01
35B(37)
LHSMW53
08SB03
LH-DL44-01
LH-S44-02
LH-S44-01
LHSMW60
LH-S48-01
LH-S48-02
08SB01
08SB05
WRS019-SB01
LH-DL47-01
LH-S47-01
08SB04
08
LH-DL45-01
LH-S45-01
50SB06
50
50SS07
FWS-234
MAM-GP150-SS
FWS-196
FWS-195
FWS-194
FWS-193
Legend
Cape Environmental Samples 2006
Planned Explosives Sample Location
ITS explosives data removed. No explosives data available for this sample.
Post-BERA and Non-ITS explosives sample.
2,4-DNT and 2,6-DNT (SVOC) data available for this sample.
Roads
Buildings
Streams
Lakes
Industrial Sub-Area
Low Impact Sub-Area
Waste Sub-Area
LHAAP Boundary
0
350
Feet
1 inch = 350 feet
ISA-1
ISA-2
ISA-3
ISA-4
ISA-5
ISA-6
ISA-7
ISA-8
ISA-9
ISA-10
U.S. ARMY CORPS OF ENGINEERS
TULSA DISTRICT
TULSA, OKLAHOMA
APPENDIX E - FIGURE 5
AREA ISA-4
PLANNED DATA GAPS
SAMPLES FOR SOIL,
INDUSTRIAL SUB-AREA
LONGHORN ARMY AMMUNITION PLANT
KARNACK, TEXAS
benjamin.grod - HOU - 5/16/2013

00188276



ISA-5
FWS-191
FWS-189
FWS-190
LH-S100-01
LHSMW66
LH-S99-01
LH-S97-01
LH-S98-01
LH-S101-01
LHSMW65
FWS-178
LHSMW63
LH-S123-01
48SB01
LH-S94-01
LHSMW64
48
LHSMW62
LH-DL95-01
LH-S95-02
LH-S95-01
LH-S96-01
FWS-167
FWS-168
FWS-176
FWS-192
LHSMW61
FWS-177
FWS-133
FWS-134
FWS-132
FWS-166
FWS-165
LHSMW71
FWS-164
LHSMW70
FWS-160
FWS-161
35C(53)
FWS-130
Legend
Cape Environmental Samples 2006
Planned Explosives Sample Location
ITS explosives data removed. No explosives data available for this sample.
Post-BERA and Non-ITS explosives sample.
2,4-DNT and 2,6-DNT (SVOC) data available for this sample.
Roads
Buildings
Streams
Lakes
Industrial Sub-Area
Low Impact Sub-Area
Waste Sub-Area
LHAAP Boundary
N
0
350
Feet
1 inch = 350 feet
Texas State Plane North Central Feet
ISA-1
ISA-2
ISA-3
ISA-4
ISA-5
ISA-6
ISA-7
ISA-8
ISA-9
ISA-10
CB&I
U.S. ARMY CORPS OF ENGINEERS
TULSA DISTRICT
TULSA, OKLAHOMA
APPENDIX E - FIGURE 6
AREA ISA-5
PLANNED DATA GAPS SAMPLES FOR SOIL, INDUSTRIAL SUB-AREA
LONGHORN ARMY AMMUNITION PLANT
KARNACK, TEXAS
T:\Graphics\GIM\GIS\117591_LHAAP\Doc\Mxd\Bera\Wkpln_AppendixMpbk.mxd
benjamin.grod - HOU - 5/16/2013

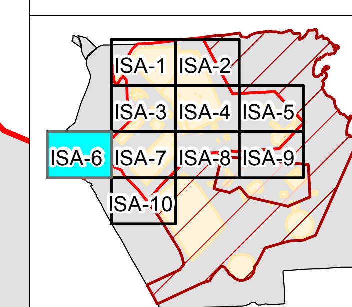
00188278



Legend

- Cape Environmental Samples 2006
- Planned Explosives Sample Location
- ITS explosives data removed. No explosives data available for this sample.
- Post-BERA and Non-ITS explosives sample.
- 2,4-DNT and 2,6-DNT (SVOC) data available for this sample.
- Roads
- Buildings
- Streams
- Lakes
- Industrial Sub-Area
- Low Impact Sub-Area
- Waste Sub-Area
- LHAAP Boundary

0 350
Feet
1 inch = 350 feet



CB&I

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

APPENDIX E - FIGURE 7
AREA ISA-6

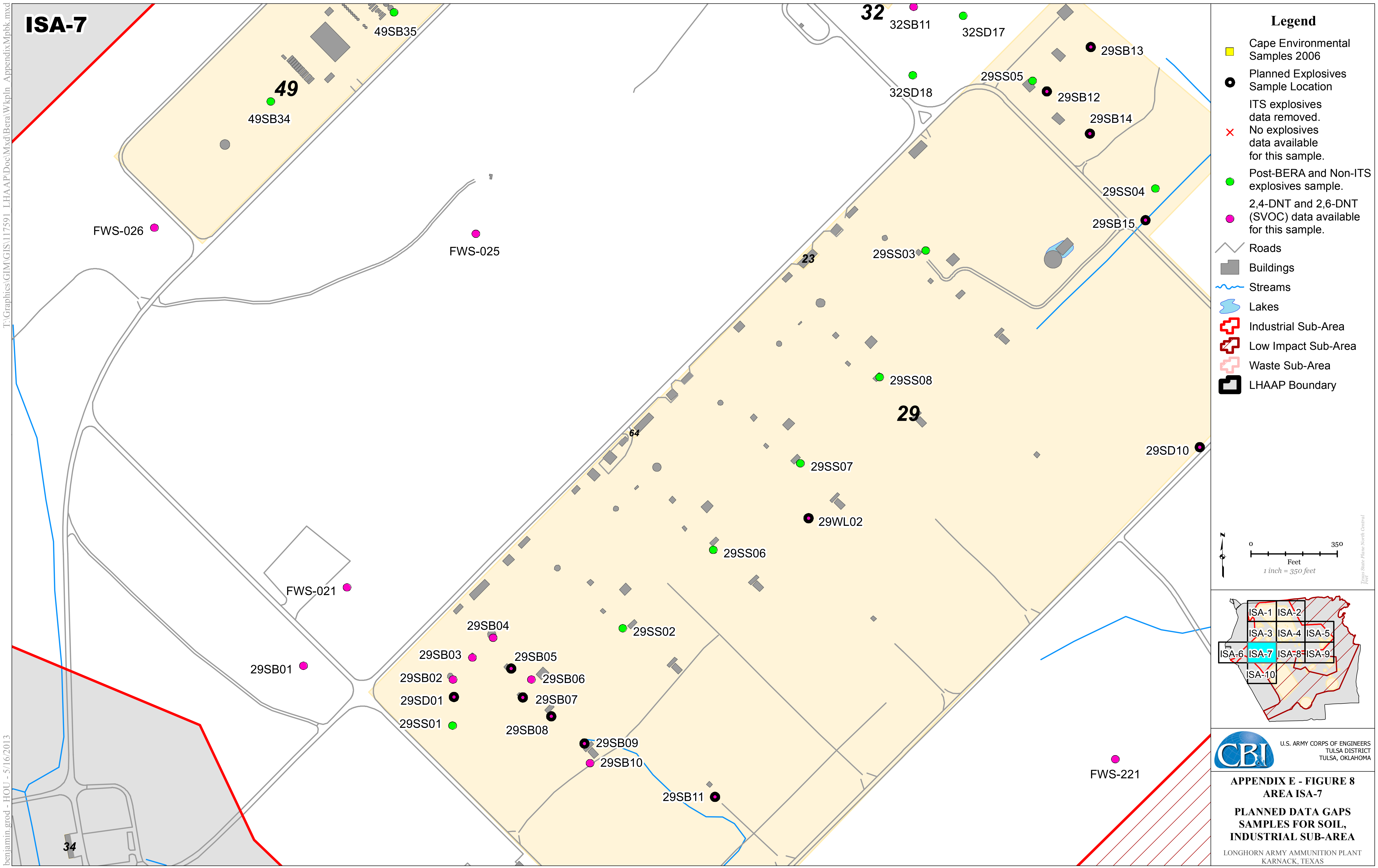
PLANNED DATA GAPS SAMPLES FOR SOIL, INDUSTRIAL SUB-AREA

LONGHORN ARMY AMMUNITION PLANT
KARNACK, TEXAS

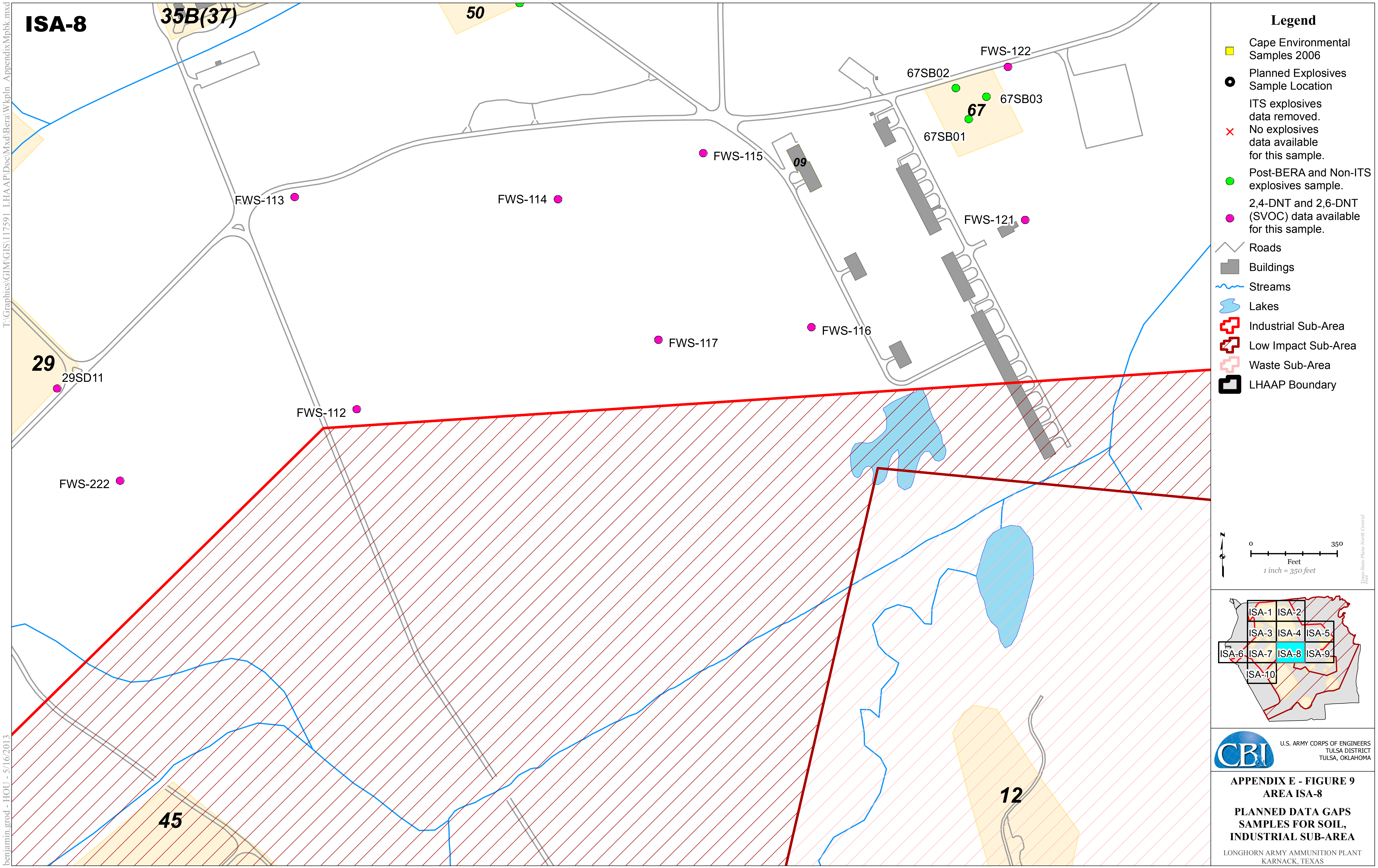
T:\Graphics\GIM\GIS\117591 LHAAP\Doc\Mxd\Bera\Wkpln AppendixMpbk.mxd

benjamin.grod - HOU - 5/16/2013

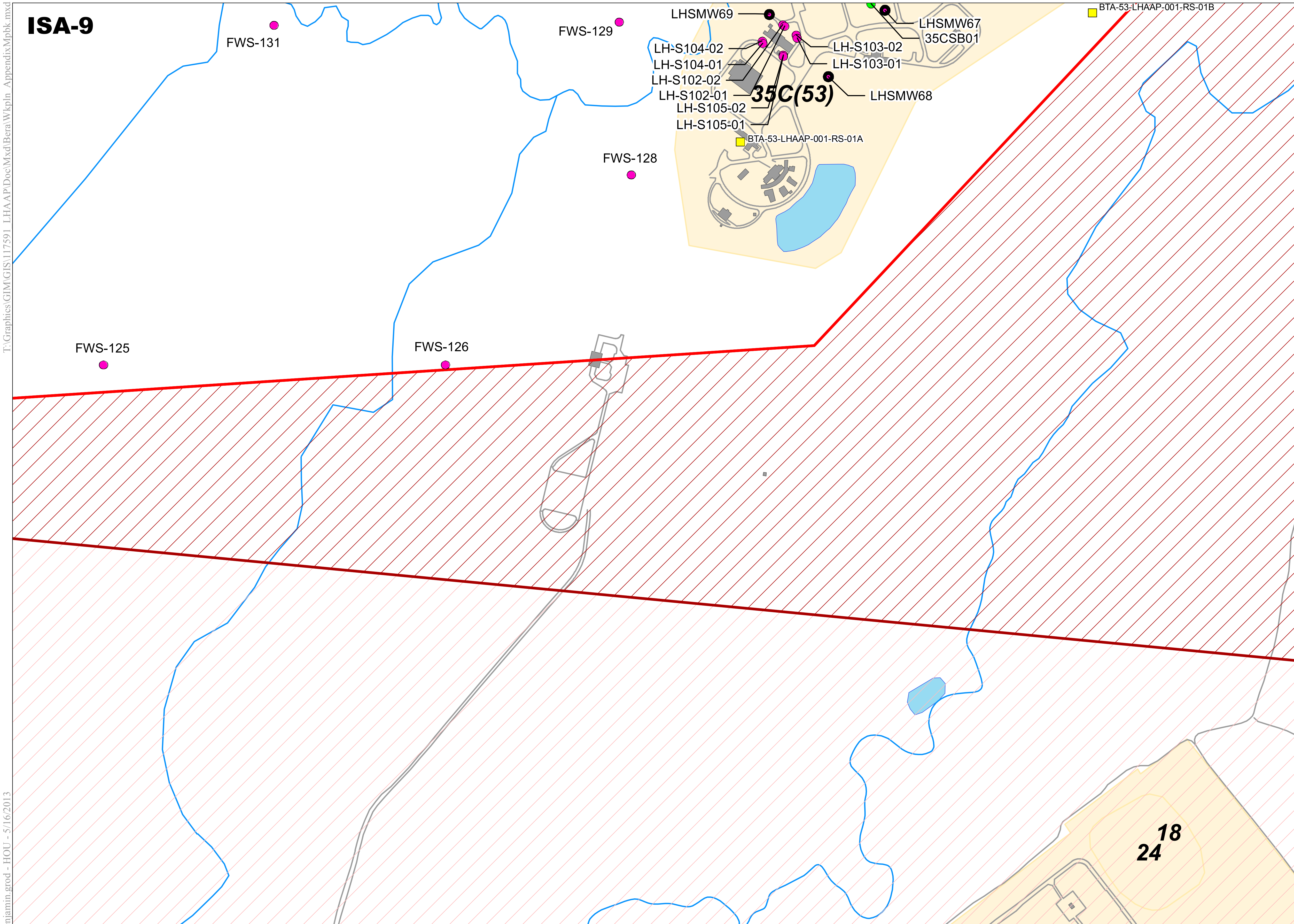
00188279


ISA-7
49
32
29
23
64
34
49SB35
49SB34
32SB11
32SD17
32SD18
29SB13
29SS05
29SB12
29SB14
29SS04
29SB15
29SS03
29SS08
29SS07
29SD10
29WL02
29SS06
29SS02
29SB04
29SB03
29SB05
29SB06
29SB02
29SD01
29SB07
29SS01
29SB08
29SB09
29SB10
29SB11
29SB01
FWS-026
FWS-025
FWS-021
FWS-221
Legend
Cape Environmental Samples 2006
Planned Explosives Sample Location
ITS explosives data removed. No explosives data available for this sample.
Post-BERA and Non-ITS explosives sample.
2,4-DNT and 2,6-DNT (SVOC) data available for this sample.
Roads
Buildings
Streams
Lakes
Industrial Sub-Area
Low Impact Sub-Area
Waste Sub-Area
LHAAP Boundary
0
350
Feet
1 inch = 350 feet
ISA-1
ISA-2
ISA-3
ISA-4
ISA-5
ISA-6
ISA-7
ISA-8
ISA-9
ISA-10
CB&I
U.S. ARMY CORPS OF ENGINEERS
TULSA DISTRICT
TULSA, OKLAHOMA
APPENDIX E - FIGURE 8
AREA ISA-7
PLANNED DATA GAPS SAMPLES FOR SOIL, INDUSTRIAL SUB-AREA
LONGHORN ARMY AMMUNITION PLANT
KARNACK, TEXAS
benjamin.grod - HOU - 5/16/2013

00188282



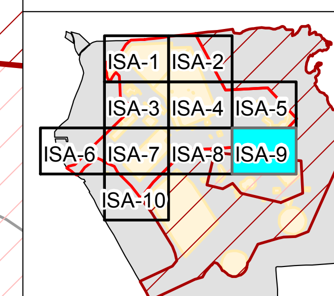
ISA-8
35B(37)
50
67
09
29
45
12
FWS-122
67SB02
67SB03
67SB01
FWS-115
FWS-113
FWS-114
FWS-121
FWS-116
FWS-117
29SD11
FWS-112
FWS-222
Legend
Cape Environmental Samples 2006
Planned Explosives Sample Location
ITS explosives data removed. No explosives data available for this sample.
Post-BERA and Non-ITS explosives sample.
2,4-DNT and 2,6-DNT (SVOC) data available for this sample.
Roads
Buildings
Streams
Lakes
Industrial Sub-Area
Low Impact Sub-Area
Waste Sub-Area
LHAAP Boundary
0
350
Feet
1 inch = 350 feet
ISA-1
ISA-2
ISA-3
ISA-4
ISA-5
ISA-6
ISA-7
ISA-8
ISA-9
ISA-10
CB&I
U.S. ARMY CORPS OF ENGINEERS
TULSA DISTRICT
TULSA, OKLAHOMA
APPENDIX E - FIGURE 9
AREA ISA-8
PLANNED DATA GAPS
SAMPLES FOR SOIL,
INDUSTRIAL SUB-AREA
LONGHORN ARMY AMMUNITION PLANT
KARNACK, TEXAS



Legend

- Cape Environmental Samples 2006
- Planned Explosives Sample Location
- ITS explosives data removed. No explosives data available for this sample.
- Post-BERA and Non-ITS explosives sample.
- 2,4-DNT and 2,6-DNT (SVOC) data available for this sample.
- Roads
- Buildings
- Streams
- Lakes
- Industrial Sub-Area
- Low Impact Sub-Area
- Waste Sub-Area
- LHAAP Boundary

0 350
Feet
1 inch = 350 feet



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

APPENDIX E - FIGURE 10
AREA ISA-9

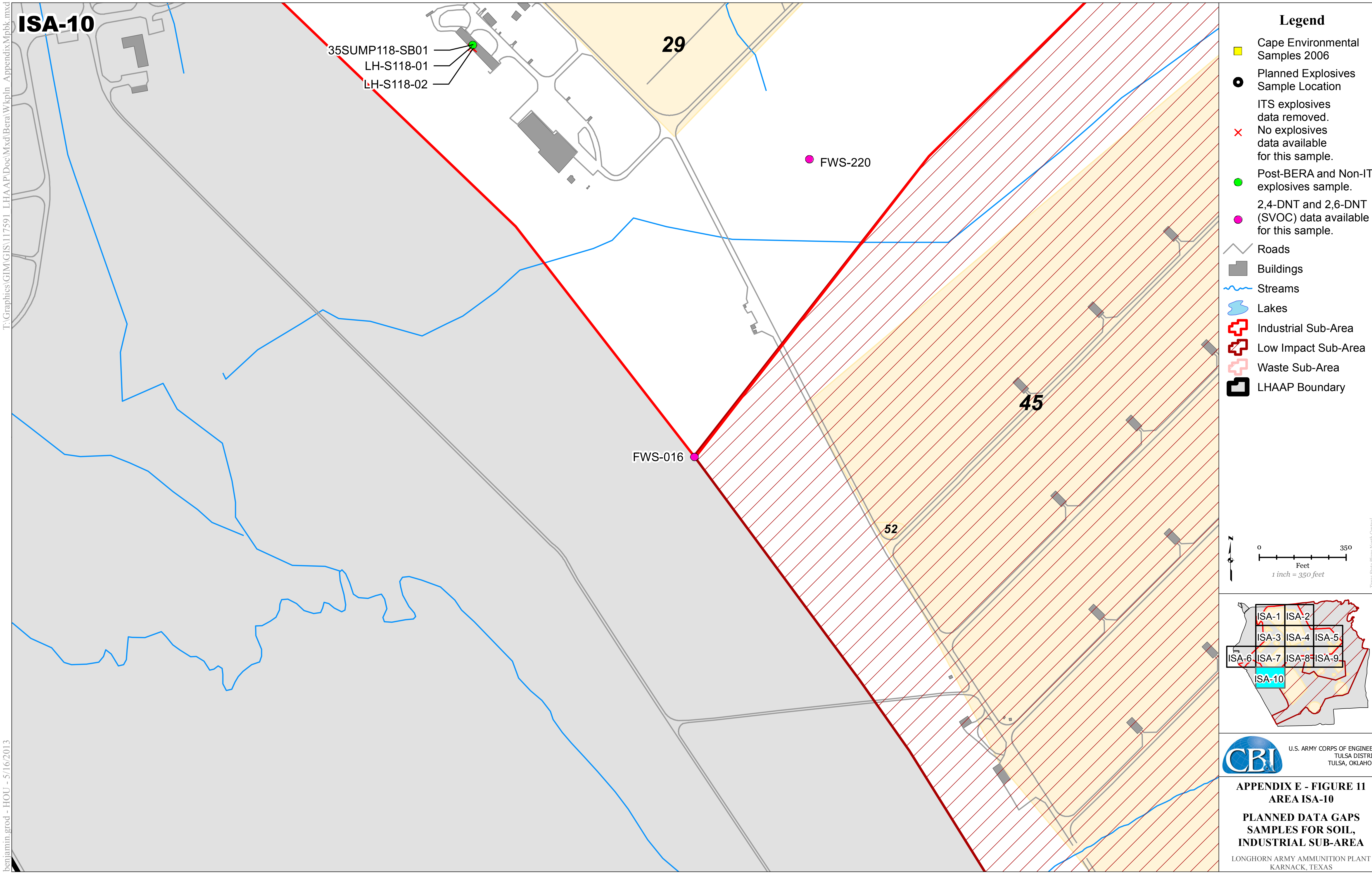
PLANNED DATA GAPS SAMPLES FOR SOIL, INDUSTRIAL SUB-AREA

LONGHORN ARMY AMMUNITION PLANT
KARNACK, TEXAS

T:\Graphics\GIM\GIS\117591_LHAAP\Doc\Mxd\Bera\Wkpln_AppendixMpbk.mxd

benjamin.grod - HOU - 5/16/2013

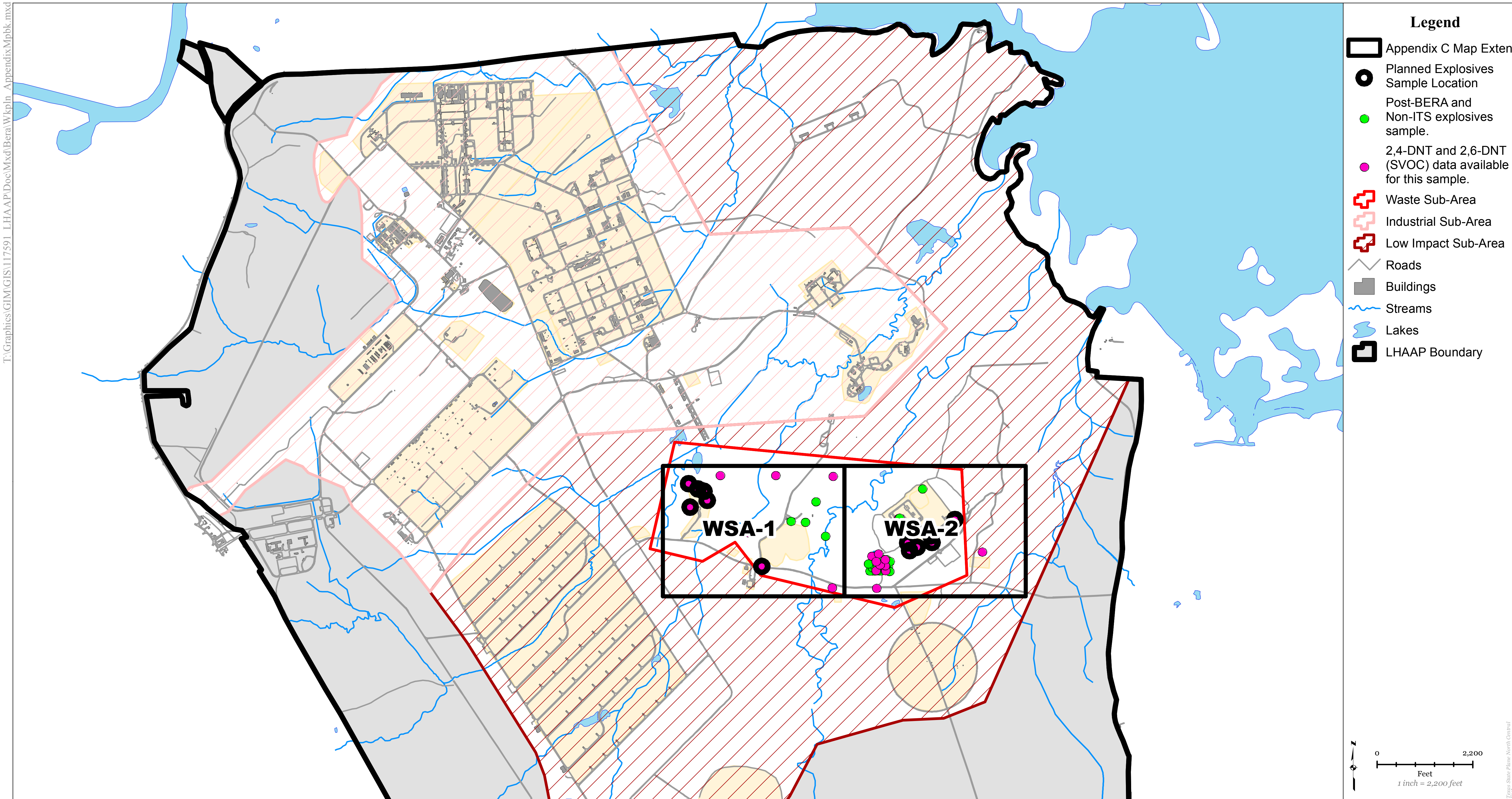
00188286


ISA-10
35SUMP118-SB01
LH-S118-01
LH-S118-02
29
FWS-220
45
FWS-016
52
Legend
Cape Environmental Samples 2006
Planned Explosives Sample Location
ITS explosives data removed. No explosives data available for this sample.
Post-BERA and Non-ITS explosives sample.
2,4-DNT and 2,6-DNT (SVOC) data available for this sample.
Roads
Buildings
Streams
Lakes
Industrial Sub-Area
Low Impact Sub-Area
Waste Sub-Area
LHAAP Boundary
0
350
Feet
1 inch = 350 feet
ISA-1
ISA-2
ISA-3
ISA-4
ISA-5
ISA-6
ISA-7
ISA-8
ISA-9
ISA-10
CB&I
U.S. ARMY CORPS OF ENGINEERS
TULSA DISTRICT
TULSA, OKLAHOMA
APPENDIX E - FIGURE 11
AREA ISA-10
PLANNED DATA GAPS SAMPLES FOR SOIL, INDUSTRIAL SUB-AREA
LONGHORN ARMY AMMUNITION PLANT
KARNACK, TEXAS
benjamin.grod - HOU - 5/16/2013

APPENDIX F

Large Scale Maps of Waste Sub-Area Sample Locations

This page is intentionally left blank.



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

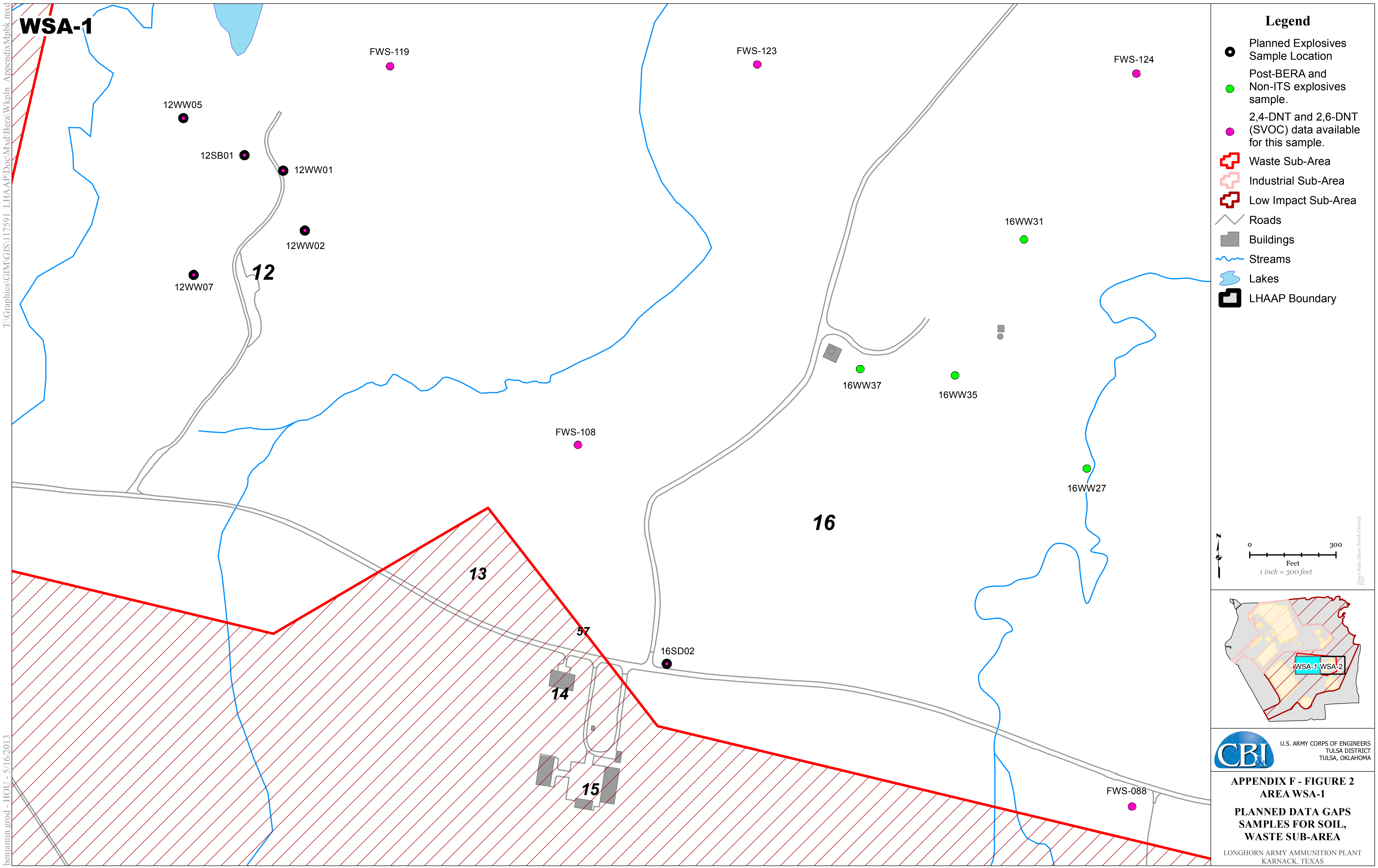
APPENDIX F
FIGURE 1
OVERVIEW MAP
PLANNED DATA GAPS SAMPLES FOR SOIL, WASTE SUB-AREA

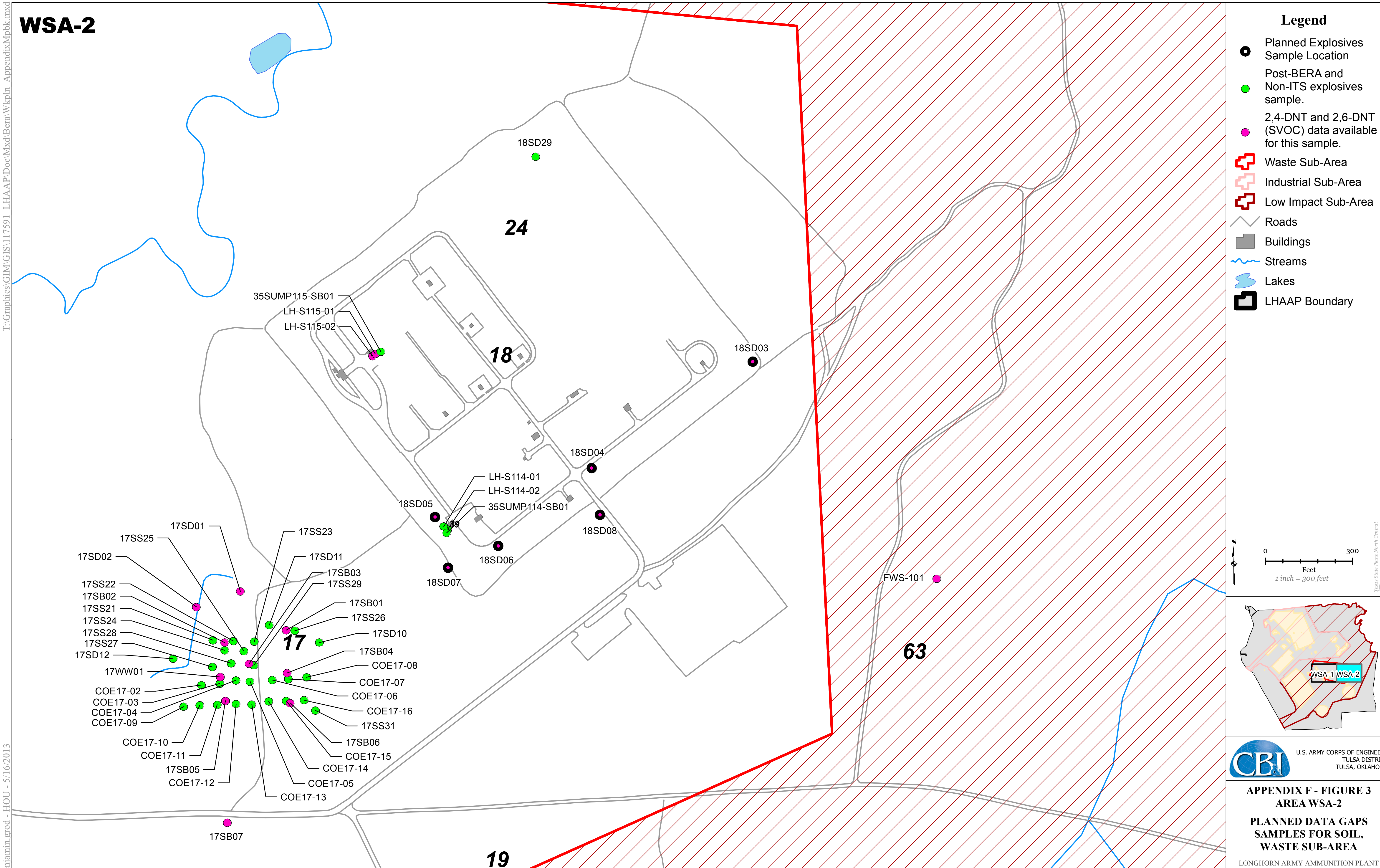
LONGHORN ARMY AMMUNITION PLANT
KARNACK, TEXAS

T:\Graphics\GIM\GIS\117591 LHAAP\Doc\Mxd\Bera\Wkpln AppendixMpbk.mxd

benjamin.grod - HOU - 5/16/2013

00188291


WSA-1
FWS-119
FWS-123
FWS-124
12WW05
12SB01
12WW01
12WW02
12WW07
12
16WW31
16WW37
16WW35
FWS-108
16WW27
16
13
57
16SD02
14
15
FWS-088
Legend
Planned Explosives Sample Location
Post-BERA and Non-ITS explosives sample.
2,4-DNT and 2,6-DNT (SVOC) data available for this sample.
Waste Sub-Area
Industrial Sub-Area
Low Impact Sub-Area
Roads
Buildings
Streams
Lakes
LHAAP Boundary
0
300
Feet
1 inch = 300 feet
WSA-1
WSA-2
U.S. ARMY CORPS OF ENGINEERS
TULSA DISTRICT
TULSA, OKLAHOMA
APPENDIX F - FIGURE 2
AREA WSA-1
PLANNED DATA GAPS SAMPLES FOR SOIL, WASTE SUB-AREA
LONGHORN ARMY AMMUNITION PLANT
KARNACK, TEXAS
benjamin.grod - HOU - 5/16/2013



APPENDIX F - FIGURE 3
AREA WSA-2

PLANNED DATA GAPS SAMPLES FOR SOIL, WASTE SUB-AREA

LONGHORN ARMY AMMUNITION PLANT
KARNACK, TEXAS

APPENDIX G

Uniform Federal Policy for Quality Assurance Project Plan

[On compact disc]

This page is intentionally left blank.

00188298

FINAL

BASELINE ECOLOGICAL RISK ASSESSMENT ADDENDUM LONGHORN ARMY AMMUNITION PLANT, KARNACK, TEXAS

UNIFORM FEDERAL POLICY FOR QUALITY ASSURANCE PROJECT PLAN

Contract No. W912BV-10-D-2010

Task Order 0004

PREPARED FOR:

U.S. Army Corps of Engineers, Tulsa District
1645 South 101 East Avenue
Tulsa, OK 74128

PREPARED BY:

AGEISS Inc.
1202 Bergen Parkway, Suite 310
Evergreen, CO 80439

September 2013
Revision 0

TABLE OF CONTENTS

Section **Page**

LIST OF TABLES

LIST OF FIGURES

LIST OF APPENDICES

ABBREVIATION / ACRONYM LIST

AGEISS	AGEISS Inc.
AHA	Activity Hazard Analysis
APP	Accident Prevention Plan
BERA	Baseline Ecological Risk Assessment
CC	Central Creek
CSM	Conceptual Site Model
DNT	dinitrotoluene
DQO	data quality objective
DVSR	Data Validation Summary Report
EPC	exposure point concentration
FFA	Federal Facilities Agreement
GPC	Goose Prairie Creek
GPS	global positioning system
HASP	Health and Safety Plan
HAZWOPER	Hazardous Waste Operations and Emergency Response
HB	Harrison Bayou
IDW	Investigative Derived Waste
ISA	Industrial Sub-Area
ITS	Intertek Testing Services
ITS-ENV	Intertek Testing Services Environmental Laboratories, Inc.
LHAAP	Longhorn Army Ammunition Plant
LISA	Low Impact Sub-Area
LOQ	level of quantitation
MDL	method detection limit
MEC	munitions and explosives of concern
MS	matrix spike
MSD	matrix spike duplicate
PAL	project action limit
PQO	project quality objective
PSR	progress summary report
QC	quality control
RCRA	Resource Conservation and Recovery Act
RPD	relative percent difference
RTC	response to comment
SAP	Sampling and Analysis Plan
SB	Saunders Branch
Shaw	Shaw Environmental & Infrastructure Group
SOP	standard operating procedure
SOW	scope of work
SPP	systematic planning process
SVOC	semivolatile organic compound
TCEQ	Texas Commission on Environmental Quality
TNT	trinitrotoluene
TO	task order
UFP-QAPP	Uniform Federal Policy for Quality Assurance Project Plan
USACE	U.S. Army Corps of Engineers
USEPA	U.S. Environmental Protection Agency
USFWS	U.S. Fish and Wildlife Service
WSA	Waste Sub-Area

EXECUTIVE SUMMARY

SITE LOCATION AND HISTORY

Currently inactive, Longhorn Army Ammunition Plant (LHAAP) was an 8,493-acre government-owned, contractor-operated facility in Karnack, TX that was established in 1942. The Monsanto Chemical Company selected the site in December 1941 to produce trinitrotoluene (TNT). The plant produced 393,000,000 pounds of TNT throughout World War II. After the signing of the Intermediate-Range Nuclear Forces Treaty on December 8, 1987, LHAAP was operated by Thiokol and used to destroy Pershing IA and II missiles.

LHAAP was proposed for the National Priorities List on July 14, 1989 due to metals and explosives contamination. The installation was placed on the final National Priorities List on August 30, 1990. The U.S. Environmental Protection Agency (USEPA) Region 6, the Texas Water Commission (now Texas Commission on Environmental Quality [TCEQ]), and the Army signed a Federal Facilities Agreement (FFA) on December 30, 1991. LHAAP applied for a Resource Conservation and Recovery Act (RCRA) Part A Permit; a RCRA Part B Permit was signed February 1992 (TNRCC Permit No. HW-50195); however, this permit has since expired.

LHAAP became inactive and excess to the Army's needs in July 1997. Between 1998 and 2000, the Army liquidated all personal property and specific installed property. In 1999, the Army demolished several structurally unsafe buildings. A Memorandum of Agreement between the Army and U.S. Fish and Wildlife Service (USFWS) was signed on October 21, 2000 designating an area consisting of approximately 7,200 acres for establishment of a wildlife refuge at LHAAP. LHAAP was administratively transferred to the Base Realignment and Closure Division in October 2002.

PROJECT OBJECTIVES

The project objective is to complete the on-going Baseline Ecological Risk Assessment (BERA) for LHAAP. To complete the BERA, AGEISS Inc. (AGEISS) and CB&I (formerly Shaw Environmental & Infrastructure Group [Shaw]), referred to as the AGEISS Team, will prepare for and conduct sampling to fill the data gaps resulting from the loss of rejected Intertek Testing Services (ITS) explosives data. The data gaps are identified and rationale for sample collection are explained in detail in the *Data Gap Memorandum for Explosives in Soil at the Longhorn Army Ammunition Plant, Karnack, TX* (AGEISS/CB&I 2013) and the *Data Gap Memorandum for Explosives in Sediment and Surface Water at the Longhorn Army Ammunition Plant, Karnack, TX* (AGEISS/CB&I 2013). The AGEISS Team will meet the project objectives by preparing a BERA Addendum in compliance with the FFA.

PURPOSE OF UFP-QAPP

On behalf of the U.S. Army Corps of Engineers (USACE), Tulsa District, AGEISS has prepared this Quality Assurance Project Plan (QAPP) for sampling activities to be performed at LHAAP, Karnack, TX under AGEISS Contract Number W912BV-10-D-2010.

This Uniform Federal Policy for Quality Assurance Project Plan (UFP-QAPP) is based on the Intergovernmental Data Quality Task Force's *Uniform Federal Policy for Quality Assurance Project Plans (UFP-QAPP): Evaluating, Assessing, and Documenting Environmental Data Collection and Use Programs*, Final Version 1 March 2005. The worksheets included in this UFP-QAPP have been prepared in accordance with guidance in the *UFP-QAPP Manual*.

The UFP-QAPP is organized into the following four sections:

- Project Management and Objectives, Worksheets 1 through 16
- Measurement and Data Acquisition, Worksheets 17 through 30
- Assessment and Oversight, Worksheets 31 through 33
- Data Review, Worksheets 34 through 37

This UFP-QAPP is required reading for all staff participating in the work effort. The UFP-QAPP will be in the possession of the field team collecting the samples. All subcontractors will be required to comply with the procedures documented in the planning documents in order to maintain comparability and representativeness of the collected and generated data.

Worksheets #1 and #2: Title and Approval Pages and Identifying Information

These worksheets provide the title of this document and other identifying information.

Site Name/Project Name:	Baseline Ecological Risk Assessment Addendum
Site Location:	LHAAP, Karnack, TX
Contract Number:	W912BV-10-D-2010 Task Order (TO) 0004
Document Title:	Baseline Ecological Risk Assessment Addendum, Longhorn Army Ammunition Plant, Karnack, Texas, Uniform Federal Policy For Quality Assurance Project Plan
Identify Guidance Used to Prepare QAPP:	• Uniform Federal Policy for Quality Assurance Project Plans (Intergovernmental Data Quality Task Force, March 2005) • Optimized UFP-QAPP Worksheets, March 2012 • U.S. Department of Defense (DOD) Quality Systems Manual for Environmental Laboratories, Version 4.2, October 2010
Indicate Whether the QAPP is a Generic or a Project-Specific QAPP?	This UFP-QAPP is Project Specific.
List Dates of Scoping Sessions that were Held:	A kick-off meeting was held on August 23, 2012.
List Dates and Titles of QAPP Documents Written for Previous Site Work, if Applicable:	Not Applicable (N/A)
Regulatory Program:	TCEQ USEPA
Approval Entity:	USACE, Tulsa District
Organizational Partners (Stakeholders) and Connection with Lead Organization:	• LHAAP (Lead Agency/Owner) • USACE Tulsa District (Approval Agency) • TCEQ (Regulatory Agency) • USEPA Region 6 (Regulatory Agency) • USFWS (transfer recipient of the property)
List Data Users:	• LHAAP (Lead Agency/Owner) • USACE Tulsa District (Approval Agency) • TCEQ (Regulatory Agency) • USEPA Region 6 (Regulatory Agency) • Contractor - AGEISS • Contractor – CB&I • USFWS (transfer recipient of the property) • The public
Preparer's Name and Organizational Affiliation:	Gloria Beilke, Senior Chemist AGEISS
Preparer's Address, Telephone Number, and E-mail Address:	1202 Bergen Parkway, Suite 310 Evergreen, CO 80439 gloriab@ageiss.com
Preparation Date:	March 2013

Position/Title	Name	Organization	Printed Name	Signature	Date
Approval Agency's Project Manager	John Lambert	USACE, Tulsa District			
Approval Agency's Technical Manager	Aaron Williams	USACE, Tulsa District			
Lead Organization's LHAAP Site Manager	Dr. Rose Zeiler	LHAAP			
Investigative Organization's Program Manager	Melissa Russ	AGEISS			
Investigative Organization's TO Manager	Jim Denier	AGEISS			
Investigative Organization's Project QC Manager	Leroy Shaser	AGEISS			

Document Control Number: G019-004-LH-T-052

Required QAPP Element(s) and Corresponding QAPP Section(s) (per Uniform Federal Policy QAPP 2005)	Required Information	Crosswalk to Required Documents
PROJECT MANAGEMENT AND OBJECTIVES		
2.1 Title and Approval Page	- Title and Approval Page	Worksheets #1 & #2 – Title and Approval Pages and Identifying Information
2.2 Document Format and Table of Contents 2.2.1 Document Control Format 2.2.2 Document Control Numbering System 2.2.3 Table of Contents 2.2.4 QAPP Identifying Information	- Table of Contents - Document Control Number - QAPP Identifying Information	Worksheets #2 & #5 – Document Control Number The Table of Contents is provided following the QAPP cover page. Worksheets #1 & #2 – Title and Approval Pages and Identifying Information
2.3 Distribution List and Project Personnel Sign-Off Sheet 2.3.1 Distribution List 2.3.2 Project Personnel Sign-Off Sheet	- Distribution List - Project Personnel Sign-Off Sheet	Worksheets #3 & #5 – Project Organization and QAPP Distribution Worksheet #4, #7, & #8 – Personnel Qualifications and Sign-Off Sheet
2.4 Project Organization 2.4.1 Project Organizational Chart 2.4.2 Communication Pathways 2.4.3 Personnel Responsibilities and Qualifications 2.4.4 Special Training Requirements and Certification	- Project Organizational Chart - Communication Pathways - Personnel Responsibilities and Qualifications Table - Special Personnel Training Requirements Table	Worksheets #3 & #5 – Project Organization and QAPP Distribution Worksheet #6 – Communication Pathways Worksheet #4, #7, & #8 – Personnel Qualifications and Sign-Off Sheet

Required QAPP Element(s) and Corresponding QAPP Section(s) (per Uniform Federal Policy QAPP 2005)	Required Information	Crosswalk to Required Documents
2.5 Project Planning/Problem Definition 2.5.1 Project Planning (Scoping) 2.5.2 Problem Definition, Site History and Background	- Project Planning Session Documentation (including data needs tables) - Project Scoping Session Participants Sheet - Problem Definition, Site History and Background	Worksheet #9 – Project Planning Session Summary Worksheet #10 – Conceptual Site Model Executive Summary
2.6 Project Quality Objectives and Measurement Performance Criteria 2.6.1 Development of Project Quality Objectives Using the Systematic Planning Process 2.6.2 Measurement Performance Criteria	- Site-Specific Project Quality Objectives - Measurement Performance Criteria Table	Worksheet #11 – Project/Data Quality Objectives Worksheets #12-1 through #12-3 – Measurement Performance Criteria for Project Analytes
2.7 Secondary Data Evaluation	- Sources of Secondary Data and Information - Secondary Data Criteria and Limitations Table	Worksheet #13 – Secondary Data Uses and Limitations
2.8 Project Overview and Schedule 2.8.1 Project Overview 2.8.2 Project Schedule	- Summary of Project Tasks - Reference Limits and Evaluation Table - Project Schedule/Timeline Table	Worksheet #14 – Project Tasks & Schedule Worksheet #15 – Project Action Limits and Laboratory-Specific Detection/Quantitation Limits Worksheet #16 – Project Tasks & Schedule

Required QAPP Element(s) and Corresponding QAPP Section(s) (per Uniform Federal Policy QAPP 2005)	Required Information	Crosswalk to Required Documents
MEASUREMENT/DATA ACQUISITION		
3.1 Sampling Tasks 3.1.1 Sampling Process Design and Rationale 3.1.2 Sampling Procedures and Requirements 3.1.2.1 Sampling Collection Procedures 3.1.2.2 Sample Containers, Volume and Preservation 3.1.2.3 Equipment/Sample Containers Cleaning and Decontamination Procedures 3.1.2.4 Field Equipment Calibration, Maintenance, Testing and Inspection Procedures 3.1.2.5 Supply Inspection and Acceptance Procedures 3.1.2.6 Field Documentation Procedures	- Sampling Design and Rationale - Sample Location Map - Sampling Locations and Methods/Standard Operating Procedure (SOP) Requirements Table - Analytical Methods/SOP Requirements Table - Field Quality Control (QC) Sample Summary Table - Sampling SOPs - Project Sampling SOP References Table - Field Equipment Calibration, Maintenance, Testing, and Inspection Table	Worksheet #17 – Sampling Design and Rationale Worksheet #18 – Sampling Locations and Methods Worksheet #19 – Analytical SOP Requirements (Sample Containers, Preservation, and Holding Times) Worksheet #20 – Field QC Summary Worksheet #21 – Field SOPs (Field SOPs can be found in Appendix C.) Worksheet #22 – Field Equipment Calibration, Maintenance, Testing and Inspection

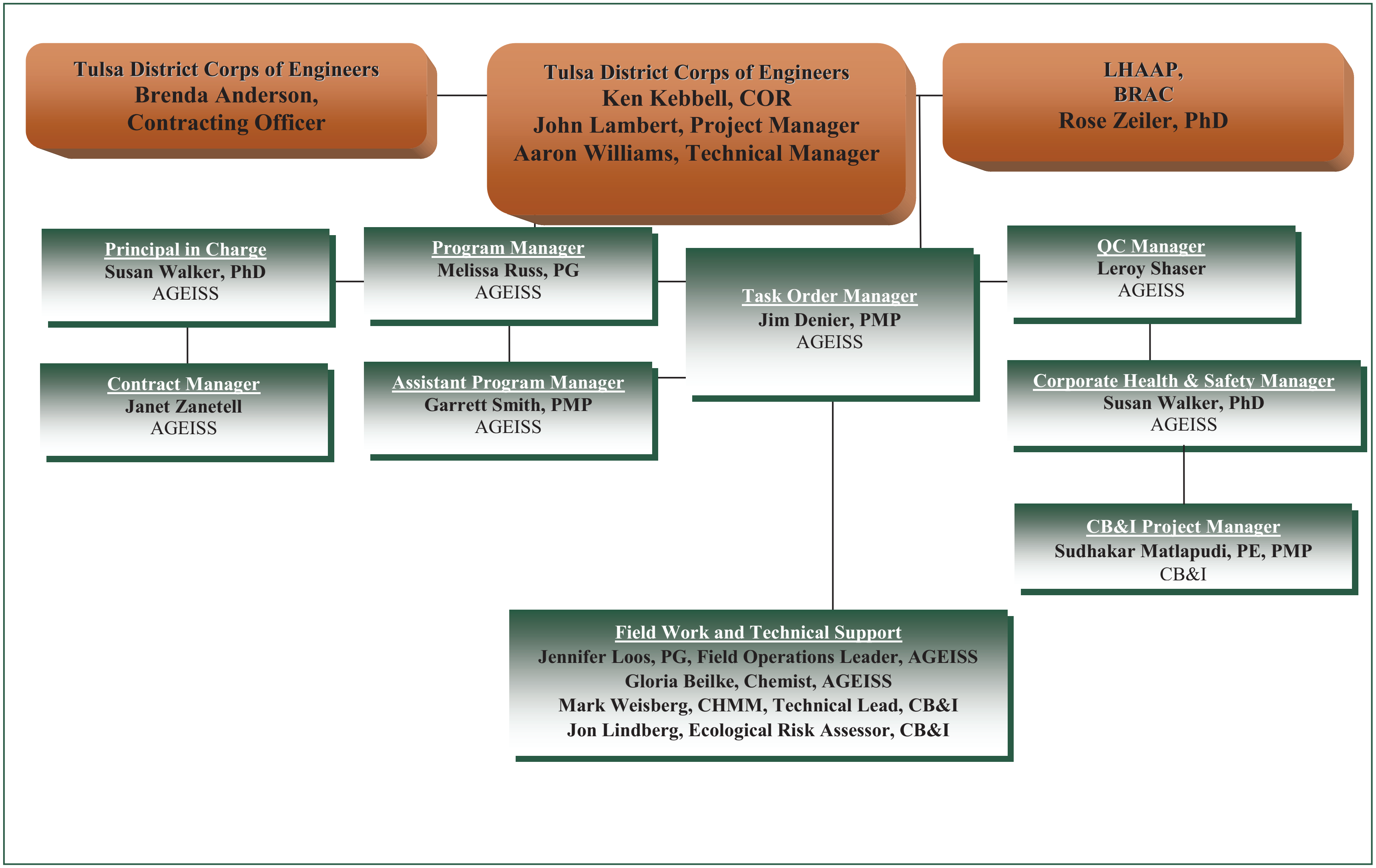
Required QAPP Element(s) and Corresponding QAPP Section(s) (per Uniform Federal Policy QAPP 2005)	Required Information	Crosswalk to Required Documents
3.2 Analytical Tasks 3.2.1 Analytical SOPs 3.2.2 Analytical Instrument Calibration Procedures 3.2.3 Analytical Instrument and Equipment Maintenance, Testing and Inspection Procedures 3.2.4 Analytical Supply Inspection and Acceptance Procedures	- Analytical SOPs - Analytical SOP References Table - Analytical Instrument Calibration Table - Analytical Instrument and Equipment Maintenance, Testing and Inspection Table	Worksheet #23 – Analytical SOPs (Analytical SOPs can be found in Appendix D.) Worksheet #24 – Analytical Instrument Calibration Worksheet #25 – Analytical Instrument and Equipment Maintenance, Testing, and Inspection
3.3 Sample Collection Documentation, Handling, Tracking and Custody Procedures 3.3.1 Sample Collection Documentation 3.3.2 Sample Handling and Tracking System 3.3.3 Sample Custody	- Sample Collection Documentation Handling, Tracking and Custody SOPs - Sample Container Identification - Sample Handling Flow Diagram - Example Chain-of-Custody (COC) Form and Seal	Worksheet #26 – Sample Handling, Custody, and Disposal Worksheet #27 – Sample Handling, Custody, and Disposal An example of the COC form is provided in SOP LHAAP-F-7, Sample Handling, Labeling, Packaging, and Custody.
3.4 Quality Control Samples 3.4.1 Sampling Quality Control Samples 3.4.2 Analytical Quality Control Samples	- QC Samples Table - Screening/Confirmatory Analysis Decision Tree	Worksheets #28-1, #28-2, and #28-3 present QC sample information for project analytes.
3.5 Data Management Tasks 3.5.1 Project Documentation and Records 3.5.2 Data Package Deliverables 3.5.3 Data Reporting Formats 3.5.4 Data Handling and Management 3.5.5 Data Tracking and Control	- Project Documents and Records Table - Analytical Services Table - Data Management	Worksheet #29 – Project Documents and Records Worksheet #30 – Sample Containers, Preservation, and Hold Times

Required QAPP Element(s) and Corresponding QAPP Section(s) (per Uniform Federal Policy QAPP 2005)	Required Information	Crosswalk to Required Documents
ASSESSMENT/OVERSIGHT		
4.1 Assessments and Response Actions 4.1.1 Planned Assessments 4.1.2 Assessment Findings and Corrective Action Responses	- Assessments and Response Actions - Planned Project Assessments Table - Audit Checklists - Assessment Findings and Corrective Action Responses Table	Worksheet #31 – Planned Project Assessments Worksheet #32 – Assessment Findings and Corrective Action Responses
4.2 Quality Assurance (QA) Management Reports	- QA Management Reports Table	Worksheet #33 – Assessments and Corrective Actions
4.3 Final Project Report	N/A	N/A
DATA REVIEW		
5.1 Overview		
5.2 Data Review Steps 5.2.1 Step I: Verification 5.2.2 Step II: Validation 5.2.2.1 Step IIa Validation Activities 5.2.2.2 Step IIb Validation Activities 5.2.3 Step III: Usability Assessment 5.2.3.1 Data Limitations and Actions from Usability Assessment 5.2.3.2 Activities	- Verification (Step I) Process Table - Validation (Steps IIa and IIb) Process Table - Validation (Steps IIa and IIb) Summary Table - Usability Assessment	Worksheet #34 – Data Verification and Validation Inputs Worksheet #35 – Data Verification Procedures Worksheet #36 – Data Validation Procedures Worksheet #37 – Data Usability Assessment
5.3 Streamlining Data Review 5.3.1 Data Review Steps to be Streamlined 5.3.2 Criteria for Streamlining Data Review 5.3.3 Amounts and Types of Data Appropriate for Streamlining	N/A	N/A

Worksheets #3 and # 5: Project Organization and QAPP Distribution

This worksheet presents the project organizational chart and distribution information.

Figure 1. Organizational Chart for the BERA at Longhorn Army Ammunition Plant, Karnack, Texas



Copies of the Army Draft QAPP, approved Final QAPP, subsequent QAPP revisions, addenda, and amendments will be sent to the entities provided on this QAPP Distribution List worksheet.

QAPP Recipients	Title	Organization	Telephone Number	E-mail Address	Document Control Number
Lambert, John	Project Manager	USACE, Tulsa District	918-669-4992	John.R.Lambert@usace.army.mil	G019-004-LH-T-052
Williams, Aaron	Technical Manager	USACE, Tulsa District	918-669-4915	Aaron.K.Williams@usace.army.mil	G019-004-LH-T-052
Zeiler, Rose	LHAAP Site Manager	LHAAP BRAC	479-635-0110	Rose.Zeiler@us.army.mil	G019-004-LH-T-052
Agron, Gina	Health & Safety Officer	AGEISS	907-726-1647	ginaa@ageiss.com	G019-004-LH-T-052
Beilke, Gloria	Project Chemist	AGEISS	303-741-5870	gloriab@ageiss.com	G019-004-LH-T-052
Denier, Jim	TO Manager	AGEISS	303-674-5059 extension 120	jimd@ageiss-inc.com	G019-004-LH-T-052
Loos, Jennifer	Field Operations Leader	AGEISS	303-674-5059, extension 121	jenniferl@ageiss-inc.com	G019-004-LH-T-052
Russ, Melissa	Program Manager	AGEISS	303-300-9096	melissar@ageiss.com	G019-004-LH-T-052
Shaser, Leroy	QC Manager	AGEISS	303-674-5059 extension 122	leroys@ageiss.com	G019-004-LH-T-052
Walker, Susan	Principal-in-Charge/H&S Manager	AGEISS	303-789-5414	susanw@ageiss.com	G019-004-LH-T-052
Dill, Don	Data Validation Specialist	CB&I	865-670-2660	Don.Dill@cbi.com	G019-004-LH-T-052
Lindberg, Jon	Ecological Risk Assessor	CB&I	865-692-3647	Jonathan.Lindberg@cbi.com	G019-004-LH-T-052
Sudhakar, Matlapudi	CB&I Project Manager	CB&I	281-531-3104	Sudhakar.Matlapudi@cbi.com	G019-004-LH-T-052
Weisberg, Mark	Technical Lead	CB&I	412-858-3996	Mark.Weisberg@cbi.com	G019-004-LH-T-052
Bucina, Leslie	QA/QC Manager	MICROBAC Laboratory	800-373-4071	Leslie.bucina@microbac.com	G019-004-LH-T-052
Mossburg, Stephanie	Project Manager	MICROBAC Laboratory	800-373-4071	stephanie.mossburg@microbac.com	G019-004-LH-T-052

Worksheet #4, 7, & 8: Personnel Qualifications and Sign-off Sheet

This worksheet presents relevant personnel qualifications for each organization involved with this project.

ORGANIZATION: AGEISS

Name	Project Title/Role	Education/Experience	Specialized Training/Certifications	Signature*/Date
Dr. Susan Walker	Principal in Charge, Corporate Health & Safety Manager	Ph.D. Pathology B.S. Zoology 34 years experience	• 40-Hour Occupational Safety and Health Administration (OSHA) Health and Safety Hazardous Waste Site Worker • 8-Hour OSHA Supervisor Health and Safety Hazardous Waste Site Worker	
Melissa Russ	Program Manager	M.S. Geology B.S. Geology 28 years experience	• Registered Professional Geologist Utah • Registered Professional Geologist Wyoming • 40-Hour Hazardous Waste Operations and Emergency Response (HAZWOPER) Training and annual 8-Hour HAZWOPER Refresher courses	
Jim Denier	TO Manager	MBA, Business Management B.A. Zoology 32 years experience	• Certified Project Management Professional (PMP) • NEPA training	
Leroy Shaser	Quality Control Manager	M.S. Geology 32 years experience	• 32-Hour HAZWOPER Training	
Jennifer Loos	Field Operations Leader	M.S. Geology B.S. Biology 15 years experience	• Registered Professional Geologist No. 2233-TX • 40-Hour HAZWOPER Training and 8-Hour HAZWOPER Refresher courses • Texas Risk Reduction Program Training - Guidance and Policy	
Gloria Beilke	Project Chemist	B.S. Chemistry and Biology 24 years experience	• 40-Hour HAZWOPER Training and annual 8-Hour HAZWOPER Refresher courses	
Gina Agron	Health & Safety Officer	M.S. Industrial Hygiene & Environmental Management B.S. Biology 18 years experience	• OSHA 511 • 40-Hour HAZWOPER Training and annual 8-Hour HAZWOPER Refresher courses	

*Signatures indicate personnel have read and agree to implement this QAPP as written.

ORGANIZATION: CB&I

Name	Project Title/Role	Education/Experience	Specialized Training/Certifications	Signature*/Date
Sudhakar Matlapudi	Project Manager	Master of Engineering, Environmental Science; Bachelor of Engineering, Civil Engineering; 19+ years experience	• Professional Engineer (PE) • Certified Project Management Professional (PMP) • Manufacturer's Training Course - Niton XRF Spectrum Analyzer • 40-Hour Hazardous Waste Operations and Emergency Response Training and annual 8-Hour HAZWOPER Refresher courses	
Mark Weisberg	Technical Lead	M.S. Water Resources Management; M.S. Oceanography and Limnology; B.S. Biology and Environmental Studies 25 years experience	• Certified Hazardous Materials Manager • 40-Hour Hazardous Waste Operations and Emergency Response Training • Annual 8-Hour HAZWOPER Refresher courses	
Jon Lindberg	Ecological Risk Assessor	M.S. Environmental Science B.S. Biology 13+ years experience	• 40-Hour Hazardous Waste Operations and Emergency Response Training • Annual 8-Hour HAZWOPER Refresher courses	
Don Dill	Data Validation Specialist	B.S. Physics 20 years experience	• 40-Hour Hazardous Waste Operations and Emergency Response Training • Annual 8-Hour HAZWOPER Refresher courses	

*Signatures indicate personnel have read and agree to implement this QAPP as written.

ORGANIZATION: Microbac Laboratory

Name	Project Title/Role	Education/Experience	Specialized Training/Certifications	Signature*/Date
Leslie Bucina	Laboratory Manager	B.S. Chemistry 25 years experience	DOD; ISO 17025; National Environmental Laboratory Accreditation Program (NELAP)	
Wade Delong	Quality Control Manager	B.S. Natural Systems 22 years experience	DOD; ISO 17025; NELAP; Method Development	
Stephanie Mossburg	Project Manager/Client Service Supervisor	B.A. Biochemistry 21 years experience	DOD; ISO 17025; NELAP; Laboratory Information Management Systems; Client Services	

*Signatures indicate personnel have read and agree to implement this QAPP as written.

Worksheet #6: Communication Pathways

This worksheet provides the communication pathways and modes of communication that will be used during the project.

Communication Drivers	Responsible Entity	Name	Phone Number	Procedure (Timing, pathways, documentation, etc)
Project issues and corporate policies	AGEISS Program Manager	Melissa Russ	303-300-9096	The AGEISS Program Manager communicates with USACE and LHAAP regarding overall project issues, corporate policies, and situations that need to be addressed at the program/contractual level (e-mail or hardcopy).
Project management issues	USACE Project Manager	John Lambert	918-669-4992	Project management issues are communicated to the USACE Project Manager via phone and written communication for resolution and approval. Monthly progress summary reports are provided to the USACE Project Manager.
Project technical issues	USACE Technical Manager	Aaron Williams	918-669-4915	Technical project issues are communicated to the USACE Technical Manager via phone and written communication for resolution and approval. Monthly progress summary reports are provided to the USACE Project Manager.
Project Management Investigative Organization	AGEISS TO Manager	Jim Denier	303-674-5059	The AGEISS TO Manager oversees all work performed by the AGEISS Team on this TO. The AGEISS TO Manager manages the project schedule and budget and communicates project information to the project team and Program Manager.
Stop Work and Initiation of Corrective Action	AGEISS TO Manager	Jim Denier	303-674-5059	The AGEISS TO Manager communicates as soon as possible after the work stoppage to the entire organization provided in Worksheets #3 & #5. The communication will provided by e-mail.
Manage Project – Subcontractor	CB&I Project Manager	Sudhakar Matlapudi	281-531-3104	The CB&I Project Manager oversees all office work to be performed by CB&I personnel on this TO and closely coordinates with the AGEISS TO Manager on the overall TO.
Start of planned field activities	AGEISS TO Manager	Jim Denier	303-674-5059	The AGEISS TO Manager contacts the LHAAP Site Manager and the USACE Technical Manager one week prior to the start of field activities.

Communication Drivers	Responsible Entity	Name	Phone Number	Procedure (Timing, pathways, documentation, etc)
QAPP deviation in field	AGEISS Field Operations Leader	Jennifer Loos	303-674-5059	The AGEISS Field Operations Leader plans and oversees all field work to be performed on this TO. The Field Operations Leader notifies the AGEISS TO Manager and Project Chemist of deviations from QAPP protocol that occurred in the field prior to the end of the sampling day. Deviations are documented in the field notebook and in the final report and may be proposed for QAPP modification, if appropriate.
Proposed QAPP Changes (Modification to QAPP)	AGEISS Program Manager AGEISS TO Manager AGEISS Project Chemist AGEISS Field Operations Leader USACE Technical Manager	Melissa Russ Jim Denier Gloria Beilke Jennifer Loos Aaron Williams	303-300-9096 303-674-5059 303-741-5870 303-674-5059 918-669-4915	If required, the AGEISS Field Operations Leader and Project Chemist propose modifications to the AGEISS TO Manager. The AGEISS TO Manager, with concurrence from the AGEISS Program Manager, proposes modifications to the USACE Technical Manager for approval prior to change implementation. Communication regarding modification is in writing.
Field Activities and Progress Reports	AGEISS TO Manager	Jim Denier	303-674-5059	The AGEISS TO Manager notifies installation personnel prior to the start of field work and maintains on-going communication with LHAAP Site Manager throughout field activities.
Laboratory Issues	MICROBAC Project Manager	Stephanie Mossburg	1-800-373-4071	The MICROBAC Project Manager notifies the AGEISS Project Chemist of any problems at the laboratory, including receipt of samples, instrument problems, reporting limits, or any other issues that will affect the data or Turn Around Time of reported results within 24 hours of the occurrence.

Communication Drivers	Responsible Entity	Name	Phone Number	Procedure (Timing, pathways, documentation, etc)
Field and Laboratory Data Quality Issues	AGEISS Project Chemist AGEISS TO Manager AGEISS Field Operations Leader	Gloria Beilke Jim Denier Jennifer Loos	303-741-5870 303-674-5059 303-674-5059	The AGEISS Project Chemist notifies the MICROBAC Project Manager, AGEISS TO Manager, and AGEISS Field Operations Leader, as appropriate, by phone or e-mail of field and/or lab quality assurance/quality control issues within one business day.
Field and Analytical Corrective Actions	AGEISS TO Manager AGEISS Field Operations Leader AGEISS Project Chemist	Jim Denier Jennifer Loos Gloria Beilke	303-674-5059 303-674-5059 303-741-5870	The Project QC Manager determines the need for field or laboratory corrective action, coordinates between appropriate team members, and communicates in writing to the field staff and or laboratory prior to the next sampling event.
Release of Analytical Data	AGEISS Project Chemist	Gloria Beilke	303-741-5870	Analytical data are not released for use until data review and data validation are complete and data are deemed usable. Following approval of validation findings by the AGEISS Project Chemist, the data are released for project team use via e-mail to the project team.

Worksheet #9: Project Planning Session Summary

Date of planning session: August 23, 2012
Location: Teleconference

Purpose: The purpose of the kick-off meeting was to: review the project history, discuss the project scope and identify lines of communication, review the Project Management Plan, and discuss the project schedule, deliverables, and logistics.

The following main topics were discussed during the meeting.

Project Objectives/History

- ♦ TCEQ and USEPA had initially requested a 1:1 replacement of lab data that was presented inadvertently in the BERA. USEPA, TCEQ, and USACE later discussed a reduced number of samples. Responses to comments (RTCs) have been received from the regulators that provide direction on the path forward. Dr. Zeiler provided a copy of the RTCs during the teleconference.
- ♦ The Data Gap Memoranda, to be prepared by AGEISS/CB&I, will formally present the resampling plan, including the number of samples discussed by TCEQ and USACE and a map of the sample locations. The sampling map will include the locations of samples that were rejected and those that were not rejected. Mr. Lindberg said that those maps have already been created, and that the new sampling locations can be added to those maps. He noted that some of the original explosives data were duplicated by other analytical methods, although those methods did not necessarily include all explosives constituents.
- ♦ Mr. Matlapudi noted that TCEQ's email/memo could be combined with Mr. Williams' summary paper to create the Data Gap Memoranda. Once the Data Gap Memoranda are provided to the USEPA and TCEQ, the Work Plan could be started during USEPA and TCEQ review of the memoranda.

Agency Coordination

- ♦ There is an FFA among the U.S. Army, TCEQ, and the USEPA. While USEPA is the lead regulatory agency, USEPA and TCEQ will review documents and provide comments. Mr. Barry Forsythe is the USEPA reviewer. Currently, there is no enforcement schedule.
- ♦ Dr. Zeiler noted that team members should not contact the regulators directly and nothing should be submitted to regulators without first going through USACE.
- ♦ With regard to the USFWS, Dr. Zeiler noted that the USFWS is a transfer recipient of the property, and as such, may have a conflict of interest in reviewing deliverables. USFWS comments are submitted directly to Dr. Zeiler. Although the USFWS is not a party to the FFA, and therefore the Army is not bound to satisfy USFWS, the Army is still interested in obtaining USFWS' comments, because they are the future transferee and because they have ecological expertise.

Logistics/Communications

- ♦ Ms. Russ reviewed the Organizational Chart in the Project Management Plan. The chart reflects that Jim Denier (AGEISS TO Manager) is the central Point of Contact. The line of formal communication is from USACE to Mr. Denier to AGEISS/ CB&I. This does not preclude informal technical discussions that CB&I may need to have with USACE. All deliverables, even those prepared by CB&I, will be submitted through AGEISS and Mr. Denier. Additionally, AGEISS will maintain the project file and needs copies of all pertinent documents.
- ♦ With regard to site coordination issues that might arise, Dr. Zeiler should be contacted through USACE or directly and also should be copied on all communications. Contractual and technical issues that might arise should go through USACE.

- With regard to taking photographs at the site, Dr. Zeiler noted that the site is not active so there are no restrictions on taking photographs.
- Ms. Russ brought up for discussion the procedures to access the site for field work. The field work schedule will need to be coordinated through the USFWS, as they are managing 7,000 acres that have already been transferred to USFWS. The USFWS contact is Mr. Paul Bruckwicki. Dr. Zeiler noted that LHAAP is a Superfund site and as such, members of the public are not allowed to be present during sampling. It is anticipated that a new permit issued to USFWS to manage the land on which the sampling will occur will probably be in place by the time sampling is conducted, tentatively planned for March 2013. Ms. Russ noted that AGEISS would like to coordinate a space for sample management. Mr. Lambert replied that he would check on an available location. He noted that there is a trailer at the site but it is being used by the Performance-Based Contractor, AECOM. Mr. Foss noted that Shaw conducted sample management at the Water Treatment Plant, but that AECOM is currently using that space.
- Ms. Russ noted that the potential for encountering munitions and explosives of concern (MEC) was discussed during the proposal stage. She requested that field personnel receive a field briefing regarding MEC. Discussion ensued regarding there being no record of MEC at sites 17 and 19. If MEC is suspected or encountered, a stop work order will be issued immediately. However, MEC is not expected to be present. The USACE stated that they would provide a copy of the MEC safety video and a MEC information pamphlet. Both were provided after the meeting.
- With regard to site access, the gates are open during daylight hours and are locked at night. AGEISS should let AECOM know when AGEISS/CB&I personnel will be on site, and AGEISS will need to coordinate with AECOM, letting them know they will be sampling and to gain access to Site 17, which is within a locked area. USACE will provide a contact number for AECOM.

Schedule/Deliverables

- Dr. Zeiler should be copied on deliverables.
- Dr. Zeiler noted that with regard to deliverables, the Army uses a new terminology. The first deliverable is the "Army Draft," and the second deliverable that is submitted to the regulators for review is the "Draft." The third version is the "Draft Final" which automatically becomes the Final after 30 days and no additional comments. Mr. Lambert and Mr. Williams concurred.
- Ms. Russ asked about submitting the Draft deliverables to regulators. USACE noted that they want to perform an additional check of Draft deliverables that incorporate responses to the Army comments prior to submittal to the regulators. Ms. Russ noted that AGEISS would provide responses to Army comments in redline strikeout along with a comment /response sheet to the USACE for their approval prior to finalizing the document. Dr. Zeiler noted that the transmittal letter for Draft deliverables is required to have an official Point of Contact signature. She will provide a block signature to AGEISS.
- Dr. Zeiler asked Mr. Williams if the Ecological Risk Assessment is listed as a primary or secondary document in FAA, as these types of documents require different review times. He responded that he didn't know, but would check. She also noted that target dates given to regulators are very important to keep. For this project, the remedy is dependent on the BERA results so deliverable delays will also delay the remedy.
- Mr. Williams noted that the Army usually requires 30 days to review documents. Ms. Russ responded that she used shorter review periods on the schedule contained in the Project Management Plan because the documents are smaller than usual, but that the schedule can be adjusted to 30 days if necessary. It was agreed to use 20 days for Army review and 30 days for regulatory review.

- Discussion ensued about whether the deliverables schedule should reflect working days or calendar days. USACE requested that it be presented as calendar days. Ms. Russ said that the Project Management Plan calendar would be revised to reflect calendar days.

The following deliverables/requirements were discussed:

- **Project Management Plan** – The Draft Project Management Plan was submitted on August 17, 2012. The content of the plan was discussed to some degree at the kick off meeting. Ms. Russ reviewed the progress summary report (PSR) as presented in the plan. Mr. Lambert noted that the contract specified that the reporting also must include the percent complete by task. Ms. Russ agreed to include that information in the PSR. The PSR will be provided to Mr. Williams whereas invoices will go to Ms. Ginger Wilkins.
- **QAPP** – Ms. Russ introduced Ms. Gloria Beilke, an AGEISS Chemist and the lead author on the QAPP. Ms. Beilke said that she has started preparing the QAPP, but that she still needs information on sampling plan design and sampling locations. Ms. Russ noted that the QAPP will be completed hand-in-hand with the Data Gap Memorandum. Ms. Beilke noted that MICROBAC won the laboratory bid and that they are an excellent lab, and in response to a question, that they are NELAP-certified.
- **Data Gap Memoranda** – Most of the discussion of this deliverable occurred early in the meeting and has already been summarized in these meeting minutes.
- **BERA Addendum Work Plan** – AGEISS and CB&I will prepare the BERA Addendum Work Plan, which will include a Health and Safety Plan (HASP); Sampling and Analysis Plan (SAP); and Investigation-Derived Waste Management Plan. Data quality objectives (DQOs) will be captured in the QAPP but should also be cross referenced in the SAP. It was discussed that the SAP will also discuss sample management and field logistics. Preparation of the Work Plan will commence once concurrence on the Data Gap Memoranda has been obtained. Ms. Russ brought up the topic of regulator meetings, noting that the Statement of Work includes a meeting in Austin with TCEQ during the BERA Addendum Work Plan preparation and review. Dr. Zeiler indicated that the FFA Managers have quarterly on site meetings and project review meetings can be aligned with that schedule. She said that teleconferences should be fine for project review meetings. Ms. Russ noted that AGEISS can conduct Webex meetings which will allow review of site data together.
  NOTE: After the kick-off meeting, it was determined that with the Data Gap Memoranda and the QAPP, which would contain detailed field operating procedures, an SAP would not be needed.
- **Field Work –** Ms. Russ next discussed the general field operations plan. AGEISS plans to use a team of five people, comprised of two teams of two samplers and an additional person to coordinate sample management and work out field problems as necessary. It is expected that the teams would collect approximately 40 samples per day, with samples being shipped to the lab on a daily basis. The field program is expected to last about two weeks. Once sampling locations are identified, access issues, if any, can be addressed.
- **Lab Analysis and Data Validation –** CB&I will be preparing the data validation summary report. CB&I is also managing the data and the database. AGEISS is subcontracting and coordinating with the laboratory. Mr. Matlapudi noted that there will be no follow up sampling conducted and there is no step out sampling. The sampling objective is to generally replace existing data that were rejected, although at a reduced number. Horizontal extent delineation is not the objective.
- **BERA Addendum –** CB&I will be preparing the BERA Addendum.

Participants. Personnel from USACE – Tulsa District, LHAAP, AGEISS, and Shaw participated.

Name	Title/Role	Affiliation	Phone	E-mail Address
Aaron Williams	Technical Manager	USACE – Tulsa District	918-669-4915	Aaron.K.Williams@usace.army.mil
John Lambert	Project Manager	USACE – Tulsa District	918-669-4992	John.R.Lambert@usace.army.mil
Dr. Rose Zeiler	Site Manager	LHAAP	479-635-0110	Rose.Zeiler@us.army.mil
Melissa Russ	Program Manager	AGEISS	303-300-9096	MelissaR@ageiss.com
Gloria Beilke	Project Chemist	AGEISS	303-741-5870	gloriab@ageiss.com
Jennifer Loos	Field Operations Leader	AGEISS	303-674-5059 (ext 121)	JenniferL@ageiss-inc.com
Sudhakar "Matt" Matlapudi	Project Manager	Shaw	281-531-3104	Sudhakar.Matlapudi@shawgrp.com
Jon Lindberg	Ecological Risk Assessor	Shaw	865-692-3647	Jonathan.Lindberg@shawgrp.com
Mark Weisberg	Technical Lead	Shaw	412-858-3996	Mark.Weisberg@shawgrp.com

The following are Action Items from the meeting.

Action	Responsible Party	Due Date	Completion Date
Revise the project schedule to reflect calendar days and to show the agency review period to be 30 calendar days and the Army review period to be 20 calendar days. As noted previously, the FFA calls for calendar days.	AGEISS	Per project schedule	September 13, 2012
Provide comments on the Project Management Plan.	USACE and LHAAP	Per project schedule	August 27, 2012
Prepare and submit first deliverables, including the QAPP and Data Gap Memoranda.	AGEISS Team	Per project schedule	November 2012 December 2012

Worksheet #10: Conceptual Site Model

This worksheet is used to present the project's Conceptual Site Model (CSM). The CSM is a tool to assist in the development of DQOs.

PROBLEM DEFINITION

Step 1: The problem to be addressed by the project:
The project objective is to complete the on-going BERA for LHAAP, Karnack, Texas. To complete the BERA, the AGEISS Team will prepare for and conduct sampling to fill data gaps resulting from the loss of previously rejected explosives data and prepare a BERA Addendum in compliance with the FFA.
Step 2: The environmental questions being asked:
Do the sampling results collected to fill data gaps substantiate the original BERA results/conclusions? Do the additional sampling results support the CSM presented in the BERA? The ecological conceptual exposure model for the BERA at LHAAP integrates and summarizes the information concerning sources, constituent migration pathways, exposure routes, and measurement receptors into a combination of exposure pathways. This model identifies the key potential release mechanisms, transport media, exposure media, exposure routes, and measurement receptors for the BERA and has been presented in the *Baseline Ecological Risk Assessment Field Sampling Work Plan, Longhorn Army Ammunition Plant, Karnack, Texas* (Shaw 2006).
Step 3: Observations from any site reconnaissance reports:
Four watersheds at LHAAP comprise the aquatic ecological exposure units of concern that were evaluated in the BERA and include Central Creek, Goose Prairie Creek, Harrison Bayou, and Saunders Branch. Three terrestrial exposure units at LHAAP are "sub-areas" that were delineated based on their common historical uses and similar ecological habitat. These sub-areas include the Low Impact Sub-Area (LISA), the Industrial Sub-Area (ISA), and the Waste Sub-Area (WSA). The WSA was the only sub-area where explosives compounds were identified as chemicals of concern in the BERA.
Step 4: A synopsis of secondary data or information from all site reports:
Previous site investigations have been conducted. A summary is provided on Worksheet #17. The data from this re-sampling event are to fill in data gaps resulting from the loss of previously rejected explosives data.
Step 5: The possible classes of contaminants and the affected matrices:
Soil, sediment, and surface water samples will be collected for analysis of explosives using USEPA Method 8330A.
Step 6: The rationale for inclusion of chemical and nonchemical analyses:
Chemical analyses for Method 8330A will be necessary to have sufficient samples to conduct the required analyses in the BERA Addendum. Rationale is provided in the associated Data Gap Memoranda [*Data Gap Memorandum for Explosives in Soil at the Longhorn Army Ammunition Plant, Karnack, TX* (AGEISS/CB&I 2013) and the *Data Gap Memorandum for Explosives in Sediment and Surface Water at the Longhorn Army Ammunition Plant, Karnack, TX* (AGEISS/CB&I 2013)] and summarized on Worksheet #17. Samples will be analyzed for the parameters/analytes listed in Appendix A.
Information concerning various environmental indicators: N/A
Project decision conditions ("If…., then…" statements): The risk questions and testable hypotheses presented by Shaw in the original work plan for the BERA still apply [*Baseline Ecological Risk Assessment Field Sampling Work Plan, Longhorn Army Ammunition Plant, Karnack, Texas* (Shaw 2006)].

Worksheet #11: Project/Data Quality Objectives

This worksheet is used to develop and document project quality objectives (PQOs) or data quality objectives (DQOs) using a systematic planning process (SPP).

Who will use the data?
AGEISS and CB&I, on behalf of the USACE, Tulsa District and LHAAP, will use the data.
What will the data be used for?
New explosives soil, sediment, and surface water sample results obtained from this data gaps effort will be used to revisit the BERA conclusions, based on, but not limited to, a comparison of exposure point concentrations (EPCs) presented in the BERA with EPCs generated using the new sample results. The results of this analysis will be presented in a BERA Addendum Report that includes re-calculated EPCs, revised food chain models, if needed, and a revised analysis of potential impacts to ecological receptors. A subset of the results from any new samples may also be used to perform a statistical comparison with the rejected Intertek Testing Services Environmental Laboratories, Inc. (ITS-ENV) results. It is possible that results of this statistical test may show that individual explosive compounds do not have statistically significantly greater concentrations in the new data set compared with the rejected ITS-ENV data set. This finding would lend additional support to the conclusions previously presented in the BERA.
What type of data is needed (e.g., target analytes, analytical groups, field screening, on-site analytical or off-site laboratory techniques, or sampling techniques)?
Soil, sediment, and surface water samples will be collected from the sites listed in Worksheet #18. The samples will be analyzed using Method 8330A. (See Appendix A for analyte lists.) AGEISS' field SOPs are included in Appendix C of this plan and are listed in Worksheet #21. Worksheets #19 and #23 summarize the laboratory analytical methods that will be utilized to analyze the samples. SOPs for Microbac Laboratories are included in Appendix D of this QAPP.
How "good" do the data need to be in order to support the environmental decision?
Laboratory analytical data (generated by a U.S. Department of Defense-approved laboratory using USEPA test methods) will be used to identify the presence and concentration of contamination. The laboratories will provide acceptable electronic deliverables for use in data verification and data validation. Completeness, defined to be the percentage of analytical results that are judged to be valid and usable for intended purpose, including estimated/ estimated non-detect (J/UJ) data, will be greater than 90%.

How much data are needed (i.e., number of samples for each analytical group, matrix, and concentration)?
A total of 198 soil samples, 8 sediment samples, and 5 surface water samples are planned to be collected and analyzed for explosives compounds. Soil and sediment samples will be collected from the sites listed in Worksheet #18 using shovel/scoop, direct push drilling techniques, or hand auger; and petite ponar, respectively. Surface water samples will be collected from the sites listed in Worksheet #18 either directly into sample bottles or using scoops, dippers, or pond samplers. Quality assurance and quality control samples will be collected in accordance with the frequency outlined in Worksheet #20. The samples will be analyzed using Method 8330A. (See Appendix A for analyte lists.)
Where, when, and how should the data be collected/generated?
Data will be collected in the Summer of 2013. Data will be collected from the soil, sediment and surface water locations shown on Figures 2, 3, 4, and 5 and discussed specifically in the Data Gap Memoranda prepared for this project [*Data Gap Memorandum for Explosives in Soil at the Longhorn Army Ammunition Plant, Karnack, TX* (AGEISS/CB&I 2013) and the *Data Gap Memorandum for Explosives in Sediment and Surface Water at the Longhorn Army Ammunition Plant, Karnack, TX* (AGEISS/CB&I 2013)]. Global positioning system (GPS) will be used to locate all sampling locations in the field. Sampling will progress according to the field SOPs that are provided in Appendix C and listed in Worksheet #21.
Who will collect and generate the data?
AGEISS, CB&I, and Microbac
How will the data be reported?
A BERA Addendum Report will be issued to present the results of the sampling (including re-calculated 95% upper confidence limits on the mean (UCLs), revised food chain models, if necessary, etc.) and a revised analysis of potential impacts to ecological receptors. Final conclusions and recommendations for explosives compounds in the three sub-areas and four watersheds will also be presented in the BERA Addendum Report.
How will the data be archived?
Data will be archived by AGEISS in the Evergreen, Colorado office. Electronic files will be stored on the Evergreen computer server and regularly backed up for disaster recovery purposes.

Worksheet #12-1: Measurement Performance Criteria - SW-846 Method 8330A - Soil

Matrix	Soil		
Analytical Method	SW-846 Method 8330A		
Analytical Group	Nitroaromatics and Nitramines by High Performance Liquid Chromatography		
Concentration Level	All		
Sampling SOPs	**Data Quality Indicators**	**Measurement Performance Criteria**	**QC Sample and/or Activity Used to Assess Measurement Performance**
(See Worksheet #18)	Precision	≤30% RPD	Field Duplicate
	Accuracy/Bias	Recovery acceptance criteria listed in Appendix A, Table A-1	LCS and MS/MSD
	Individual Sample Accuracy/Bias	Recovery acceptance criteria listed in Appendix A, Table A-1	Surrogate
	Sensitivity	<QL	Limit of Quantitation
	Accuracy/Bias/Contamination	No analytes detected >½ RL and > 1/10 the amount measured in any sample or 1/10 the regulatory limit (whichever is greater)	Method Blanks, Equipment Rinsate Blanks
	Precision	RPD criteria listed in Appendix A, Table A-1	MS/MSD

HPLC High Performance Liquid Chromatography
LCS laboratory control sample
MS/MSD matrix spike/matrix spike duplicate
QC quality control
QL quantitation limit
RL reporting limit
RPD relative percent difference
SOP standard operating procedure

Worksheet #12-2: Measurement Performance Criteria – SW-846 Method 8330A – Sediment

Matrix	Sediment		
Analytical Method	SW-846 Method 8330A		
Analytical Group	Nitroaromatics and Nitramines by High Performance Liquid Chromatography		
Concentration Level	All		
Sampling SOPs	**Data Quality Indicators**	**Measurement Performance Criteria**	**QC Sample and/or Activity Used to Assess Measurement Performance**
(See Worksheet #18)	Precision	≤30% RPD	Field Duplicate
	Accuracy/Bias	Recovery acceptance criteria listed in Appendix A, Table A-2	LCS and MS/MSD
	Individual Sample Accuracy/Bias	Recovery acceptance criteria listed in Appendix A, Table A-2	Surrogate
	Sensitivity	<QL	Limit of Quantitation
	Accuracy/Bias/Contamination	No analytes detected >½ RL and > 1/10 the amount measured in any sample or 1/10 the regulatory limit (whichever is greater)	Method Blanks, Equipment Rinsate Blanks
	Precision	RPD criteria listed in Appendix A, Table A-2	MS/MSD

HPLC High Performance Liquid Chromatography
LCS laboratory control sample
MS/MSD matrix spike/matrix spike duplicate
QC quality control
QL quantitation limit
RL reporting limit
RPD relative percent difference
SOP standard operating procedure

Worksheet #12-3: Measurement Performance Criteria – SW-846 Method 8330A – Water

Matrix	Water		
Analytical Method	SW-846 Method 8330A		
Analytical Group	Nitroaromatics and Nitramines by High Performance Liquid Chromatography		
Concentration Level	All		
Sampling SOPs	**Data Quality Indicators**	**Measurement Performance Criteria**	**QC Sample and/or Activity Used to Assess Measurement Performance**
(See Worksheet #18)	Precision	≤30% RPD	Field Duplicate
	Accuracy/Bias	Recovery acceptance criteria listed in Appendix A, Table A-3	LCS and MS/MSD
	Individual Sample Accuracy/Bias	Recovery acceptance criteria listed in Appendix A, Table A-3	Surrogate
	Sensitivity	<QL	Limit of Quantitation
	Accuracy/Bias/Contamination	No analytes detected >½ RL and > 1/10 the amount measured in any sample or 1/10 the regulatory limit (whichever is greater)	Method Blanks, Equipment Rinsate Blanks
	Precision	RPD criteria listed in Appendix A, Table A-3	MS/MSD

HPLC High Performance Liquid Chromatography
LCS laboratory control sample
MS/MSD matrix spike/matrix spike duplicate
QC quality control
QL quantitation limit
RL reporting limit
RPD relative percent difference
SOP standard operating procedure

Worksheet #13: Secondary Data Uses and Limitations

This worksheet is used to identify sources of secondary data (i.e., data generated for purposes other than this specific project or data pertinent to this project generated under a separate QAPP) and summarize information relevant to their uses for the current project.

There are no sources of secondary data for this project; therefore this worksheet is listed as "Not Applicable."

Worksheet #14/16: Project Tasks & Schedule

The objective of this project is to complete the BERA for LHAAP. To complete the BERA, AGEISS will prepare for and conduct sampling to fill any remaining data gaps resulting from the loss of rejected ITS explosives data. The AGEISS Team will meet the project objectives by preparing a BERA Addendum in compliance with the FFA.

To accomplish this objective, the AGEISS Team will employ the following Work Breakdown Structure approach to conduct the tasks and related activities outlined in the scope of work (SOW) for the duration of this TO:

- Task 1: Project Management Plan/Kickoff Conference Call
- Task 2: Uniform Federal Policy for Quality Assurance Project Plan
- Task 3: Data Gap Memoranda
- Task 4: BERA Addendum Work Plan
- Task 5: Field Work
- Task 6: Laboratory Analysis and Data Validation
- Task 7: BERA Addendum
- Task 8: Consulting Hours

Required activities include: assessing the impact of excluding ITS sampling data from the BERA, establishing the number of additional samples required to complete the BERA for LHAAP, collecting and analyzing the additional samples for explosives, and completing a BERA Addendum. The BERA Addendum may reference portions of the BERA where applicable. This action is required to complete the BERA after USEPA deemed ITS explosives analyses unusable for environmental decision making and subsequently the ITS data were inadvertently included in the BERA.

Projected timeframes for each activity and deliverable are based on the scheduled dates as specified in the SOW. **Table 1** shows the schedule of deliverables required under this TO.

Table 1. Schedule of Deliverables

WBS	Deliverable	Schedule (Calendar Days)	Number and Distribution* of Copies
1	Project Management Plan	30 days after TO award	Army Draft: 1 e-copy to USACE, 1 hardcopy and e-copy to LHAAP. Final: 2 hardcopies and e-copy to USACE, 1 hardcopy and e-copy to LHAAP.
2	UFP-QAPP	45 days after TO award	Army Draft: 1 e-copy to USACE, 1 hardcopy and e-copy to LHAAP. Final: 2 hardcopies and e-copy to USACE; and 1 hardcopy, 1 CD, and e-copy to LHAAP.
3	Data Gap Memoranda	45 days after TO award	Army Draft: 1 e-copy to USACE, 1 hardcopy and e-copy to LHAAP. Draft: 2 hardcopies and e-copy to USACE, 1 hardcopy and e-copy to LHAAP, 4 hardcopies and e-copy to Regulators, and 1 hardcopy and e-copy to USFWS. Draft Final: 2 hardcopies and e-copy to USACE; 1 hardcopy, 1 CD, and e-copy to LHAAP, 4 hardcopies and e-copy to Regulators, and 1 hardcopy and e-copy to USFWS.
4	Army Draft and Draft BERA Addendum Work Plan	90 days after TO award	Army Draft: 2 hardcopies and e-copy to USACE, 1 hardcopy and e-copy to LHAAP. Draft: 2 hardcopies and e-copy to USACE, 1 hardcopy and e-copy to LHAAP, 4 hardcopies and e-copy to Regulators, and 1 hardcopy and e-copy to USFWS.
4	Draft Final BERA Addendum Work Plan	135 days after TO award	Draft Final: 2 hardcopies and e-copy to USACE, 1 hardcopy, 1 CD, and e-copy to LHAAP, 4 hardcopies and e-copy to Regulators, and 1 hardcopy and e-copy to USFWS.
5	Field Work (Status Reports)	Initiate Field Work within 10 days of approval of Final Work Plan; provide weekly status reports	Weekly e-copy to USACE and LHAAP
6	Laboratory Analysis and Data Validation (Quality Control Summary Report)	14 days after Receipt from Lab	E-copy to USACE and 1 hardcopy and e-copy to LHAAP.

WBS	Deliverable	Schedule (Calendar Days)	Number and Distribution* of Copies
6	Disposal Manifests	Within 10 days of generation of waste ready for disposal	E-copy to USACE and hardcopy originals and e-copy to LHAAP. Please note that all original waste manifests will be kept in the on-site trailer at LHAAP.
7	Army Draft BERA Addendum	60 days after field work completion and incorporation of data validation results into analytical database	Army Draft: 2 hardcopies and e-copy to USACE, 1 hardcopy and e-copy to LHAAP.
7	Draft BERA Addendum	14 days after resolution of Army Draft Report review comments	Draft: 2 hardcopies and e-copy to USACE, 1 hardcopy and e-copy to LHAAP, 4 hardcopies and e-copy to Regulators, and 1 hardcopy and e-copy to USFWS.
7	Draft Final BERA Addendum	14 days after resolution of Draft Report review comments	Draft Final: 2 hardcopies and e-copy to USACE, 1 hardcopy, 1 CD, and e-copy to LHAAP, 4 hardcopies and e-copy to Regulators, and 1 hardcopy and e-copy to USFWS.

*Copies to be distributed to LHAAP include copies designated for the Regulators, and will be forwarded by LHAAP.

BERA	Baseline Ecological Risk Assessment
LHAAP	Longhorn Army Ammunition Plant
SOW	scope of work
TO	task order
UFP-QAPP	Uniform Federal Policy-Quality Assurance Project Plan
USACE	U.S. Army Corps of Engineers
USFWS	United States Fish and Wildlife Service
WBS	work breakdown structure

Worksheet #15: Project Action Limits and Laboratory-Specific Detection/Quantitation Limits

This worksheet is comprised of Tables 2, 3, and 4, which present the project action limits (PALs) for each target compound and matrix (soil, sediment, and surface water, respectively). The purpose of this worksheet is to make sure the selected analytical laboratory and analytical method can provide accurate data at the PAL. Tables supporting this worksheet are presented in Appendix B which include Microbac Laboratories analytical method detection limits (MDLs), levels of quantitation (LOQs), and a comparison of these values to the PALs.

Table 2. Soil – Project Action Limits

Compounds	Units	PAL	PAL Reference	LOQ	MDL
HMX (Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine)	mg/kg	No Value Available	N/A	0.25	0.1
RDX (Hexahydro-1,3,5-trinitro-1,3,5-triazine)	mg/kg	100	Final Ecological Screening Value (1)	0.25	0.1
1,3,5-TNB (1,3,5-Trinitrobenzene)	mg/kg	0.376	Final Ecological Screening Value (1)	0.25	0.1
1,3-DNB (1,3-Dinitrobenzene)	mg/kg	0.655	Final Ecological Screening Value (1)	0.25	0.1
Tetryl (Methyl-2,4,6-trinitrophenylnitramine)	mg/kg	25	Talmage et al. (1999)	0.25	0.1
NB (Nitrobenzene)	mg/kg	40	Final Ecological Screening Value (1)	0.25	0.1
2,4,6-TNT (2,4,6-Trinitrotoluene)	mg/kg	30	Final Ecological Screening Value (1)	0.25	0.1
4-Am-DNT (4-Amino-2,6-dinitrotoluene)	mg/kg	80	Final Ecological Screening Value (1)	0.25	0.1
2-Am-DNT (2-Amino-4,6-dinitrotoluene)	mg/kg	80	Final Ecological Screening Value (1)	0.25	0.1
2,4-DNT (2,4-Dinitrotoluene)	mg/kg	1.28	Final Ecological Screening Value (1)	0.25	0.1
2,6-DNT (2,6-Dinitrotoluene)	mg/kg	0.0328	Final Ecological Screening Value (1)	0.25	0.1
2-NT (2-Nitrotoluene)	mg/kg	No Value Available	N/A	0.25	0.1
3-NT (3-Nitrotoluene)	mg/kg	No Value Available	N/A	0.25	0.1
4-NT (4-Nitrotoluene)	mg/kg	No Value Available	N/A	0.25	0.1

(1) LHAAP Installation-Wide BERA Volume I Shaw Environmental, Inc. 2007

LOQ limit of quantitation
MDL method detection limit
mg/kg milligrams per kilogram
N/A not applicable
PAL project action limit

The following hierarchy was used to select the final soil ecological screening toxicity values:

1) U.S. Environmental Protection Agency (USEPA), 2010, *Guidance for Developing Ecological Soil Screening Levels (Eco-SSL)*, Office of Solid Waste and Emergency Response, Website version last updated October 20, 2010. http://www.epa.gov/ecotox/ecossl.
2) Texas Commission on Environmental Quality (TCEQ), 2005, *Guidance for Conducting Ecological Risk Assessments at Remediation Sites in Texas*, *RG-263 (Revised)*, and *Update to Guidance for Conducting Ecological Risk Assessments at Remediation Sites in Texas, RG-263 (Revised), January 2006 Version*.
3) Lower of Efroymson, 1997 and Region 5
   - Efroymson, R.A., Suter II, G.W., Sample, B.E. and Jones, D.S., 1997. Preliminary Remediation Goals for Ecological Endpoints. Lockheed Martin Energy Systems, Inc. ES/ER/TM-162/R2
   - USEPA, 2003, *U.S. EPA Region 5 RCRA Ecological Screening Levels (ESL)*, Website version last updated August 22, 2003 http://www.epa.gov/reg5rcra/ca/edql.htm.
4) Other available screening values including the following:

- USEPA, 2001, *Supplemental Guidance to RAGS: Region 4 Bulletins, Ecological Risk Assessment*. Originally published November 1995. Website version last updated November 30, 2001 http://www.epa.gov/region4/waste/ots/ecolbul.htm.
- Talmage, S.S., D.M. Opresko, C.J. Maxwell, C.J.E. Welsh, F.M. Cretella, P.H. Reno, and F.B. Daniel, 1999, Nitroaromatic Munition Compounds: Environmental Effects and Screening Values **Rev. Environ. Contam. Toxicol.** 161:1-156, Springer-Verlag. Screening concentration used is the lowest of the Plant and Soil Invertebrate concentrations. Wildlife (shrew) values were not included as candidates for screening values. This is consistent with TCEQ's method of only using the Plant and Earthworm values to select their screening values.
- Earthworm and plant soil benchmark values in TCEQ 2005 were transposed, the values were corrected to reflect the Eco-SSLs (2005). *Personal Communication* with Vickie Reat, TCEQ, 12/06/05.

Table 3. Sediment – Project Action Limits

Compounds	Units	PAL	PAL Reference	LOQ	MDL
HMX (Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine)	mg/kg	27000	LANL (2012)	0.25	0.1
RDX (Hexahydro-1,3,5-trinitro-1,3,5-triazine)	mg/kg	45	LANL (2012)	0.25	0.1
1,3,5-TNB (1,3,5-Trinitrobenzene)	mg/kg	1300	LANL (2012)	0.25	0.1
1,3-DNB (1,3-Dinitrobenzene)	mg/kg	1.2	LANL (2012)	0.25	0.1
Tetryl (Methyl-2,4,6-trinitrophenylnitramine)	mg/kg	100	LANL (2012)	0.25	0.1
NB (Nitrobenzene)	mg/kg	27	LANL (2012)	0.25	0.1
2,4,6-TNT (2,4,6-Trinitrotoluene)	mg/kg	0.092	Final Ecological Screening Value (1)	0.25	0.1
4-Am-DNT (4-Amino-2,6-dinitrotoluene)	mg/kg	1.40	Final Ecological Screening Value (1)	0.25	0.1
2-Am-DNT (2-Amino-4,6-dinitrotoluene)	mg/kg	7.00	Final Ecological Screening Value (1)	0.25	0.1
2,4-DNT (2,4-Dinitrotoluene)	mg/kg	0.29	LANL (2012)	0.25	0.1
2,6-DNT (2,6-Dinitrotoluene)	mg/kg	0.0398	Final Ecological Screening Value (1)	0.25	0.1
2-NT (2-Nitrotoluene)	mg/kg	28	LANL (2012)	0.25	0.1
3-NT (3-Nitrotoluene)	mg/kg	24	LANL (2012)	0.25	0.1
4-NT (4-Nitrotoluene)	mg/kg	52	LANL (2012)	0.25	0.1

(1) LHAAP Installation-Wide BERA Volume I Shaw Environmental, Inc. 2007

LANL Los Alamos National Laboratory
LOQ limit of quantitation
MDL method detection limit
mg/kg milligrams per kilogram
N/A not applicable
PAL project action limit

The following hierarchy was used to select the final sediment ecological screening toxicity values:

1) Texas Commission on Environmental Quality (TCEQ), 2005, *Guidance for Conducting Ecological Risk Assessments at Remediation Sites in Texas*, *RG-263 (Revised)*, and *Update to Guidance for Conducting Ecological Risk Assessments at Remediation Sites in Texas, RG 263 (Revised)*, *January 2006 Version*.
2) Lower value from the following:
   - Ecological Screening Levels (ESLs), U.S. Environmental Protection Agency (USEPA) Region V, August 2003.
   - Preliminary Remediation Goals (PRGs), ORNL, ES/ER/TM-162/R2, Efroymson, R.A., et al., 1997.
   - Canadian Interim Sediment Quality Guidelines (ISQGs) Summary Table, CCME, December 2003.
3) Ecological Benchmark Screening Values for Sediment, USEPA Region IV, 2000.
4) ESLs for Los Alamos National Laboratory (LANL), 2005, and LANL (2012) for 2012 QAPP.

Table 4. Surface Water – Project Action Limits

Compounds	Units	PAL	PAL Reference	LOQ	MDL
HMX (Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine)	μg/L	150	TCEQ (2005)	1	0.25
RDX (Hexahydro-1,3,5-trinitro-1,3,5-triazine)	μg/L	180	Final Ecological Screening Value (1)	1	0.25
1,3,5-TNB (1,3,5-Trinitrobenzene)	μg/L	11	Final Ecological Screening Value (1)	1	0.25
1,3-DNB (1,3-Dinitrobenzene)	μg/L	72	Final Ecological Screening Value (1)	1	0.25
Tetryl (Methyl-2,4,6-trinitrophenylnitramine)	μg/L	5800	Final Ecological Screening Value (1)	1	0.25
NB (Nitrobenzene)	μg/L	270	TCEQ (2005)	1	0.25
2,4,6-TNT (2,4,6-Trinitrotoluene)	μg/L	50	Final Ecological Screening Value (1)	1	0.25
4-Am-DNT (4-Amino-2,6-dinitrotoluene)	μg/L	740	Final Ecological Screening Value (1)	1	0.25
2-Am-DNT (2-Amino-4,6-dinitrotoluene)	μg/L	740	Final Ecological Screening Value (1)	1	0.25
2,4-DNT (2,4-Dinitrotoluene)	μg/L	1,220	Final Ecological Screening Value (1)	1	0.25
2,6-DNT (2,6-Dinitrotoluene)	μg/L	1,220	Final Ecological Screening Value (1)	1	0.25
2-NT (2-Nitrotoluene)	μg/L	440	Final Ecological Screening Value (1)	1	0.25
3-NT (3-Nitrotoluene)	μg/L	47000	LANL (2012)	1	0.25
4-NT (4-Nitrotoluene)	μg/L	950	LANL (2012)	1	0.25

(1) LHAAP Installation-Wide BERA Volume I Shaw Environmental, Inc. 2007

μg/kg milligrams per kilogram
LOQ limit of quantitation
MDL method detection limit
N/A not applicable
PAL project action limit

The following hierarchy was used to select the final surface water ecological screening toxicity value:

1) Texas Commission on Environmental Quality (TCEQ), 2005, *Guidance for Conducting Ecological Risk Assessments at Remediation Sites in Texas, RG-263 (Revised), and Update to Guidance for Conducting Ecological Risk Assessments at Remediation Sites in Texas, RG-263 (Revised), January 2006.*
2) Lower value from the following:
   - ♦ Ecological Screening Levels (ESLs), U.S. Environmental Protection Agency (USEPA) Region V, August 2003
   - ♦ Preliminary Remediation Goals (PRGs), ORNL, ES/ER/TM-162/R2, Efroymson, R.A., et al., 1997
   - ♦ Canadian Environmental Quality Guidelines (EQGs), CCME, 2002
3) Ecological Benchmark Screening Values for Surface Water, USEPA Region IV, 2000.
4) Talmage et al., 1999, Los Alamos National Laboratory (LANL), Los Alamos National Laboratory Eco Risk database, 2002 or LANL (2012) for 2012 QAPP.

Worksheet #17: Sampling Design and Rationale

This worksheet is used to describe the sampling design and the basis for its selection. It documents the last step of the SPP.

The sampling design and rationale are based on the *Data Gap Memorandum for Explosives in Soil at the Longhorn Army Ammunition Plant, Karnack, TX* (AGEISS/CB&I 2013) and the *Data Gap Memorandum for Explosives in Sediment and Surface Water at the Longhorn Army Ammunition Plant, Karnack, TX* (AGEISS/CB&I 2013). These memoranda contain recommendations for the collection of additional samples to address data gaps including recommendations of sample locations and number of samples which are detailed in Worksheet #18.

Worksheet #17 discusses the following items.

- Background Information for Soil, Sediment, and Surface Water
- Soil
  - Prior Communications Regarding Data Gaps
  - Addressing Identified Data Gaps
  - Data Gaps Conclusions and Recommendations
- Sediment and Surface Water
  - Prior Communications Regarding Data Gaps
  - Addressing Identified Data Gaps
  - Data Gaps Conclusions and Recommendations
- BERA Addendum Work Plan

Background Information for Soil, Sediment, and Surface Water

In 2003, Shaw was tasked by USACE, Tulsa District, to perform an installation-wide BERA at LHAAP, located in Karnack, Texas. This BERA included Steps 3 through 8 of the 8-Step ecological risk assessment process; Steps 1 and 2 had been previously performed by Jacobs Engineering. Shaw finalized the BERA in November 2007. The BERA included a synthesis of many environmental investigations that had previously been performed by other sub-contractors at the facility in prior years.

The primary dataset used to calculate potential risks to various representative receptors in the BERA was comprised of data from 1993 through 2003. These data are referred to herein as "the BERA dataset." Additional data from samples collected between 2003 and the time when the BERA was finalized in 2007 were also evaluated in the BERA to ensure that more recent sampling information did not affect overall site conclusions. These data were referred to in the BERA and herein as the "post-BERA dataset."

Explosives data are of primary concern at the LHAAP due to its history as an ammunition plant whose primary mission was to produce 2,4,6-TNT flake. Explosives data collected for the LHAAP investigation in the 1993 through 1995 timeframe that were analyzed by ITS-ENV in Richardson, TX, were deemed unusable by the USEPA for environmental decision making. Although the determination that the ITS-ENV data were unusable was made prior to Shaw's involvement on the project, the quality problems with the ITS-ENV explosives data were known when the BERA was initiated, and all data associated with ITS-ENV (as determined by the code "ITS" in the Laboratory Identification field of the electronic database) were eliminated from Shaw's BERA dataset.

After the BERA was approved and finalized, a data review performed as part of the remediation design for LHAAP-17 revealed that a number of historical samples that were included in the BERA dataset had explosives data from the 1993-1995 timeframe, and it was suspected that these data likely originated from the ITS-ENV laboratory, even though the electronic database provided to Shaw by the Army did not carry unusable data qualifiers for these results. A review of the hard copy Phase I and II reports was performed, and it was confirmed that many of these data were from the ITS-ENV laboratory. Therefore, ITS-ENV data that were incorrectly or cryptically coded for their laboratory source were inadvertently retained in the dataset and used to quantify ecological risk in the BERA.

Soil – Prior Communications Regarding Data Gaps

Once it was discovered that the BERA had inadvertently used ITS-ENV data, Shaw was asked by regulatory stakeholders to determine how the removal of these data affected the BERA conclusions. To address this question, Shaw performed an evaluation on the impact of the ITS-ENV data removal, including evaluations for each LHAAP sub-area on 1) how EPCs and numerical risk calculations changed after the ITS-ENV data were removed, and 2) what (if any) significant data gaps remained after the removal of the ITS-ENV data. The three terrestrial exposure units at LHAAP are "sub-areas" that were delineated based on their common historical uses and similar ecological habitat. These sub-areas include the LISA, the ISA, and the WSA. The WSA was the only sub-area where explosives compounds were identified as chemicals of concern in the BERA. Shaw prepared a series of technical memoranda for LHAAP stakeholders describing the impacts to the BERA conclusions resulting from the removal of the ITS-ENV from the BERA dataset (taking into account additional data that have been obtained from ongoing investigations since the BERA was finalized), including responding to comments from both the TCEQ and the USEPA Region 6. Transmittal of these emails, memos, and RTCs occurred in the February 2011 through March 2012 timeframe, approximately, at which time both the TCEQ and USEPA Region 6 requested the USACE to proceed with a formal proposal for addressing any data gaps in the LHAAP BERA resulting from the removal of the ITS-ENV data.

Soil – Addressing Identified Data Gaps

Once consensus is reached on the basic framework for addressing the data gaps, additional details will be provided in a formal Work Plan (including a HASP and other standard work plan components). After the Work Plan is approved and the additional samples described have been collected, a BERA Addendum Report will be issued to present the results of the sampling (including re-calculated 95% upper confidence limits on the mean, revised food chain models, if necessary, etc.) and a revised analysis of potential impacts to ecological receptors. A subset of the results from any new samples may also be used to perform a statistical comparison with the rejected ITS-ENV results for one or more LHAAP sites where explosives are a concern but have not been remediated. It is possible that results of this statistical test may show that individual explosive compounds do not have statistically significantly greater concentrations in the new data set compared with the rejected ITS-ENV data set. This finding would lend additional support to the conclusions previously presented in the BERA. Final conclusions and recommendations for explosives compounds in the three sub-areas will also be presented in the BERA Addendum Report.

Soil - Data Gaps Conclusions and Recommendations

The recommendations presented are intended as a starting point for reaching consensus on the number and location of additional samples that will be collected to address data gaps caused by the elimination of the ITS-ENV data. The final recommended number and location codes for soil samples to replace the ITS-ENV data are presented in Worksheet #18. A total of 16, 170, and 12 soil samples are planned to be collected from the LISA, ISA, and WSA, respectively, and analyzed for explosives compounds. Replacement sample locations were selected from the pool of locations with ITS-ENV data removed. Preference for replacement was given to those samples that lost full suites of explosives data and that lacked limited semi-volatile organic compound (SVOC) explosives data. The replacement sample locations are presented in Figure 2 (WSA), Figure 3 (LISA) and Figure 4 (ISA) for the three sub-areas. A full description of the sampling methodology will be presented in a formal Work Plan, which will be submitted following approval of the Soil Data Gap Memorandum. The rationale for sample number and location will reference this Data Gap Memorandum, and the Work Plan will summarize these recommendations and conclusions. New explosives soil sample results obtained from this data gaps effort will be used to revisit the BERA conclusions, based on, but not limited to, a comparison of EPCs presented in the BERA with EPCs generated using the new sample results. The results of this analysis will be presented in a BERA Addendum Report. Sampling will proceed according to Field SOP LHAAP-F-3, provided in Appendix C. Decontamination will proceed according to Field SOP LHAAP-F-8, provided in Appendix C. Investigation derived waste will be handled in accordance with the project's approved Waste Management Plan for Investigation Derived Waste.

Sediment and Surface Water - Prior Communications Regarding Data Gaps

Once it was discovered that the BERA dataset inadvertently included some ITS-ENV data, Shaw was asked by regulatory stakeholders to determine how the removal of these data affected the BERA conclusions. To address this question, Shaw performed an evaluation on the impact of the ITS-ENV data removal, including evaluations for each LHAAP watershed. The four watersheds at LHAAP comprise the aquatic ecological exposure units of concern that were evaluated in the BERA and include Central Creek (CC), Goose Prairie Creek (GPC), Harrison Bayou (HB), and Saunders Branch (SB). Shaw prepared a series of memoranda for LHAAP stakeholders describing the potential impacts to the BERA conclusions resulting from the removal of the ITS-ENV from the BERA dataset, including responding to comments from both the TCEQ and USEPA Region 6. Transmittal of these emails, memos, and RTCs occurred in the February 2011 through March 2012 timeframe, approximately, at which time both the TCEQ and USEPA Region 6 requested the USACE to proceed with a formal proposal for addressing any data gaps in the LHAAP BERA resulting from the removal of the ITS-ENV data.

Sediment and Surface Water - Addressing Identified Data Gaps

Once consensus is reached on the basic framework for addressing the data gaps, additional details will be provided in a formal Work Plan (including a HASP and other standard work plan components). After the Work Plan is approved and the additional samples described have been collected, a BERA Addendum Report will be issued that presents the results of the sampling (including re-calculated EPCs, revised food chain models, if needed, etc.) and a revised analysis of potential impacts to ecological receptors. A subset of the results from any new samples may also be used to perform a statistical comparison with the rejected ITS-ENV results. It is possible that results of this statistical test may show that individual explosive compounds do not have statistically significantly greater concentrations in the new data set compared with the rejected ITS-ENV data set. This finding would lend additional support to the conclusions previously presented in the BERA. Final conclusions and recommendations for explosives compounds in the four watersheds will also be presented in the BERA Addendum Report.

Sediment and Surface Water - Data Gaps Conclusions and Recommendations

- **Saunders Branch**- Explosives data for six sediment and four surface water samples were eliminated; however, three additional post-BERA sediment and surface water samples were collected. Also, all of the eliminated results had SVOC explosives data (i.e., 2,4-dinitrotoluene [DNT] and 2,6-DNT). The revised dataset includes adequate sediment and surface water spatial coverage, and all explosives data were non-detect. In addition, this watershed is on the eastern-most portion of LHAAP and drains many non-impacted terrestrial areas, so explosives contamination is not believed to be a major concern for SB. Therefore, no additional sediment and surface water sampling is recommended for SB.
- **Harrison Bayou** - Explosives data for 26 sediment and 27 surface water samples were eliminated and one additional post-BERA sample was collected for each media type. Also, 11 and 13 of these eliminated sample results for surface water and sediment, respectively, had SVOC explosives data (i.e., 2,4-DNT and 2,6-DNT). Even though a large number of samples were removed, sediment and surface water spatial coverage is generally still adequate. Although all explosives data were non-detect in both the BERA and the revised dataset, there is some uncertainty related to this finding, due to the loss of a considerable amount of explosives data. In addition, USEPA's 2010 ProUCL statistical software and Guidance states that 8 to 10 samples are generally recommended for estimation of EPCs for use in risk assessments, and only seven sediment samples remain with full explosives results. Therefore, it is recommended that eight additional sediment samples and five additional surface water samples be collected for HB. These eight sample locations are presented in Figure 5 (Worksheet #18).
- **Central Creek -** Explosives data for 28 sediment and 28 surface water samples were eliminated; however, 10 additional sediment and five additional surface water post-BERA samples were collected. Also, 14 of these eliminated sample results for both surface water and sediment had SVOC explosives data (i.e., 2,4-DNT and 2,6-DNT). The revised dataset includes adequate sediment and surface water spatial coverage, and explosives were infrequently detected in both media. Therefore, no additional sediment and surface water sampling is recommended for CC.
- **Goose Prairie Creek -** GPC had the lowest percentage of sediment and surface water samples eliminated, and it had the most samples available in both the BERA and the revised dataset. Explosives data for 22 sediment and 15 surface water samples were eliminated; however, six additional sediment and two surface water post-BERA samples were collected. Also, nine and 16 of these eliminated sample results had SVOC explosives data (i.e., 2,4-DNT and 2,6-DNT) for surface water and sediment, respectively. The revised dataset includes adequate sediment and surface water spatial coverage. In addition, some explosives were non-detect, or were generally infrequently detected in both media, and the frequency of detections was very similar between the BERA and the revised datasets. Therefore, no additional sediment and surface water sampling is recommended for GPC.

Based on this evaluation of surface water and sediment data, BERA conclusions appear to remain valid for sediment and surface water for GPC, CC, and SB following the elimination of the ITS-ENV data. However, due to the loss of considerable sediment data for HB, the collection of eight additional sediment samples is recommended, so that a total of 15 sediment sample results may be used to recalculate EPCs of explosives, if explosives are selected as chemicals of potential ecological concern in this data set. Sampling will proceed according to Field SOP LHAAP-F-4, provided in Appendix C. Decontamination will proceed according to Field SOP LHAAP-F-8, provided in Appendix C. Investigation derived waste will be handled in accordance with the project's approved Waste Management Plan for Investigation Derived Waste.

BERA Addendum Work Plan

The AGEISS Team will use the results of the UFP-QAPP and the Data Gap Memoranda as the basis for developing the BERA Addendum Work Plan (Work Plan). The Work Plan will contain the following components: HASP, Accident Prevention Plan (APP), Activity Hazard Analysis (AHA), and Waste Management Plan for Investigative Derived Waste (IDW). The Work Plan will also include processes and procedures to address QC measures that shall be implemented to ensure quality work and defensible results, and all other pertinent documents and references.

Worksheet #18: Sampling Locations and Methods

This worksheet provides the planned sampling locations and methods for each sample to be taken for soil, sediment, and surface water samples. Figures 2, 3, 4, and 5 located at the end of this worksheet, show the locations for samples at the WSA, LISA, ISA, and HB, respectively. The sample naming scheme is provided in SOP LHAAP-F-7, *Sample Handling, Labeling, Packaging, and Custody.*

Table 5. Planned Soil Replacement Samples to Address Data Gaps for the BERA at the Waste Sub-Area

Site	Number of Surface Soil (0-0.5 feet) Samples*	Number of Subsurface Soil (0.5-3 feet) Samples**	Total Number of Samples	Planned Replacement Sample Locations	Type	Analytical Method	Sampling SOP	Comments
LHAAP-12	4	1	5	12SB01 (DS), 12WW05 (SS), 12WW01 (SS), 12WW02 (SS), 12WW07 (SS)	Shovel/scoop; Direct Push or Hand Auger	Method 8330A	LHAAP-F-3 LHAAP-F-9	GPS coordinates will be recorded
LHAAP-16	1	0	1	16SD02 (SS)	Shovel/scoop	Method 8330A	LHAAP-F-3 LHAAP-F-9	GPS coordinates will be recorded
LHAAP-18	6	0	6	18SD03, 18SD04, 18SD05, 18SD06, 18SD07, 18SD08 (all SS)	Shovel/scoop	Method 8330A	LHAAP-F-3 LHAAP-F-9	GPS coordinates will be recorded
		WSA Total:	**12**					

*Indicates grab sample
**Indicates composite sample covering indicated depth interval

DS subsurface soil sample
SS surface soil sample
GPS global positioning system
SOP standard operating procedure
WSA Waste Sub-Area

Table 6. Planned Soil Replacement Samples to Address Data Gaps for the BERA at the Low Impact Sub-Area

Site	Number of Surface Soil (0-0.5 feet) Samples*	Number of Subsurface Soil (0.5-3 feet) Samples**	Total Number of Samples	Planned Replacement Sample Locations	Type	Analytical Method	Sampling SOP	Comments
LHAAP-11	3	3	6	11SB03, 11SB05, 11SD13	Shovel/scoop; Direct Push or Hand Auger	Method 8330A	LHAAP-F-3 LHAAP-F-9	GPS coordinates will be recorded
LHAAP-27	2	2	4	27SB34, 27SB38	Shovel/scoop; Direct Push or Hand Auger	Method 8330A	LHAAP-F-3 LHAAP-F-9	GPS coordinates will be recorded
LHAAP-54	3	3	6	XXSB15, XXSB17, XXSB20	Shovel/scoop; Direct Push or Hand Auger	Method 8330A	LHAAP-F-3 LHAAP-F-9	GPS coordinates will be recorded
		LISA Total:	**16**					

*Indicates grab sample
**Indicates composite sample covering indicated depth interval
GPS global positioning system
LISA Low Impact Sub-Area
SOP standard operating procedure

Table 7. Planned Soil Replacement Samples to Address Data Gaps for the BERA at the Industrial Sub-Area

Site	Number of Surface Soil (0-0.5 feet) Samples*	Number of Subsurface Soil (0.5-3 feet) Samples**	Total Number of Samples	Planned Replacement Sample Locations	Type	Analytical Method	Sampling SOP	Comments
LHAAP-01	5	5	10	01A-SB02, 01A-SB04, 01-SD09, 01SB23, 01SB28	Shovel/scoop; Direct Push or Hand Auger	Method 8330A	LHAAP-F-3 LHAAP-F-9	GPS coordinates will be recorded
LHAAP-04	2	2	4	LHSMW01, LHSMW02	Shovel/scoop; Direct Push or Hand Auger	Method 8330A	LHAAP-F-3 LHAAP-F-9	GPS coordinates will be recorded
LHAAP-29	12	12	24	29SD01, 29SB05, 29SB07, 29SB08, 29SB09, 29SB11, 29SD10, 29WL02, 29SB14, 29SB15, 29SB12, 29SB13	Shovel/scoop; Direct Push or Hand Auger	Method 8330A	LHAAP-F-3 LHAAP-F-9	GPS coordinates will be recorded
LHAAP-32	8	8	16	32SB13, 32SB03, 32 SB06, 32SB14, 32SS03, 32SS04, 32WL01, 32SD06	Shovel/scoop; Direct Push or Hand Auger	Method 8330A	LHAAP-F-3 LHAAP-F-9	GPS coordinates will be recorded
LHAAP-35A (58)	5	5	10	LH-S723-01, LH-S111-01, LH-S112-01, LH-S113-01, LH-S117-01	Shovel/scoop; Direct Push or Hand Auger	Method 8330A	LHAAP-F-3 LHAAP-F-9	GPS coordinates will be recorded
LHAAP-35C (53)	5	5	10	LHSMW67, LHSMW68, LHSMW69, LHSMW70, LHSMW71	Shovel/scoop; Direct Push or Hand Auger	Method 8330A	LHAAP-F-3 LHAAP-F-9	GPS coordinates will be recorded

Site	Number of Surface Soil (0-0.5 feet) Samples*	Number of Subsurface Soil (0.5-3 feet) Samples**	Total Number of Samples	Planned Replacement Sample Locations	Type	Analytical Method	Sampling SOP	Comments
LHAAP-46	20	20	40	LH-S30-01, LH-S32-01, LH-S14-02, LH-S16-01, LH-S22-01, LH-S27-01, LH-S05-01, LH-S29-01, LH-S026-01, LH-S025-01, LH-S19-01, LH-S021-01, LH-S43-01, LH-S41-01, LH-S08-01, LH-S06-01, LH-S12-01, LH-S10-01, LH-S11-01, 46SD02	Shovel/scoop; Direct Push or Hand Auger	Method 8330A	LHAAP-F-3 LHAAP-F-9	GPS coordinates will be recorded
LHAAP-47	23	23	46	LH-S93-01, LH-S92-01, LH-S88-01, LH-S89-02, LH-S86-01, LH-S83-01, LH-S82-01, LH-S73-01, LH-DL74-01, LH-DL75-01, LH-S77-01, LH-S71-01, LH-S61-01, LH-S59-01, LH-S58-01, LH-S55-01, LH-S121-01, LH-S44-01, H-DL45-01, LH-S47-01, LH-S49-01, LH-S48-01, LH-S50-01	Shovel/scoop; Direct Push or Hand Auger	Method 8330A	LHAAP-F-3 LHAAP-F-9	GPS coordinates will be recorded
LHAAP-48	5	5	10	LH-S94-01, LH-S95-01, LH-S97-01, LH-S98-01, LH-S100-01	Shovel/scoop; Direct Push or Hand Auger	Method 8330A	LHAAP-F-3 LHAAP-F-9	GPS coordinates will be recorded
		ISA Total:	**170**					

*Indicates grab sample
**Indicates composite sample covering indicated depth interval
GPS global positioning system
ISA Industrial Sub-Area
NA not applicable
SOP standard operating procedure

Table 8. Planned Sediment Samples for the Harrison Bayou Watershed

Site	Matrix	Depth (ft bgs)*	Total Number of Sediment Samples	Planned Replacement Sample Locations	Type	Analytical Method	Sampling SOP	Comments
Harrison Bayou	Sediment	0-0.5	8	LHAAP-HB-ABERA-01, LHAAP-HB-ABERA-02, LHAAP-HB-ABERA-03, LHAAP-HB-ABERA-04, LHAAP-HB-ABERA-05, LHAAP-HB-ABERA-06, LHAAP-HB-ABERA-07, LHAAP-HB-ABERA-08	Scoop/trowel/ petite ponar	Method 8330A	LHAAP-F-4 LHAAP-F-9	GPS coordinates will be recorded

*Indicates grab sample
bgs below ground surface
ft feet
GPS global positioning system
SOP standard operating procedure

Table 9. Planned Surface Water Samples for the Harrison Bayou Watershed

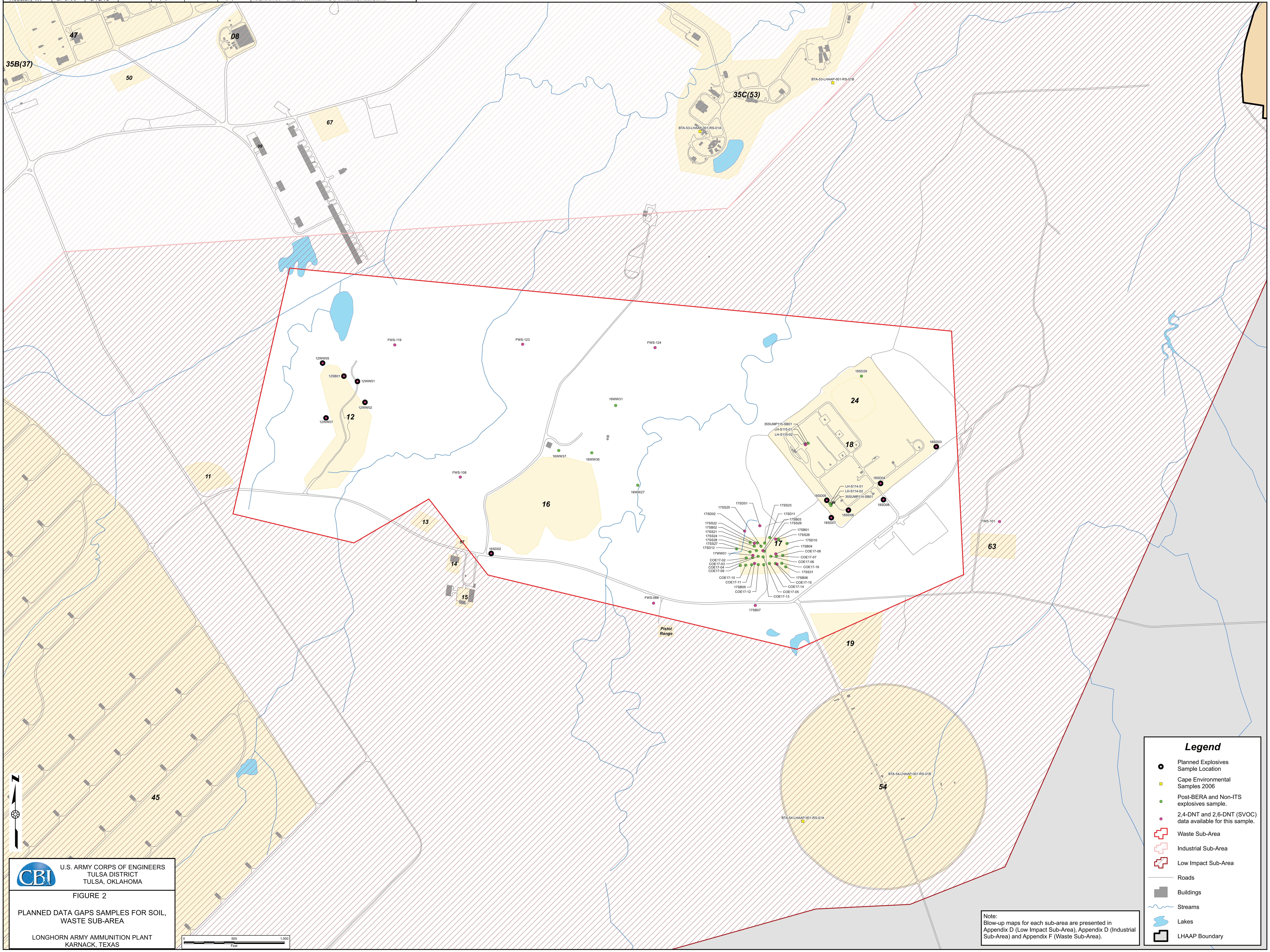
Site	Matrix	Total Number of Surface Water Samples*	Planned Replacement Sample Locations	Type	Analytical Method	Sampling SOP	Comments
Harrison Bayou	Surface Water	5	LHAAP-HB-ABERA-01, LHAAP-HB-ABERA-03, LHAAP-HB-ABERA-04, LHAAP-HB-ABERA-07, LHAAP-HB-ABERA-08	Sample bottle or scoop/dipper/pond sampler	Method 8330A	LHAAP-F-5 LHAAP-F-9	GPS coordinates will be recorded

*Surface water samples will be collected if water is present. Samples will be collected from areas with flow or recent runoff. Sampling from still or standing water, or water pooled in small areas of the drainage, will be avoided when possible. Samples will be collected approximately 1 ft below the water surface.

GPS global positioning system
SOP standard operating procedure
ft foot

00188348

OFFICE	DRAWN BY		CHECKED BY		APPROVED BY		FILE PATH
Houston, TX	B. Grod	5/15/13	- - -	--/--/--	- - -	--/--/--	T:\Graphics\GIM\GIS\117591_LHAAP\Doc\Mxd\Bera\Wkpln_PlannedDataGapsWsaSamples.mxd



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

FIGURE 2

PLANNED DATA GAPS SAMPLES FOR SOIL, WASTE SUB-AREA

LONGHORN ARMY AMMUNITION PLANT
KARNACK, TEXAS

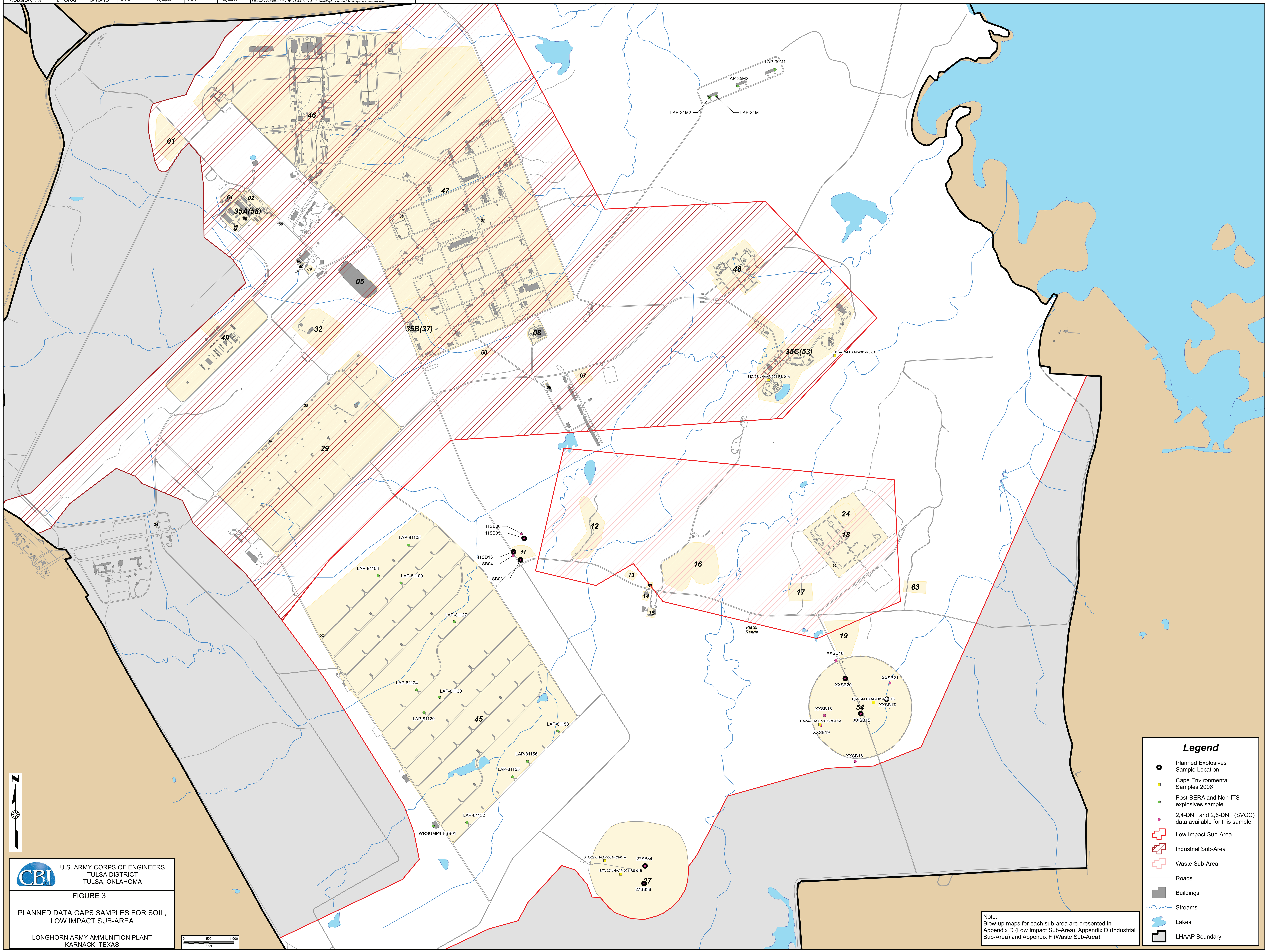
Note:
Blow-up maps for each sub-area are presented in Appendix D (Low Impact Sub-Area), Appendix D (Industrial Sub-Area) and Appendix F (Waste Sub-Area).

Legend

- Planned Explosives Sample Location
- Cape Environmental Samples 2006
- Post-BERA and Non-ITS explosives sample.
- 2,4-DNT and 2,6-DNT (SVOC) data available for this sample.
- Waste Sub-Area
- Industrial Sub-Area
- Low Impact Sub-Area
- Roads
- Buildings
- Streams
- Lakes
- LHAAP Boundary

00188349

OFFICE	DRAWN BY		CHECKED BY		APPROVED BY		FILE PATH
Houston, TX	B. Grod	5/15/13	- - -	--/--/--	- - -	--/--/--	T:\Graphics\GIMGIS\117591_LHAAP\Doc\Mxd\Bera\Wkpln_PlannedDataGapsLisaSamples.mxd



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

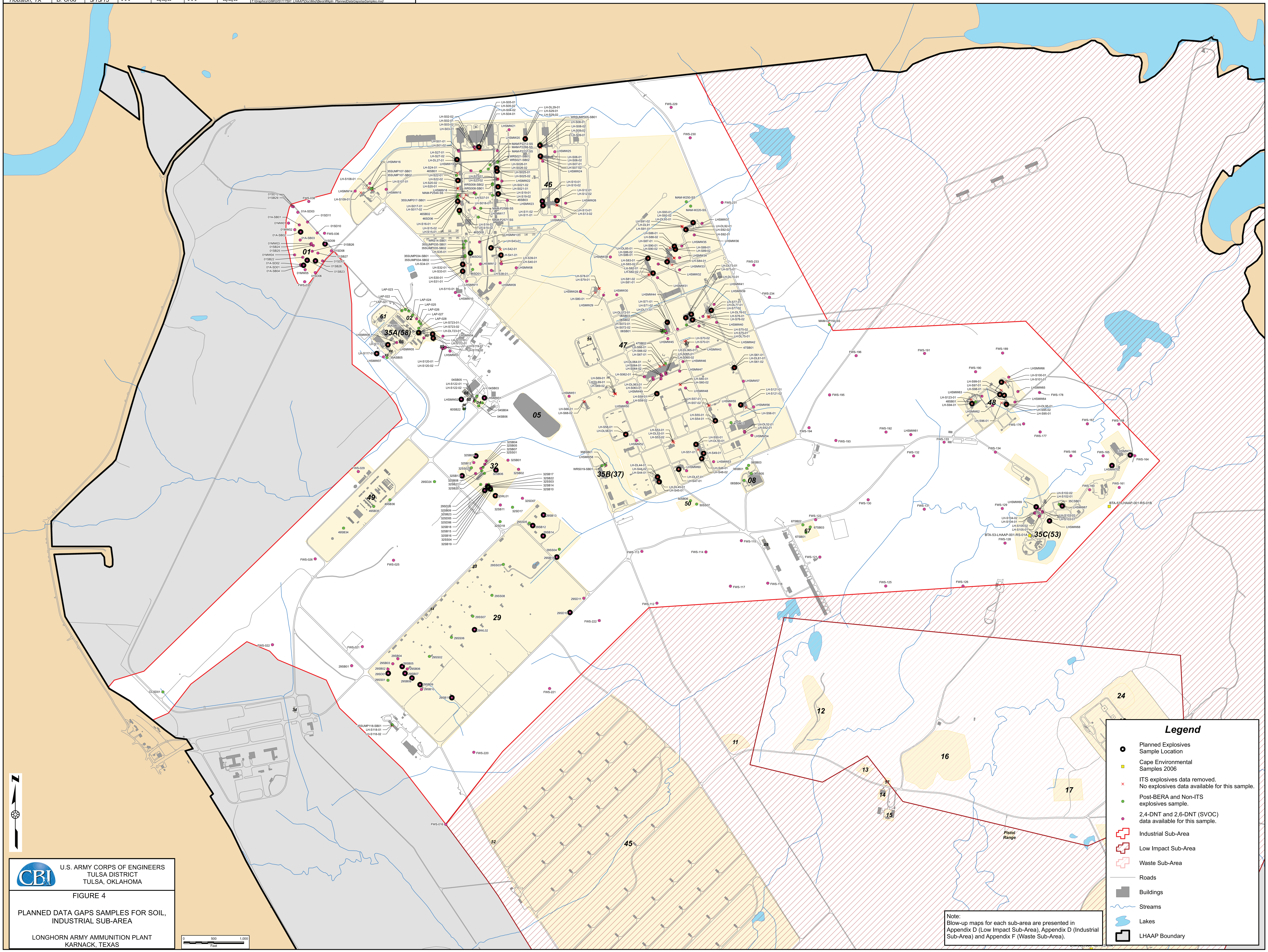
CB&I

FIGURE 3

PLANNED DATA GAPS SAMPLES FOR SOIL, LOW IMPACT SUB-AREA

LONGHORN ARMY AMMUNITION PLANT
KARNACK, TEXAS

OFFICE	DRAWN BY		CHECKED BY		APPROVED BY		FILE PATH
Houston, TX	B. Grod	5/15/13	- - -	--/--/--	- - -	--/--/--	T:\Graphics\GIMG\S\117591_LHAAP\Doc\Mxd\Bera\Wkpln_PlannedDataGapsIsaSamples.mxd



Note:
Blow-up maps for each sub-area are presented in Appendix D (Low Impact Sub-Area), Appendix D (Industrial Sub-Area) and Appendix F (Waste Sub-Area).

CB&I

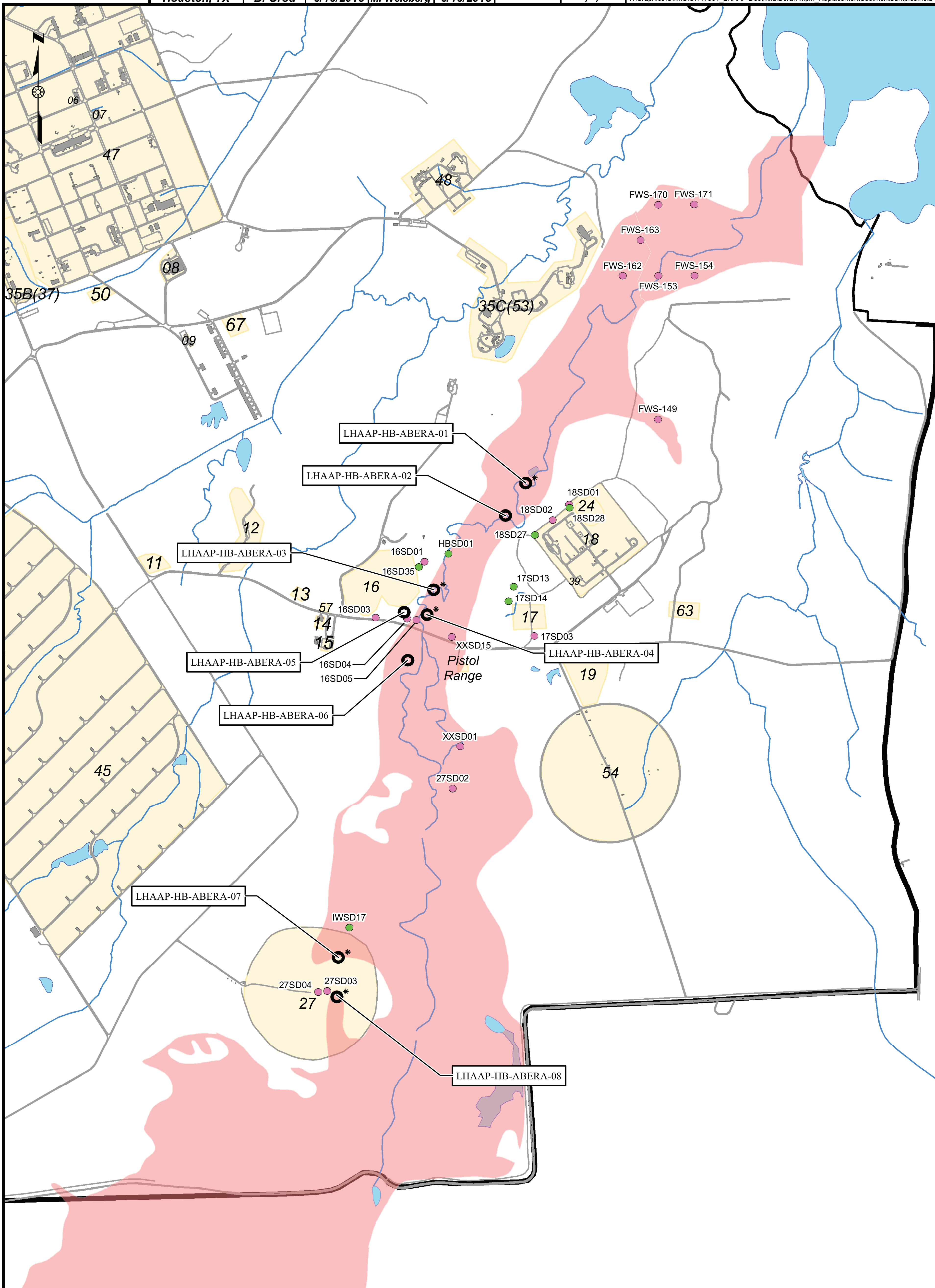
U.S. ARMY CORPS OF ENGINEERS
TULSA DISTRICT
TULSA, OKLAHOMA

FIGURE 4

PLANNED DATA GAPS SAMPLES FOR SOIL, INDUSTRIAL SUB-AREA

LONGHORN ARMY AMMUNITION PLANT
KARNACK, TEXAS

OFFICE	DRAWN BY		CHECKED BY		APPROVED BY		FILE PATH
Houston, TX	B. Grod	5/16/2013	M. Weisberg	5/16/2013	---	--/--/--	T:\Graphics\GIM\GIS\117591_LHAAP\Doc\Mxd\Bera\Wkpln_ReplacementSedimentSamples.mxd



LEGEND

- Planned Explosives Sediment Sample Location
- Planned Explosives Surface Water Sample Location (if water present)
- Post-BERA and Non-ITS explosives Sample
- 2,4-DNT and 2,6-DNT (SVOC) data available for this sample
- Watershed
- Roads
- Buildings
- Streams
- Lakes
- LHAAP Boundary

0 650 1,300 2,600 Feet

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

FIGURE 5

PLANNED REPLACEMENT SEDIMENT AND SURFACE WATER SAMPLES IN THE HARRISON BAYOU WATERSHED

LONGHORN ARMY AMMUNITION PLANT
KARNACK, TEXAS

Worksheets #19 & #30: Sample Containers, Preservation, and Hold Times

Laboratory: Microbac Laboratories Inc.
158 Starlite Drive
Marietta, OH 45750
1-800-373-4071
PM: Stephanie Mossburg

Certifications: DOD ELAP, TCEQ

Sample Delivery Method: Shipped by Federal Express

Matrix	Analyte/ Analyte Group	Method/ SOP	Accreditation Expiration Date	Container	Minimum Sample Volume or Weight	Preservation	Preparation Holding Time	Analytical Holding Time
Soil	Nitroaromatics and Nitramines by HPLC	SW-846 Method 8330A Microbac SOP #L-1	DOD ELAP 12/31/2013 TCEQ 3/31/2013	4 ounce Glass Amber with Teflon-lined cap	4 ounce Glass Amber with Teflon-lined cap	Cool to 4 ± 2°C	14 days	40 days
Sediment	Nitroaromatics and Nitramines by HPLC	SW-846 Method 8330A Microbac SOP #L-1	DOD ELAP 12/31/2013 TCEQ 3/31/2013	4 ounce Glass Amber with Teflon-lined cap	4 ounce Glass Amber with Teflon-lined cap	Cool to 4 ± 2°C	14 days	40 days
Water	Nitroaromatics and Nitramines HPLC	SW-846 Method 8330A Microbac SOP #L-1	DOD ELAP 12/31/2013 TCEQ 3/31/2013	2 1 Liter Amber	1 Liter	Cool to 4 ± 2°C	14 days	40 days

°C degrees Celsius
DOD ELAP Department of Defense Environmental Laboratory Accreditation Program
HPLC High Performance Liquid Chromatography
PM Project Manager
SOP standard operating procedure
TCEQ Texas Commission on Environmental Quality

Worksheet #20: Field QC Summary

Worksheet #20 summarizes the field QC samples that will be collected for the LHAAP project (SOP LHAAP-F-6). The following field QC samples will be collected and submitted for the LHAAP project.

- Field duplicates will be collected at a frequency of one per every 20 environmental samples for each analyte and matrix.
- Matrix spike (MS) and matrix spike duplicate (MSD) samples will be collected at a frequency of one per every 20 environmental samples for each analyte and matrix.
- Equipment rinsate blank samples will be collected at a rate of 5 percent for each analyte for soil and sediment samples.
- Temperature blanks will be submitted with every cooler containing analytical samples.

Soil and sediment samples will be collected using non-disposable sampling equipment. The following table presents a summary of the field QC samples.

Table 10. Field QC Summary

Matrix	Analyte/Analytical Group	Field Samples (Estimated)	Field Duplicates (Estimated	Matrix Spikes/Matrix Spike Duplicates (Estimated)	Equipment Rinsate Blanks (Estimated)	Total # Analyses (Estimated)
Soil	Nitroaromatics and Nitramines by HPLC	198	10	10	10	238
Sediment	Nitroaromatics and Nitramines by HPLC	8	1	1	1	12
Surface water	Nitroaromatics and Nitramines by HPLC	5	1	1	0	8

HPLC High Performance Liquid Chromatography
QC quality control

Field Duplicate Samples

A field duplicate is a generic term for two or more field samples collected at the same time in the same location. Field duplicate samples are submitted to the laboratory labeled as "DUP" and are taken through all steps of the analytical preparation and analysis process in an identical manner. These samples are used to assess precision of the entire data collection activity, including sampling, analysis, and site heterogeneity.

Matrix Spike/Matrix Spike Duplicate Samples

The MS is used to assess the performance of the method as applied to a particular matrix. MS and MSD samples are aliquots of samples spiked with known amounts of all target analytes. The spiking occurs in the laboratory prior to sample preparation and analysis. The spiking level should be greater than the lowest concentration standard used for calibration and less than or equal to the midpoint of the linear calibration range.

Equipment Rinsate Blanks

An equipment rinsate blank (i.e., decontamination rinsate or equipment rinsate) sample consists of a sample of analyte-free or distilled source water poured over or through decontaminated field sampling equipment that is considered ready to collect or process an additional sample. Equipment rinsate blanks are to be collected from non-dedicated sampling equipment to assess the adequacy of the decontamination process.

To collect an equipment rinsate blank sample, pump or pour the source water over and/or through the decontaminated sampling equipment. Collect this runoff water into the sample containers directly or with the use of a funnel, if necessary. The source water may be poured by use of an electric or hand submersible pump by tipping the jug of water upside down or by use of a stopcock and gravity. Results of equipment rinsate blank samples are used to evaluate whether equipment decontamination was effective.

When disposable or dedicated sampling equipment is used, equipment rinsate blank samples do not need to be collected.

Temperature Blanks

A temperature blank is a container of water that is packed and shipped to the laboratory with the field samples which require a cooling preservation not to exceed 6 degrees Celsius (C). Upon arrival of a cooler at the laboratory, the laboratory measures the temperature of the temperature blank. The temperature reading is used to represent the conditions of the field samples during shipment to the laboratory. This information is used by both the laboratory and by the data reviewer. If the temperature blank exceeds the criteria of less than 2 or greater than 6 degrees C (4 plus or minus 2 degrees C), then the laboratory must notify the Project Chemist immediately for guidance.

Worksheet #21: Field SOPs

The following is a list of field SOPs which will be used on the LHAAP project. The field SOPs can be found in Appendix C.

SOP Number	Title and Revision Date	Originating Organization	Equipment Type	Modified for Project Work? (Yes/No)	Description
LHAAP-F-1	Field Documentation	AGEISS	See SOP for specific equipment needs	Yes	This document establishes procedures for preparing, maintaining, and archiving field documentation.
LHAAP-F-2	Field Equipment Calibration and Maintenance	AGEISS	See SOP for specific equipment needs	Yes	This document establishes procedures for conducting field equipment calibration, calibration verification, and maintenance.
LHAAP-F-3	Soil Sampling	AGEISS	See SOP for specific equipment needs	Yes	This document establishes procedures for soil sampling.
LHAAP-F-4	Sediment Sampling	AGEISS	See SOP for specific equipment needs	Yes	This document establishes procedures for sediment sampling
LHAAP-F-5	Surface Water Sampling	AGEISS	See SOP for specific equipment needs	Yes	This document establishes procedures for surface water sampling
LHAAP-F-6	Field Quality Control Samples	AGEISS	See SOP for specific equipment needs	Yes	This document establishes procedures for field quality control sample collection.
LHAAP-F-7	Sample Handling, Labeling, Packaging, and Custody	AGEISS	See SOP for specific equipment needs	Yes	This document establishes procedures for sample handling, labeling, packaging, and custody.
LHAAP-F-8	Field Equipment Cleaning and Decontamination	AGEISS	See SOP for specific equipment needs	Yes	This document establishes procedures for field equipment cleaning and decontamination.
LHAAP-F-9	Global Positioning System Measurements	AGEISS	See SOP for specific equipment needs	Yes	This document establishes procedures for conducting global positioning system measurements.

Worksheet #22: Field Equipment Calibration, Maintenance, Testing, and Inspection

This worksheet provides information for calibration, maintenance, testing and inspection of field equipment.

Field Equipment	Activity	SOP Reference	Title or Position of Responsible Person	Frequency	Acceptance Criteria	Corrective Action
PID	Daily Calibration Checks	LHAAP-F-2	Field Operations Leader	Checked at the start of each day	See manufacturer's manual	Replace with new PID
Water Quality Meters	Daily Calibration Checks	LHAAP-F-2	Field Operations Leader	Checked at the start of each day	See manufacturer's manual	Replace with new meter or probe

PID photoionization detector
SOP standard operating procedure

Worksheet #23: Analytical SOPs

The following is a list of analytical methods and SOPs which will be utilized by Microbac Laboratory on the LHAAP project. The analytical SOPs can be found in Appendix D.

SOP Reference Number	Title, Revision Date, and/or Number	Definitive or Screening Data	Analytical Group	Instrument	Organization Performing Analysis	Modified for Project Work? (Yes/No)
L-1	Standard Operating Procedure Nitroaromatics and Nitramines by High Performance Liquid Chromatography Method 8330A, Rev. 16, 09/15/2012, Microbac SOP# HPLC02	Definitive	Nitroaromatics and Nitramines	HPLC	Microbac Laboratories, Inc. 158 Starlite Drive Marietta, OH 45750	No

HPLC High Performance Liquid Chromatography
SOP standard operating procedure

Worksheet #24: Analytical Instrument Calibration

The following table provides analytical instrument calibration procedures which will be utilized by Microbac Laboratory on the LHAAP project.

Instrument/Analysis	Calibration Procedure	Frequency of Calibration	Acceptance Criteria	Corrective Action	Person Responsible for CA	SOP Reference
HPLC by SW846 Method 8330A	Initial calibration — prior to sample analysis, a minimum of five concentration levels for all compounds	Prior to initial and continuing calibration	Option 1: RSD for each analyte < 20% Option 2: linear least squares regression: r > 0.995 Option 3: non-linear regression: COD r2 >0.99 (6 points shall be used for second order, 7 points shall be used for third order)	Inspect system, correct problem, rerun calibration and affected samples if the correlation coefficient must be ≥0.995	HPLC Analyst	L-1
	Second source Calibration verification	Once after each initial calibration	Value of second source for all analytes within ± 20% of expected value (initial source)	Correct problem and verify second source standard. Rerun second source verification. If that fails, correct problem and repeat initial calibration.		
	Calibration verification (ICV and CCV)	ICV: Daily, before sample analysis CCV: After every 10 field samples and at the end of the analysis sequence	All analytes within ± 20% of expected value from the ICAL	ICV: Correct problem, rerun ICV. If that fails, repeat initial calibration. CCV: Correct problem then repeat CCV and reanalyze all samples since last successful calibration verification.		

Instrument/Analysis	Calibration Procedure	Frequency of Calibration	Acceptance Criteria	Corrective Action	Person Responsible for CA	SOP Reference
	RT window width calculated for each analyte and surrogate	At method set-up and after major maintenance (e.g., column change)	RT width is ± 3 times standard deviation for each analyte RT from 72-hour Study	N/A	HPLC Analyst	L-1
	Method blank	One per preparatory batch	No analytes detected > ½ MRL. For common laboratory contaminants, no analytes detected > MRL.	Correct problem, reprep then reanalyze method blank and all samples processed with the contaminated blank.	HPLC Analyst	L-1
	Confirmation of positive results (second column or second detector)	All positive results must be confirmed	Calibration and QC criteria same as for initial or primary column analysis. Results between primary and second column RPD ± 40%.	N/A	HPLC Analyst	L-1

CA corrective action
CCV continuing calibration verification
COD coefficient of determination
HPLC High Performance Liquid Chromatography
ICAL instrument calibration
ICV initial calibration verification
MRL Method Reporting Limit
N/A not applicable
QC quality control
RPD relative percent difference
RSD relative standard deviation
RT retention time

Worksheet #25: Analytical Instrument and Equipment Maintenance, Testing, and Inspection

The following is a list of analytical instrument maintenance, testing, and inspection activities which will be conducted by Microbac Laboratory on the LHAAP project.

Instrument/ Equipment	Maintenance Activity	Testing Activity	Inspection Activity	Frequency	Acceptance Criteria	Corrective Action	Responsible Person	Analytical SOP Reference
HPLC	• Replace column as needed • Replace mobile phase • Replace guard column • Replace inlet filter	Instrument performance and sensitivity	Check connections, bake out instrument, and leak test	As required by instrument manufacturer	Initial and continuing calibration and instrument blanks within acceptable criteria	Inspect system, correct problem, and rerun calibration and affected samples	HPLC Analyst	L-1

HPLC High Performance Liquid Chromatography
SOP standard operating procedure

Worksheet #26 & 27: Sample Handling, Custody, and Disposal

Sampling Organizations: AGEISS and CB&I (AGEISS Team)

Laboratory: Microbac Laboratories Inc.
158 Starlite Drive
Marietta, OH 45750
1-800-373-4071
PM: Stephanie Mossburg

Sample Delivery Method: Shipped by Federal Express

Number of days from reporting until sample disposal: 60 days

Activity	Organization and Title or Position of Person Responsible for the Activity	Standard Operating Procedure Reference
Sample labeling	AGEISS Team	LHAAP-F-7
Chain-of-custody form completion	AGEISS Team	LHAAP-F-7
Packaging	AGEISS Team	LHAAP-F-7
Shipping coordination	AGEISS Team AGEISS Project Chemist	LHAAP-F-7
Sample receipt, inspection, & log-in	Sample custodian and analyst Microbac Laboratory	LHAAP-F-7 and per laboratory sample receipt procedure
Sample custody and storage	Sample custodian and analyst Microbac Laboratory	LHAAP-F-7 and per laboratory sample custody and storage procedures
Sample disposal	Sample custodian and analyst Microbac Laboratory	LHAAP-F-7 and per laboratory sample disposal procedure

Worksheet #28: Analytical Quality Control and Corrective Action

The purpose of this worksheet is to ensure that the selected analytical methods are capable of meeting project-specific Measurement Performance Criteria (Worksheets #12-1, #12-2, and #12-3) which are based on PQOs/DQOs.

Worksheet #28-1: Quality Control Samples – Nitroaromatics and Nitramines in Soil

Matrix	Soil	**Analytical Method/ Lab SOP Reference**	SW-846 8330A L-1 Method 8330	**No. of Sample Locations**	See Worksheet #18	
Analytical Group	Nitroaromatics and Nitramines	**Sampler's Name**	To Be Determined			
Concentration Level	All	**Field Sampling Organization**	AGEISS Team			
SOP	See Worksheet #21	**Analytical Organization**	Microbac Laboratories			
QC Sample	**Frequency/Number(1)**	**Method/SOP QC Acceptance Limits**	**Corrective Action**	**Person(s) Responsible for Corrective Action**	**Data Quality Indicator**	**Measurement Performance Criteria**
Field duplicate	One per 20 field samples of similar matrix	See Worksheet #12-1	Qualify data as needed	Data Validator	Precision – Overall	See Worksheet #12-1
Surrogates	Three per sample	See Appendix A Table A-1	Reanalyze sample	Lab personnel	Accuracy/bias	See Worksheet #12-1
Method blanks	One per analytical batch	See Worksheet #12-1	Qualify data as needed or reanalyze batch	Lab personnel and/or Data Validator	Accuracy/bias contamination	See Worksheet #12-1
Equipment rinsate blanks	One per 20 field samples	See Worksheet #12-1	Qualify data as needed	Data Validator	Accuracy/bias contamination	See Worksheet #12-1
Laboratory control sample	One per batch	See Appendix A Table A-1	Qualify data as needed or reanalyze batch	Lab personnel	Precision	See Worksheet #12-1
Matrix Spike/Matrix Spike Duplicate	One per batch	See Appendix A Table A-1	Qualify data as needed	Lab and/or Data Validator	Precision	See Worksheet #12-1

(1) An analytical batch is defined as no more than 20 analytical samples.
QC quality control
SOP standard operating procedure

Worksheet #28-2: Quality Control Samples – Nitroaromatics and Nitramines in Sediments

Matrix	Sediment	**Analytical Method/ Lab SOP Reference**	SW-846 8330A L-1 Method 8330	**No. of Sample Locations**	See Worksheet #18	
Analytical Group	Nitroaromatics and Nitramines	**Sampler's Name**	To Be Determined			
Concentration Level	All	**Field Sampling Organization**	AGEISS Team			
SOP	See Worksheet #21	**Analytical Organization**	Microbac Laboratories			
QC Sample	**Frequency/Number(1)**	**Method/SOP QC Acceptance Limits**	**Corrective Action**	**Person(s) Responsible for Corrective Action**	**Data Quality Indicator**	**Measurement Performance Criteria**
Field duplicate	One per 20 field samples of similar matrix	See Worksheet #12-2	Qualify data as needed	Data Validator	Precision – Overall	See Worksheet #12-2
Surrogates	Three per sample	See Appendix A Table A-2	Reanalyze sample	Lab personnel	Accuracy/bias	See Worksheet #12-2
Method blanks	One per analytical batch	See Worksheet #12-2	Qualify data as needed or reanalyze batch	Lab personnel and/or Data Validator	Accuracy/bias contamination	See Worksheet #12-2
Equipment rinsate blanks	One per 20 field samples	See Worksheet #12-2	Qualify data as needed	Data Validator	Accuracy/bias contamination	See Worksheet #12-2
Laboratory control sample	One per batch	See Appendix A Table A-2	Qualify data as needed or reanalyze batch	Lab personnel	Precision	See Worksheet #12-2
Matrix Spike/Matrix Spike Duplicate	One per batch	See Appendix A Table A-2	Qualify data as needed	Lab and/or Data Validator	Precision	See Worksheet #12-2

(1) An analytical batch is defined as no more than 20 analytical samples.
QC quality control
SOP standard operating procedure

Worksheet #28-3: Quality Control Samples – Nitroaromatics and Nitramines in Water

Matrix	Water	**Analytical Method/ Lab SOP Reference**	SW-846 8330A L-1 Method 8330	**No. of Sample Locations**	See Worksheet #18
Analytical Group	Nitroaromatics and Nitramines	**Sampler's Name**	To Be Determined		
Concentration Level	All	**Field Sampling Organization**	AGEISS Team		
SOP	See Worksheet #21	**Analytical Organization**	Microbac Laboratories		

QC Sample	Frequency/Number(1)	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator	Measurement Performance Criteria
Field duplicate	One per 20 field samples of similar matrix	See Worksheet #12-3	Qualify data as needed	Data Validator	Precision – Overall	See Worksheet #12-3
Surrogates	Three per sample	See Appendix A Table A-3	Reanalyze sample	Lab personnel	Accuracy/bias	See Worksheet #12-3
Method blanks	One per analytical batch	See Worksheet #12-3	Qualify data as needed or reanalyze batch	Lab personnel and/or Data Validator	Accuracy/bias contamination	See Worksheet #12-3
Laboratory control sample	One per batch	See Appendix A Table A-3	Qualify data as needed or reanalyze batch	Lab personnel	Precision	See Worksheet #12-3
Matrix Spike/Matrix Spike Duplicate	One per batch	See Appendix A Table A-3	Qualify data as needed	Lab and/or Data Validator	Precision	See Worksheet #12-3

(1) An analytical batch is defined as no more than 20 analytical samples.
QC quality control
SOP standard operating procedure

Worksheet #29: Project Documents and Records

This worksheet provides information for project documents and records, including sample collection and field records, project assessment records, laboratory records, and laboratory data deliverable records.

Sample Collection and Field Records			
Record	**Generation**	**Verification**	**Storage Location/Archival**
Field Logbooks	AGEISS Team	AGEISS Field Operations Leader, Jennifer Loos	AGEISS Inc. 1202 Bergen Parkway, Ste 310 Evergreen, CO 80439 303-674-5059 Project File
Field Data Forms and Associated Documents	AGEISS Team	AGEISS Field Operations Leader, Jennifer Loos	AGEISS Inc. 1202 Bergen Parkway, Ste 310 Evergreen, CO 80439 303-674-5059 Project File
Photographs	AGEISS Team	AGEISS Field Operations Leader, Jennifer Loos	AGEISS Inc. 1202 Bergen Parkway, Ste 310 Evergreen, CO 80439 303-674-5059 Project File
Electronic Data	AGEISS Team	AGEISS Field Operations Leader, Jennifer Loos	AGEISS Inc. 1202 Bergen Parkway, Ste 310 Evergreen, CO 80439 303-674-5059 Project File
Chain-of-Custody Forms	AGEISS Team	AGEISS Field Operations Leader, Jennifer Loos	AGEISS Inc. 1202 Bergen Parkway, Ste 310 Evergreen, CO 80439 303-674-5059 Project File

Sample Collection and Field Records			
Record	**Generation**	**Verification**	**Storage Location/Archival**
Air Bills	AGEISS Team	AGEISS Field Operations Leader, Jennifer Loos	AGEISS Inc. 1202 Bergen Parkway, Ste 310 Evergreen, CO 80439 303-674-5059 Project File
Corrective Action Reports	AGEISS Team	AGEISS Field Operations Leader, Jennifer Loos	AGEISS Inc. 1202 Bergen Parkway, Ste 310 Evergreen, CO 80439 303-674-5059 Project File
Correspondence	AGEISS Team	AGEISS Field Operations Leader, Jennifer Loos	AGEISS Inc. 1202 Bergen Parkway, Ste 310 Evergreen, CO 80439 303-674-5059 Project File
Field Training Records	AGEISS Team	AGEISS Field Operations Leader, Jennifer Loos	AGEISS Inc. 1202 Bergen Parkway, Ste 310 Evergreen, CO 80439 303-674-5059 Project File

Project Assessments			
Record	**Generation**	**Verification**	**Storage Location/Archival**
Field Audit Checklists	AGEISS Team	AGEISS Field Operations Leader, Jennifer Loos	AGEISS Inc. 1202 Bergen Parkway, Ste 310 Evergreen, CO 80439 303-674-5059 Project File
Data Verification Checklists	AGEISS Project Chemist Gloria Beilke	AGEISS Field Operations Leader, Jennifer Loos	AGEISS Inc. 1202 Bergen Parkway, Ste 310 Evergreen, CO 80439 303-674-5059 Project File
Data Validation Reports	CB&I Data Validation Specialist Don Dill	AGEISS Field Operations Leader, Jennifer Loos AGEISS TO Manager, Jim Denier	AGEISS Inc. 1202 Bergen Parkway, Ste 310 Evergreen, CO 80439 303-674-5059 Project File
Data Usability Assessment Report	AGEISS Project Chemist Gloria Beilke	AGEISS Field Operations Leader, Jennifer Loos AGEISS TO Manager, Jim Denier	AGEISS Inc. 1202 Bergen Parkway, Ste 310 Evergreen, CO 80439 303-674-5059 Project File
Corrective Action Reports	AGEISS Project Chemist Gloria Beilke	AGEISS Field Operations Leader, Jennifer Loos AGEISS TO Manager, Jim Denier	AGEISS Inc. 1202 Bergen Parkway, Ste 310 Evergreen, CO 80439 303-674-5059 Project File

Laboratory Records			
Record	**Generation**	**Verification**	**Storage Location/Archival**
Laboratory Analytical Data Packages	Analysts	Project Manager, Stephanie Mossburg	Microbac Laboratories, Inc. 158 Starlite Drive Marietta, OH 45750 1-800-373-4071
Electronic Data	Analysts	Project Manager, Stephanie Mossburg	Microbac Laboratories, Inc. 158 Starlite Drive Marietta, OH 45750 1-800-373-4071
Instrument Calibration Reports	Analysts	Project Manager, Stephanie Mossburg	Microbac Laboratories, Inc. 158 Starlite Drive Marietta, OH 45750 1-800-373-4071
Corrective Action Reports	Analysts	Project Manager, Stephanie Mossburg	Microbac Laboratories, Inc. 158 Starlite Drive Marietta, OH 45750 1-800-373-4071

Laboratory Data Deliverables	
Record	**Method 8330A**
Case Narrative	X
Chain-of-Custody Forms	X
Sample Identification Number	X
Sample Summary Results	X
QC Summary Forms – including LCS, MS/MSD, Surrogates, Internal Standards, Blanks, Duplicates, ICVs and CCVs, as applicable	X
Calibrations	X
Chromatograms	X
Raw Data for All Samples including QC Samples	X
Run Logs	X
Extraction and Standard Preparation Logbook Pages	X

CCV continuing calibration verification
ICV initial calibration verification
LCS laboratory control sample
MS/MSD matrix spike/matrix spike duplicate
QC quality control

Worksheets #31, 32, & 33: Assessments and Corrective Action

This worksheet is used to document responsibilities for conducting project assessments, responding to assessment findings and implementing corrective action.

Assessment Type	Responsible Party & Organization	Number/Frequency	Estimated Dates	Assessment Deliverable	Deliverable Due Date
Planning documents	AGEISS Team	To be prepared prior to initiation of activities at the sites	November 2012	TBD	TBD
Technical project reports	AGEISS Team	To be prepared upon completion of activities at the sites	TBD	TBD	TBD
Internal and external project reporting reviews	AGEISS Team	After receiving comments	TBD	Internal and external corrective action reports, updated case narratives, and corrected data submissions	TBD
Data quality and usability assessment	AGEISS Project Chemist	After all laboratory data deliverables have been received and validated	30 days after data has been validated	Data quality and usability assessment report	After data has been generated and validated
Data validation	CB&I Project Chemist	10% Level IV Data Validation 100% Level III Data Review	TBD	Data Validation Report	TBD
Technical performance audit/field audit/laboratory audit	AGEISS Team	As necessary	TBD	Internal audit reports	TBD

TBD to be determined

Worksheet #34: Data Verification and Validation Inputs

This worksheet provides verification and validation inputs for planning documents/records, field records, and analytical data packages.

	Description	Level III Verification (Completeness)	Level IV Validation (Conformance to Specifications)
Planning Documents/Records			
1	Approved QAPP	X	
2	Contract	X	
3	Field SOPs	X	
4	Laboratory certifications, SOPs, and reporting limits	X	X
5	Statement(s) of work	X	
Field Records			
1	Field logbooks	X	X
2	Field instrument calibration records	X	X
3	Chain-of-custody forms and custody seals	X	X
4	Sampling diagrams/surveys	X	X
5	Soil sampling form	X	X
6	Sediment sampling form	X	X
7	Surface water sampling form	X	X
8	Relevant correspondence	X	X
9	Change orders/deviations	X	X
10	Field corrective action reports	X	X
Analytical Data Package			
1	Cover sheet (laboratory identifying information)	X	X
2	Case narrative	X	X
3	Internal laboratory chain-of-custody	X	X
4	Sample receipt records for each cooler	X	X
5	Sample chronology (i.e. dates and times of receipt, preparation, & analysis)	X	X
6	Communication records	X	X
7	DL, LOD and LOQ establishment, verification, and reporting	X	X
8	Standards traceability	X	X
9	Initial and continuing calibration records	X	X
10	Definition of laboratory qualifiers	X	X

Description		Level III Verification (Completeness)	Level IV Validation (Conformance to Specifications)
11	Results reporting forms	**X**	**X**
12	Laboratory QC sample results	**X**	**X**
13	Field sample and field QC sample results	**X**	**X**
14	Documentation of data quality issues and their resolution, including corrective action reports	**X**	**X**
15	Raw data	**X**	**X**
16	Electronic data deliverable	**X**	**X**

DL detection limit
LOD limit of detection
LOQ limit of quantitation
QAPP Quality Assurance Project Plan
QC quality control
SOP standard operating procedure

Worksheet #35: Data Verification Procedures

This worksheet provides data verification procedures including a description of the verification process and the responsible person.

Records Reviewed	Requirement Documents	Process Description	Responsible Person, Organization
Field logbook	• UFP-QAPP • SOP LHAAP-F-1	Verify that records are present and complete for each day of field activities. Verify that all planned samples including field QC samples were collected and that sample collection locations are documented. Verify that meteorological data were provided for each day of field activities. Verify that changes/exceptions are documented and were reported in accordance with requirements. Verify that any required field monitoring was performed and results are documented.	Daily — AGEISS Field Operations Leader Jennifer Loos At conclusion of field activities — AGEISS Field Operations Leader Jennifer Loos
Chain-of-custody forms	• UFP-QAPP • SOP LHAAP-F-1 • SOP LHAAP-F-7	Verify the completeness of COC records. Examine entries for consistency with the field logbook. Check that appropriate methods and sample preservation have been recorded. Verify that the required volume of sample has been collected and that sufficient sample volume is available for QC samples (e.g., MS/MSD). Verify that all required signatures and dates are present. Check for transcription errors.	Daily — AGEISS Field Operations Leader Jennifer Loos At conclusion of field activities — AGEISS Project Chemist Gloria Beilke
Laboratory deliverable	UFP-QAPP	Verify that the laboratory deliverable contains all records specified in the QAPP. Check sample receipt records to ensure sample condition upon receipt was noted, and any missing/broken sample containers were noted and reported according to plan. Compare the data package with the COCs to verify that results were provided for all collected samples. Review the narrative to ensure all QC exceptions are described. Check for evidence that any required notifications were provided to project personnel as specified in the QAPP. Verify that necessary signatures and dates are present.	Before release — Microbac Laboratory Project Manager Upon receipt – AGEISS Project Chemist Gloria Beilke
Audit reports, corrective action reports	UFP-QAPP	Examine audit reports. For any deficiencies noted, verify that corrective action was implemented according to plan.	AGEISS QC Manager – Leroy Shaser

COC	chain-of-custody	SOP	standard operating procedure
MS/MSD	matrix spike/matrix spike duplicate	UFP-QAPP	Uniform Federal Policy for Quality Assurance Project Plan
QC	quality control		

Worksheet #36: Data Validation Procedures

The following data validation procedures will be performed by the CB&I Project Chemist.

Analytical Group/Method:	Nitroaromatics and Nitramines by High Performance Liquid Chromatography by SW-846 Method 8330A
Data deliverable requirements:	ERPIMS compatible format
Analytical specifications:	Appendix A Table A-1 through Table A-3 Appendix B Table B-1 through Table B-3
Measurement performance criteria:	Appendix A Table A-1 through Table A-3
Percent of data packages to be validated:	10% Level IV Data Validation 100% Level III Data Review (Investigative Derived Waste characterization samples excepted)
Percent of raw data reviewed:	100% of laboratory data
Percent of results to be recalculated:	10% of laboratory data
Validation procedure:	USEPA National Functional Guidelines
Validation code:	S4VM - Stage 4 Validation Manual
Electronic validation program/version:	Not Applicable
Validation qualifiers:	U, UJ, R or J

ERPIMS Environmental Restoration Program Information Management System
J Estimated
R Rejected
U Not detected
UJ Not detected, result is estimated
USEPA United States Environmental Protection Agency

Worksheet #37: Data Usability Assessment

This worksheet describes the procedures, methods, or activities that will be used to determine whether data are of the right type, quality, and quantity to support environmental decision-making for the project. The usability assessment report identifies all of the procedures, interim steps, and an assessment of the data inputs to verify the adequacy of the data and whether the resulting data meet the PQOs as outlined in Worksheet #11.

The following personnel (organization and position/title) are responsible for participating in the data usability assessment:

- AGEISS TO Manager
- AGEISS QC Manager
- AGEISS and CB&I Risk Assessor
- AGEISS Geologist/Hydrogeologist
- CB&I Project Chemist
- AGEISS Project Chemist
- AGEISS Field Operations Leader

A Data Validation Summary Report (DVSR), which includes a section regarding data usability will be completed by the AGEISS Project Chemist. The information contained in the document will discuss the usability of the data based upon the overall quality in relation to the verification and validation process. The data will be evaluated using the parameters of precision, accuracy, representativeness, completeness, comparability, sensitivity, and bias. Qualified data and the impacts of the qualifications will also be discussed in the DVSR.

- **Precision**: Results of all duplicates (lab or field) (relative percent difference [RPD]) will be calculated for each analysis. For each duplicated pair, its RPD will be compared to its method and matrix performance acceptance criteria. All data outside the criteria will be flagged appropriately.
- **Accuracy/Bias**: Blanks (trip, field, lab method, etc.) will be evaluated to determine the impact on the associated sample. Data results will be flagged appropriately.
- **Overall Accuracy**: Control standards and spiked samples will be compared to the method-specific criteria. Associated data will be flagged appropriately.
- **Sensitivity**: The test methods used meet the required reporting limits.
- **Comparability**: Assessed by evaluation of laboratory reported detection limits, sample dilution factors, and the overall performance of the designated methods.
- **Representativeness**: Sample representativeness will be assessed through the evaluation of the field sampling activities and QC sample data and field duplicate precision checks.
- **Completeness**: For each analyte, completeness will be calculated as the number of data points for each analyte that meet the measurement performance criteria for precision, accuracy, and sensitivity divided by the total number of data points. Note: The completeness evaluation will include "lost" (broken sample containers, lost extracts, etc.) in the completeness calculation.

The following tables summarize the data usability assessment process that will be used to analyze the data by the AGEISS and CB&I Project Chemists and definitions for the data usability qualifiers.

Table 11. Data Usability Assessment Process

Process Step	Action
Step #1: Review the project's objectives and sampling design	The project DQOs and measurement performance criteria will be reviewed to ensure they support the project objectives and determine if the CSM needs to be revised based upon the most current site data.
Step #2: Review the data verification and data validation outputs	The applicable members of the project team will prepare and/or review project QA/QC reports. Summarized data will be evaluated for patterns, trends, and anomalies not consistent with past observations or the CSM. Deviations from planned activities will be reviewed (e.g., number and locations of samples, holding time exceedances, damaged samples, and standard operating procedure deviations) and their effects on the data usability will be determined.
Step #3: Document data usability and draw conclusions	Data usability recommendations and limitations will be provided in data validation reports. Data collected that are not qualified as rejected will be used to address data gaps.

CSM Conceptual Site Model
DQO data quality objective
QA/QC quality assurance/quality control

Table 12. Data Usability Qualifier Definitions

Qualifier	Definition
U	Not detected: Analysis for the analyte was performed, but the analyte was not detected above the level of the associated value. The associated value is the SDL.
J	Estimated: The analyte was detected and identified. The associated numerical value is the approximate concentration of the analyte in the sample.
UJ	Not detected, SDL is estimated: The analyte was not detected above the reported SDL. Value of the SDL is estimated and may be inaccurate.
R	Rejected: The data are unusable.

SDL sample detection limit

APPENDIX A

Method Performance Criteria

Appendix A
Method Performance Criteria

Table A-1. Soil QC Acceptance Criteria for SW-846 Method 8330A – Nitroaromatics and Nitramines by High Performance Liquid Chromatography

Method: SW-846 Method 8330A							
Matrix: Soil							
Compounds	**CAS No.**	**Units**	**LOQ**	**MDL**	**LCS (%Recovery)**	**MS/MSD (% Recovery)**	**RPD**
HMX (Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine)	2691-41-0	mg/kg	0.25	0.1	75-125	75-125	≤30%
RDX (Hexahydro-1,3,5-trinitro-1,3,5-triazine)	121-82-4	mg/kg	0.25	0.1	70-135	70-135	≤30%
1,3,5-TNB (1,3,5-Trinitrobenzene)	99-35-4	mg/kg	0.25	0.1	75-125	75-125	≤30%
1,3-DNB (1,3-Dinitrobenzene)	99-65-0	mg/kg	0.25	0.1	80-125	80-125	≤30%
Tetryl (Methyl-2,4,6-trinitrophenylnitramine)	479-45-8	mg/kg	0.25	0.1	10-150	10-150	≤30%
NB (Nitrobenzene)	98-95-3	mg/kg	0.25	0.1	75-125	75-125	≤30%
2,4,6-TNT (2,4,6-Trinitrotoluene)	118-96-7	mg/kg	0.25	0.1	55-140	55-140	≤30%
4-Am-DNT (4-Amino-2,6-dinitrotoluene)	19406-51-0	mg/kg	0.25	0.1	80-125	80-125	≤30%
2-Am-DNT (2-Amino-4,6-dinitrotoluene)	35572-78-2	mg/kg	0.25	0.1	80-125	80-125	≤30%
2,4-DNT (2,4-Dinitrotoluene)	121-14-2	mg/kg	0.25	0.1	80-125	80-125	≤30%
2,6-DNT (2,6-Dinitrotoluene)	606-20-2	mg/kg	0.25	0.1	80-120	80-120	≤30%
2-NT (2-Nitrotoluene)	88-72-2	mg/kg	0.25	0.1	80-125	80-125	≤30%
3-NT (3-Nitrotoluene)	99-08-1	mg/kg	0.25	0.1	75-120	75-120	≤30%
4-NT (4-Nitrotoluene)	99-99-0	mg/kg	0.25	0.1	75-125	75-125	≤30%

Surrogates	**CAS Number**	**Surrogate Limits (% Recovery)**
1,2-Dinitrobenzene	528-29-0	50-150

% percent
CAS Chemical Abstracts Service
HPLC High Performance Liquid Chromatography
LCS laboratory control sample
LOQ level of quantitation
MDL method detection limit
mg/kg milligrams/kilogram
MS matrix spike
MSD matrix spike duplicate
QC quality control
RPD relative percent difference
SW-846 Test Methods for Evaluating Solid Waste, Physical/Chemical Methods

Appendix A
Method Performance Criteria

Table A-2. Sediment QC Acceptance Criteria for SW-846 Method 8330A - Nitroaromatics and Nitramines by High Performance Liquid Chromatography

Method: SW-846 Method 8330A							
Matrix: Sediment							
Compounds	**CAS No.**	**Units**	**LOQ**	**MDL**	**LCS (%Recovery)**	**MS/MSD (% Recovery)**	**RPD**
HMX (Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine)	2691-41-0	mg/kg	0.25	0.1	75-125	75-125	≤30%
RDX (Hexahydro-1,3,5-trinitro-1,3,5-triazine)	121-82-4	mg/kg	0.25	0.1	70-135	70-135	≤30%
1,3,5-TNB (1,3,5-Trinitrobenzene)	99-35-4	mg/kg	0.25	0.1	75-125	75-125	≤30%
1,3-DNB (1,3-Dinitrobenzene)	99-65-0	mg/kg	0.25	0.1	80-125	80-125	≤30%
Tetryl (Methyl-2,4,6-trinitrophenylnitramine)	479-45-8	mg/kg	0.25	0.1	10-150	10-150	≤30%
NB (Nitrobenzene)	98-95-3	mg/kg	0.25	0.1	75-125	75-125	≤30%
2,4,6-TNT (2,4,6-Trinitrotoluene)	118-96-7	mg/kg	0.25	0.1	55-140	55-140	≤30%
4-Am-DNT (4-Amino-2,6-dinitrotoluene)	19406-51-0	mg/kg	0.25	0.1	80-125	80-125	≤30%
2-Am-DNT (2-Amino-4,6-dinitrotoluene)	35572-78-2	mg/kg	0.25	0.1	80-125	80-125	≤30%
2,4-DNT (2,4-Dinitrotoluene)	121-14-2	mg/kg	0.25	0.1	80-125	80-125	≤30%
2,6-DNT (2,6-Dinitrotoluene)	606-20-2	mg/kg	0.25	0.1	80-120	80-120	≤30%
2-NT (2-Nitrotoluene)	88-72-2	mg/kg	0.25	0.1	80-125	80-125	≤30%
3-NT (3-Nitrotoluene)	99-08-1	mg/kg	0.25	0.1	75-120	75-120	≤30%
4-NT (4-Nitrotoluene)	99-99-0	mg/kg	0.25	0.1	75-125	75-125	≤30%

Surrogates	CAS Number	Surrogate Limits (% Recovery)
1,2-Dinitrobenzene	528-29-0	50-150

% percent
CAS Chemical Abstracts Service
HPLC High Performance Liquid Chromatography
LCS laboratory control sample
LOQ level of quantitation
MDL method detection limit
mg/kg milligrams/kilogram
MS matrix spike
MSD matrix spike duplicate
QC quality control
RPD relative percent difference
SW-846 Test Methods for Evaluating Solid Waste, Physical/Chemical Methods

Appendix A
Method Performance Criteria

Table A-3. Water QC Acceptance Criteria for SW-846 Method 8330A - Nitroaromatics and Nitramines by High Performance Liquid Chromatography

Method: SW-846 Method 8330A							
Matrix: Water							
Compounds	**CAS No.**	**Units**	**LOQ**	**MDL**	**LCS (%Recovery)**	**MS/MSD (% Recovery)**	**RPD**
HMX (Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine)	2691-41-0	µg/L	1	0.25	80-115	80-115	≤30%
RDX (Hexahydro-1,3,5-trinitro-1,3,5-triazine)	121-82-4	µg/L	1	0.25	50-160	50-160	≤30%
1,3,5-TNB (1,3,5-Trinitrobenzene)	99-35-4	µg/L	1	0.25	65-140	65-140	≤30%
1,3-DNB (1,3-Dinitrobenzene)	99-65-0	µg/L	1	0.25	45-160	45-160	≤30%
Tetryl (Methyl-2,4,6-trinitrophenylnitramine)	479-45-8	µg/L	1	0.25	20-175	20-175	≤30%
NB (Nitrobenzene)	98-95-3	µg/L	1	0.25	50-140	50-140	≤30%
2,4,6-TNT (2,4,6-Trinitrotoluene)	118-96-7	µg/L	1	0.25	50-145	50-145	≤30%
4-Am-DNT (4-Amino-2,6-dinitrotoluene)	19406-51-0	µg/L	1	0.25	55-155	55-155	≤30%
2-Am-DNT (2-Amino-4,6-dinitrotoluene)	35572-78-2	µg/L	1	0.25	50-155	50-155	≤30%
2,4-DNT (2,4-Dinitrotoluene)	121-14-2	µg/L	1	0.25	60-135	60-135	≤30%
2,6-DNT (2,6-Dinitrotoluene)	606-20-2	µg/L	1	0.25	60-135	60-135	≤30%
2-NT (2-Nitrotoluene)	88-72-2	µg/L	1	0.25	45-135	45-135	≤30%
3-NT (3-Nitrotoluene)	99-08-1	µg/L	1	0.25	50-130	50-130	≤30%
4-NT (4-Nitrotoluene)	99-99-0	µg/L	1	0.25	50-130	50-130	≤30%

Surrogates	**CAS Number**	**Surrogate Limits (% Recovery)**
1,2-Dinitrobenzene	528-29-0	50-150

% percent
µg/L micrograms/liter
CAS Chemical Abstracts Service
HPLC High Performance Liquid Chromatography
LCS laboratory control sample
LOQ level of quantitation
MDL method detection limit
MS matrix spike
MSD matrix spike duplicate
QC quality control
RPD relative percent difference
SW-846 Test Methods for Evaluating Solid Waste, Physical/Chemical Methods

APPENDIX B

Project Action Limits and Laboratory-Specific Detection/Quantitation Limits

Appendix B
Project Action Limits and Laboratory-Specific Detection/Quantitation Limits

Table B-1. Soil Reference Limits and Evaluation for SW-846 Method 8330A - Nitroaromatics and Nitramines by High Performance Liquid Chromatography

Compounds	CAS Number	Units	LOQ	MDL	PAL	Does the LOQ exceed the PAL?	Does the MDL exceed the PAL?
HMX (Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine)	2691-41-0	mg/kg	0.25	0.1	No Value Available	N/A	N/A
RDX (Hexahydro-1,3,5-trinitro-1,3,5-triazine)	121-82-4	mg/kg	0.25	0.1	100	No	No
1,3,5-TNB (1,3,5-Trinitrobenzene)	99-35-4	mg/kg	0.25	0.1	0.376	No	No
1,3-DNB (1,3-Dinitrobenzene)	99-65-0	mg/kg	0.25	0.1	0.655	No	No
Tetryl (Methyl-2,4,6-trinitrophenylnitramine)	479-45-8	mg/kg	0.25	0.1	25	No	No
NB (Nitrobenzene)	98-95-3	mg/kg	0.25	0.1	40	No	No
2,4,6-TNT (2,4,6-Trinitrotoluene)	118-96-7	mg/kg	0.25	0.1	30	No	No
4-Am-DNT (4-Amino-2,6-dinitrotoluene)	19406-51-0	mg/kg	0.25	0.1	80	No	No
2-Am-DNT (2-Amino-4,6-dinitrotoluene)	35572-78-2	mg/kg	0.25	0.1	80	No	No
2,4-DNT (2,4-Dinitrotoluene)	121-14-2	mg/kg	0.25	0.1	1.28	No	No
2,6-DNT (2,6-Dinitrotoluene)	606-20-2	mg/kg	0.25	0.1	0.0328	**Yes**	**Yes**
2-NT (2-Nitrotoluene)	88-72-2	mg/kg	0.25	0.1	No Value Available	N/A	N/A
3-NT (3-Nitrotoluene)	99-08-1	mg/kg	0.25	0.1	No Value Available	N/A	N/A
4-NT (4-Nitrotoluene)	99-99-0	mg/kg	0.25	0.1	No Value Available	N/A	N/A

mg/kg	milligrams/kilogram
CAS	Chemical Abstracts Service
HPLC	High Performance Liquid Chromatography
LOQ	level of quantitation
MDL	method detection limit
N/A	not applicable
PAL	project action limit
SW-846	Test Methods for Evaluating Solid Waste, Physical/Chemical Methods

Appendix B
Project Action Limits and Laboratory-Specific Detection/Quantitation Limits

Table B-2. Sediment Reference Limits and Evaluation for SW-846 Method 8330A – Nitroaromatics and Nitramines by High Performance Liquid Chromatography

Compounds	CAS Number	Units	LOQ	MDL	PAL	Does the LOQ exceed the PAL?	Does the MDL exceed the PAL?
HMX (Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine)	2691-41-0	mg/kg	0.25	0.1	27000	No	No
RDX (Hexahydro-1,3,5-trinitro-1,3,5-triazine)	121-82-4	mg/kg	0.25	0.1	45	No	No
1,3,5-TNB (1,3,5-Trinitrobenzene)	99-35-4	mg/kg	0.25	0.1	1300	No	No
1,3-DNB (1,3-Dinitrobenzene)	99-65-0	mg/kg	0.25	0.1	1.2	No	No
Tetryl (Methyl-2,4,6-trinitrophenylnitramine)	479-45-8	mg/kg	0.25	0.1	100	No	No
NB (Nitrobenzene)	98-95-3	mg/kg	0.25	0.1	27	No	No
2,4,6-TNT (2,4,6-Trinitrotoluene)	118-96-7	mg/kg	0.25	0.1	0.092	**Yes**	**Yes**
4-Am-DNT (4-Amino-2,6-dinitrotoluene)	19406-51-0	mg/kg	0.25	0.1	1.40	No	No
2-Am-DNT (2-Amino-4,6-dinitrotoluene)	35572-78-2	mg/kg	0.25	0.1	7.00	No	No
2,4-DNT (2,4-Dinitrotoluene)	121-14-2	mg/kg	0.25	0.1	0.29	No	No
2,6-DNT (2,6-Dinitrotoluene)	606-20-2	mg/kg	0.25	0.1	0.0398	**Yes**	**Yes**
2-NT (2-Nitrotoluene)	88-72-2	mg/kg	0.25	0.1	28	No	No
3-NT (3-Nitrotoluene)	99-08-1	mg/kg	0.25	0.1	24	No	No
4-NT (4-Nitrotoluene)	99-99-0	mg/kg	0.25	0.1	52	No	No

mg/kg milligrams/kilogram
CAS Chemical Abstracts Service
HPLC High Performance Liquid Chromatography
LOQ level of quantitation
MDL method detection limit
N/A not applicable
PAL project action limit
SW-846 Test Methods for Evaluating Solid Waste, Physical/Chemical Methods

Project Action Limits and Laboratory-Specific Detection/Quantitation Limits

Table B-3. Water Reference Limits and Evaluation for SW-846 Method 8330A - Nitroaromatics and Nitramines by High Performance Liquid Chromatography

Compounds	CAS Number	Units	LOQ	MDL	PAL	Does the LOQ exceed the PAL?	Does the MDL exceed the PAL?
HMX (Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine)	2691-41-0	µg/L	1	0.25	150	No	No
RDX (Hexahydro-1,3,5-trinitro-1,3,5-triazine)	121-82-4	µg/L	1	0.25	180	No	No
1,3,5-TNB (1,3,5-Trinitrobenzene)	99-35-4	µg/L	1	0.25	11	No	No
1,3-DNB (1,3-Dinitrobenzene)	99-65-0	µg/L	1	0.25	72	No	No
Tetryl (Methyl-2,4,6-trinitrophenylnitramine)	479-45-8	µg/L	1	0.25	5800	No	No
NB (Nitrobenzene)	98-95-3	µg/L	1	0.25	270	No	No
2,4,6-TNT (2,4,6-Trinitrotoluene)	118-96-7	µg/L	1	0.25	50	No	No
4-Am-DNT (4-Amino-2,6-dinitrotoluene)	19406-51-0	µg/L	1	0.25	740	No	No
2-Am-DNT (2-Amino-4,6-dinitrotoluene)	35572-78-2	µg/L	1	0.25	740	No	No
2,4-DNT (2,4-Dinitrotoluene)	121-14-2	µg/L	1	0.25	1,220	No	No
2,6-DNT (2,6-Dinitrotoluene)	606-20-2	µg/L	1	0.25	1,220	No	No
2-NT (2-Nitrotoluene)	88-72-2	µg/L	1	0.25	440	No	No
3-NT (3-Nitrotoluene)	99-08-1	µg/L	1	0.25	47000	No	No
4-NT (4-Nitrotoluene)	99-99-0	µg/L	1	0.25	950	No	No

µg/L	micrograms/Liter
CAS	Chemical Abstracts Service
HPLC	High Performance Liquid Chromatography
LOQ	Level of Quantitation
MDL	Method Detection Limit
N/A	Not Applicable
PAL	Project Action Limit
SW-846	Test Methods for Evaluating Solid Waste, Physical/Chemical Methods

APPENDIX C

Field Standard Operating Procedures

TITLE **FIELD DOCUMENTATION**	NUMBER LHAAP-F-1 REVISION 0 (03/15/13)
CONTRACT **W912BV-10-D-2010** TASK ORDER **04**	PAGE 1 of 8

1.0 PURPOSE

This document establishes procedures for preparing, maintaining, and archiving field documentation in support of Task Order 0004, under the Tulsa U.S. Army Corps of Engineers (USACE) Contract W912BV-10-D-2010. This guidance is provided to ensure that field documentation is correct, complete, consistent, and adequate for scientific interpretation and reconstruction of field activities. Procedures described in this Standard Operating Procedure (SOP) are consistent with USACE guidelines presented in Engineer Manual (EM) 1110-1-4000.

2.0 SCOPE

This SOP applies to field documentation that is prepared during field investigations at Longhorn Army Ammunition Plant (LHAAP), Karnack, Texas, in support of an installation-wide baseline ecological risk assessment (BERA) addendum. Additional soil and sediment samples are being collected to address data gaps resulting from the removal of unusable analytical data from the primary dataset.

3.0 DEFINITIONS

Site Identification (Site ID) – A unique alpha-numeric identifier used to identify a specific field location of interest (e.g., a sampling site). The proposed sampling locations at LHAAP are presented in the *Baseline Ecological Risk Assessment Addendum Longhorn Army Ammunition Plant, Karnack, Texas, Uniform Federal Policy for Quality Assurance Project Plan* (2013). The Site ID numbers used to identify the sampling locations will follow the number order and format established during earlier field investigations.

4.0 RESPONSIBILITY

AGEISS Inc. (AGEISS) staff and subcontractor personnel that are part of the integrated project team (collectively referred to as the AGEISS Team) shall adhere to these SOP guidelines during the conduct of field investigations. AGEISS' Project Manager is responsible for implementation and oversight to ensure compliance. AGEISS' Field Operations Leader will manage field activities in accordance with the SOP guidelines.

AGEISS' Project Quality Control (QC) Manager shall verify that the procedures in this SOP are followed by the AGEISS Team. Only personnel with the appropriate qualifications, based on education, previous experience, or on-the-job-training combined with supervision by another qualified person, shall perform these procedures.

5.0 PROCEDURES

Guidelines for preparing, maintaining, and archiving field documentation are described in this section.

5.1 Basic Documentation Guidelines

Data recorded in logbooks and on forms provide a record of field activities. Documentation must be correct, complete, consistent, and adequate for scientific interpretation and reconstruction of field activities. Regardless of the type of documentation that is being completed, the following basic guidelines apply:

- Use black indelible ink.
- Print legibly.
- Use the 24-hour clock for time notations (e.g., 0900 for 9 a.m., 2100 for 9 p.m.).
- Use the mm/dd/yy format for dates.

- Record information as it is observed. Field observations should not be recorded at a later time or date or at another location. In the event that field documentation is damaged or partially destroyed (e.g., due to inclement weather), the document can be rewritten to produce a clean copy. However, the original document should be attached for backup purposes.
- Record only information that is objective, factual, and free of personal feelings or terminology that might prove inappropriate.
- Make necessary corrections by drawing a single line through the original entry (in such a manner that the original entry can still be read) and writing the corrected entry alongside it. Initial and date the correction. Do not erase the incorrect notation; do not cover it by liquid correction fluid, nor render it illegible. Any error discovered on a document shall be corrected by the person who made the entry.
- Do not alter documentation of any kind or under any circumstances which was recorded by another.
- Consider information recorded in logbooks and on field data forms to be confidential. Maintain field documents in a secure manner at all times (e.g., in the field personnel's custody during daily activities and in a locked environment overnight).
- Keep field documents clean and free of potentially contaminated material.
- In the event that it is necessary for a change in personnel prior to the completion of a task, formally relinquish documentation associated with the field activity to the replacement by signing and dating the form or logbook page just before it is surrendered. If the change in personnel is only temporary, this relinquishment procedure is required again prior to the original person resuming work on the task. If a logbook is being relinquished, a notation shall be made indicating the reason for the change in custody of the document.

5.2 Logbooks

Individual logbooks shall be distributed to field personnel. Persons who have been issued logbooks are ultimately responsible for them. Logbooks shall be constructed of weather-resistant pages permanently bound together. Each logbook shall be uniquely numbered with an alpha-numeric identifier that identifies the project as well as the individual logbook (e.g., LHAAP-01/002 is the second logbook assigned for the LHAAP-01 project).

Record the information as shown in the table below to identify the logbook. Attachment 1 presents an example logbook page with a standard heading.

Location in Logbook	**Information**
Spine	Logbook alpha-numeric identifier (e.g., LHAAP-01/002)
Outside Front Cover	Logbook alpha-numeric identifier
Inside Front Cover	• Logbook alpha-numeric identifier • Phone numbers of AGEISS field team members
First page	• Logbook alpha-numeric identifier • Name of the person issuing the logbook (Field Operations Leader) • Name of the person receiving the logbook • Date the logbook was issued • Date the completed logbook was returned (Field Operations Leader)
Top of each page in heading	• Date • Site ID • Page identifier, consisting of six digits. The first three digits represent the logbook number followed by a hyphen and then a three digit sequential page number. (e.g., 002-088 is the 88th page in logbook LHAAP-01/002). • Initials of the person performing the documentation

In addition to the basic documentation guidelines identified in Section 5.1, the following guidelines shall also be followed when making logbook entries, regardless of the field activity or individual's role:

- Record pertinent information and of adequate detail to reconstruct field activities.
- If a particular field activity requires more than one person to record information in an individual logbook, ensure the information is consistent and not contradictory. Duplication is not necessary, excluding basic information (e.g., date, Site ID, etc.). Ideally, the logbook notes of each person should be complementary so that when combined, a complete record of the field activities is produced.
- Record information to be consistent with similar information that is recorded on associated field data forms (e.g., sampling data sheets or chain-of-custody forms) and documents (e.g., sample labels). However, field measurements or observations recorded on field data forms do not require duplication in the logbook.
- Do not include empty lines between entries in the logbook.
- Only record information from one Site ID per logbook page. Before moving to another Site ID, line out the empty space that remains on the logbook page with a single diagonal line which extends to the bottom of the page (or alternatively with a Z line that extends through the first empty line, then diagonally to the bottom of the page, and finally through the last empty line). The line shall be signed and dated. Information related to activities at the next Site ID should be started on the next full page.
- Only record information from one date per logbook page. Space which remains on a page at the end of the day shall be lined out with a single diagonal line (or a Z line), signed, and dated.
- Include an abbreviation/acronym list in the back of each logbook. Define and record each abbreviation/acronym at the time of initial use.
- If appropriate, include project-specific phone numbers and point-of-contact information in the back of logbook.
- Do not remove logbook pages for any reason, regardless if they are partially mutilated or illegible.
- If a logbook page is accidently skipped, line out the blank page with a single diagonal line (or a Z line), signed, and dated.

The following information shall be recorded in each logbook every day that field work is performed at a particular Site ID (see Attachment 1 for an example):

- Name, duty, and company affiliation of on-site field personnel
- Level of protection in which the field activities are being performed
- Brief description of the weather at the site
- Brief description of the site location
- Brief description of the field activities scheduled to be performed that day

The following standard information shall be included in the logbook:

- Calibration records, including:
  - Initial calibration information, referencing the calibration certificate if necessary
  - Field verification and recalibration measurements, unless recorded on field data forms
- Serial/model numbers of equipment and instrumentation used on-site, unless recorded on field data forms
- Time of arrival at each Site ID

- Times that various activities begin and end (e.g., field safety briefing, field measurements, sample collection, etc.)
- Statement that the field safety briefing was conducted and specifics if a field form is not used (e.g., who briefed the field team, participants, topics covered, etc.)
- Field measurements or observations that are not required on field data forms
- Sample collection and handling methods used
- Decontamination procedures employed for sampling equipment
- Anything unusual, including any problems, deviations from planned activities, or changes necessitated due to field conditions especially if unusual circumstances may affect the progress or integrity of field operations
- Any change in site conditions or activities which occurs during field operations
- Field observations and details important to analysis or integrity of samples, if any (e.g., heavy rain, odors, colors, etc.)
- Name, title, and purpose of any site visitors (including time of their arrival and departure)
- Persons contacted and discussions relevant to field operations, if any
- Numbers and descriptions of any photographs taken (see Section 5.4 for further details)
- Hand drawn maps or diagrams of the location or pertinent features
- Formulas and calculated results, unless recorded on field data forms
- Time of departure from the site

5.3 Field Data Forms and Associated Documents

Field data forms may be used to record information collected during field activities (e.g., sampling data sheets, inspection forms, inventory forms, corrective action reports, etc.). Field data forms are activity specific so examples are not included in this SOP. However, the following guidelines apply when completing these types of field documentation (in addition to the basic guidelines identified in Section 5.1):

- If information is not applicable or unavailable for a particular item on a field data form, a notation indicating this shall be placed on the associated line or space (e.g., NA).
- With the exception of basic information (e.g., date, Site ID, etc.), duplication of data recorded on a field form is generally not required in the logbook.
- Information recorded on related field forms (e.g., sampling data sheets and chain-of-custody forms) and associated documents (e.g., sample labels) MUST be consistent with each other and with the similar information that is recorded in logbooks. For example, date, collection time, sample number, Site ID, etc.

SOP LHAAP-F-7, *Sample Handling, Labeling, Packaging, and Custody*, provides guidelines for codes and identifiers for completing sample labels and chain-of-custody forms. Project-specific field data forms and codes/identifiers are detailed in the Sampling and Analysis Plan.

5.4 Photographs

The site is not active so there are no restrictions on taking photographs. However, the following guidelines apply when collecting photographic documentation:

- ♦ Camera memory cards shall be verified as empty prior to the start of field activities.
- ♦ The date and time stamp feature on camera shall be enabled before taking photographs so that this information will be automatically recorded on photographs.
- ♦ For cameras with geotagging features, the global positioning system (GPS) and/or compass feature shall be enabled before taking photographs so that the camera can record GPS coordinate and direction data.
- ♦ An item of known size shall be placed in the camera's area of view for scale purposes when applicable (e.g., a logbook, 6-inch or 12-inch ruler, geologist's hand lens or hammer, etc.).
- ♦ A sequential number shall be assigned to each photograph that includes the Site ID and photographer's initials (i.e., a photograph documentation number). For example, LHAAP-11-JCJ-001 is the first photograph that John C. Jones took for the field investigation at Site ID LHAAP-11.
- ♦ The following type of information shall be recorded in the logbook or on a field data form at the time each photograph is taken, as applicable and if this information is not being automatically recorded by the camera. Note: If a series of photographs is taken from the same location at the same time (e.g., when capturing a panoramic view) this information can be recorded for the series as a whole.
  - Photograph documentation number
  - Date
  - Time
  - Direction (azimuth) that the camera is pointing when taking the photograph
  - A very brief description of the photograph being taken
- ♦ If a large number of digital photographs are taken during the field effort, the memory card may need to be emptied on a daily basis (i.e., copied to a laptop computer or an alternate data storage device and then deleted from the memory card). Alternatively, extra memory cards could be carried in the field by personnel.
- ♦ The digital camera's memory card shall be cleared at the end of the field effort.

The U.S. Army Corps of Engineers (EM 200-1-3) recommends that all sampling points be documented using photographs. Photographs taken to document a sampling point should include two or more reference points to facilitate relocating the point at a later date. A site photo map may also be included in the field logbook to document the locations of site photographs.

5.5 Recordkeeping

To safeguard field documentation, the logbooks, field data forms, and electronic data shall be maintained and archived following the guidelines identified in this section.

5.5.1 Start of Field Effort

The Field Operations Leader shall maintain a record of all issued field logbooks. This record shall include information from the first page of each individual logbook (see Section 5.2). The record shall be stored in a secure location at the AGEISS project office.

5.5.2 Daily during Field Effort

Each day at the conclusion of field activities, personnel shall make a duplicate copy of documentation prepared during that day's field activities. This applies to logbook pages, field data forms, and electronic data downloaded from digital cameras. One of the following methods shall be used to make a duplicate copy, as applicable:

- ♦ Photocopy logbook pages or field data forms.
- ♦ Prepare an electronic copy by scanning logbook pages or field data forms.
- ♦ Download electronic data from digital cameras to a laptop computer. A duplicate can be made by copying the electronic data to a compact disc (CD), digital versatile disc (DVD), flash drive, external hard drive, etc.

Field personnel shall transmit one set of copies to the Project Manager on a daily basis. Electronic files may be uploaded to the project's file transfer protocol site (FTP) site for transmittal purposes.

5.5.3 End of Field Effort

At the end of the field effort, personnel shall compile all original field documents according to the following guidelines:

- ♦ Field Data Forms – Completed field data forms shall be submitted to the Project Manager. These forms shall be subject to technical review and/or verification with final approval by the Project Manager or his/her designee. Upon approval, the original field data forms shall be submitted to the project's T-DCC for archiving.
- ♦ Logbooks – Logbooks shall be subject to technical review and/or verification at the discretion of the Project Manager. All logbooks shall be archived in the T-DCC once the project field work has been completed.
- ♦ Photographs – The photographer should review all photographs taken during a particular field effort against the logbook to confirm that the descriptions and photographs match. A photographic log may be prepared with photographs scanned or digitally added to the document and captions incorporated beneath each photograph that identify the photograph documentation number, a brief description, and other relevant information. The photographic log or captioned photographs shall be submitted to the Project Manager for review. Upon approval, a copy of the photographic log or captioned photographs shall be submitted to the T-DCC for archiving.

6.0 TRAINING

The Project QC Manager or Field Operations Leader will conduct field documentation training as needed. Training will include a step-by-step walk through of this SOP and associated project-specific field forms and logbooks to ensure that field personnel fully understand how to prepare, maintain, and archive field documents. Upon completion of the training session, records documenting the scope and identifying the date, instructor, and attendees shall be archived in the program/project's T-DCC.

7.0 REFERENCES

AGEISS' field operation SOPs and the following references were reviewed prior to writing this SOP:

AGEISS Inc. 2013. Baseline Ecological Risk Assessment Addendum, Longhorn Army Ammunition Plant, Karnack, Texas, Uniform Federal Policy for Quality Assurance Project Plan.

AGEISS Inc. and CB&I. 2013. Data Gap Memorandum for Explosives in Sediment and Surface Water at the Longhorn Army Ammunition Plant, Karnack, TX.

AGEISS Inc. and CB&I. 2013. Data Gap Memorandum for Explosives in Soil at the Longhorn Army Ammunition Plant, Karnack, TX.

U.S. Army Corps of Engineers. 2001. Engineering Manual 200-1-3. Requirements for the Preparation of Sampling and Analysis Plans.

U.S. Environmental Protection Agency. 1986, September. RCRA Groundwater Monitoring Technical Enforcement Guidance Document. OSWER - 9950.1.

8.0 ATTACHMENTS

This SOP contains the following attachment:

Attachment 1 Example Logbook Page

Attachment 1. Example Logbook Page

4/16/12	LHAAP-11	002-088 AW

0800 Arrive at Site ID LHAAP-11.

<u>Status of Daily Operations</u>

Personnel:	John Jones – H&S Officer, AGEISS Amy Wright – Geologist, AGEISS
Level of Protection:	D
Weather:	Overcast, gusty winds from the south, 30 °F
Location:	West of Building 1611
GPS Coordinates:	34.847295 -95.898253
Activities:	Conduct soil sampling activities
Equipment:	PID

0810 Set up and check PID calibration (readings recorded on field form).

0820 Collect surface soil sample: 11SB03-R (sampling data recorded on field form).

0825 Collect GPS measurement (measurement recorded on field form).

0835 Field team departs sample location.

Amy Wright
4/16/12

AGEISS INC. ENGINEERING & ENVIRONMENTAL SERVICES

FIELD STANDARD
OPERATING PROCEDURE

TITLE **FIELD EQUIPMENT CALIBRATION AND MAINTENANCE**	NUMBER REVISION	LHAAP-F-2 0 (03/15/13)
CONTRACT **W912BV-10-D-2010** TASK ORDER **04**	PAGE	1 of 4

1.0 PURPOSE

This document establishes procedures for conducting field equipment calibration, calibration verification, and maintenance in support of Task Order 0004, under the Tulsa U.S. Army Corps of Engineers (USACE) Contract W912BV-10-D-2010. This guidance is provided to ensure that field activities are conducted in a technically sound and consistent manner and that the resulting field data are technically adequate, accurate, and complete. Procedures described in this Standard Operating Procedure (SOP) are consistent with USACE guidelines presented in Engineer Manual (EM) 1110-1-4000.

2.0 SCOPE

This SOP applies to the calibration, calibration verification, and maintenance of field equipment conducted during field investigations at Longhorn Army Ammunition Plant (LHAAP), Karnack, Texas, in support of an installation-wide baseline ecological risk assessment (BERA) addendum. Additional soil and sediment samples are being collected to address data gaps resulting from the removal of unusable analytical data from the primary dataset.

3.0 DEFINITIONS

None

4.0 RESPONSIBILITY

AGEISS Inc. (AGEISS) staff and subcontractor personnel that are part of the integrated project team (collectively referred to as the AGEISS Team) shall adhere to these SOP guidelines during the conduct of field investigations. AGEISS' Project Manager is responsible for implementation and oversight to ensure compliance. AGEISS' Field Operations Leader will manage field activities in accordance with the SOP guidelines.

AGEISS' Project Quality Control (QC) Manager shall verify that the procedures in this SOP are followed by the AGEISS Team. Only personnel with the appropriate qualifications, based on education, previous experience, or on-the-job-training combined with supervision by another qualified person, shall perform these procedures.

5.0 PROCEDURES

Guidelines for calibrating and maintaining field equipment are described in this section.

5.1 Preventive Maintenance

Prior to beginning field activities, an inventory of AGEISS owned or project dedicated equipment shall be conducted and each piece of equipment will be checked to ensure that it is in proper working order. Maintenance logs that provide a history of maintenance and service procedures will be kept with each piece of serviceable equipment. Instruction manuals will be kept with each instrument at all times. Equipment shall be maintained in proper working order, stored in a secure location, decontaminated after each use, and care taken to avoid excessive cold/heat.

5.2 Calibration and Calibration Verification

Equipment used to collect sampling data shall be calibrated to ensure accuracy and reproducibility of results. Calibration and calibration verification data will be recorded in the field logbook or on field forms. Most rental equipment is pre-calibrated and is provided with a calibration certificate. To ensure accuracy of pre-calibrated rental equipment, calibration shall be verified prior to the equipment's initial use.

Equipment calibration shall be checked daily prior to the start of activities and the instrument recalibrated as necessary. Calibration will also be checked when questionable readings are noted, or when maintenance activities, such as replacing a lamp or probe, are performed. Instrument calibration should also be rechecked when significant changes in the weather occur as field instruments can be affected by changes in temperature, barometric pressure, and humidity. The instruction manual for each piece of field equipment should be consulted for the acceptable calibration check range for each particular instrument. Calibration check and recalibration data will be documented in a field logbook or on the appropriate field form.

If an instrument cannot be successfully calibrated or if it is malfunctioning, the instrument will be repaired or replaced immediately. Instances of instrument failure and corrective actions taken will be documented in the field logbook and the Project Manager notified. Field activities shall be discontinued until a suitable replacement or Project Manager's approval is obtained.

5.3 Field Equipment

Equipment to be used during field investigations at LHAAP includes air monitoring instruments. This section describes steps needed to ensure proper operation, maintenance, and calibration of the equipment.

5.3.1 Air Monitoring Instruments

A photoionization detector (PID) will be used to screen for the presence of volatile organic compounds in field personnel breathing space and soil and sediment samples. Although PIDs are typically pre-calibrated by the equipment vendor, field personnel shall conduct daily calibration checks according to the manufacturer's instructions. If necessary, the PID may be recalibrated in the field with a span gas of known concentration according to manufacturer's instructions. The linear response range of the span gas, photon energy of the PID lamp (typically 10.6 electron volts), and calibration verification results shall be noted in the field logbook or on field forms.

The PID probe may be exposed to a volatile organic compound source on a daily basis to determine if the instrument is working properly. Note: Span gases cannot be shipped by air and have to be shipped by ground transportation.

5.3.2 pH Meter

The pH meter calibration will be checked at the start of each sampling day per manufacturer's instructions. If recalibration is necessary, at least two pH buffer solutions that bracket the anticipated pH of the media to be sampled will be used to calibrate the meter. The meter should be calibrated with the buffer solutions at a temperature that is close to the predicted temperature of the expected samples. Calibration and calibration check results will be noted in the calibration and maintenance logbook, or in the field logbook, or on the appropriate field form.

5.3.3 Conductivity Meter

The conductivity meter calibration will be checked at the start of each sampling day per manufacturer's instructions using at least one conductivity standard solution. If recalibration is necessary, the conductivity solutions should be within the range of most anticipated field measurements. Calibration check and recalibration results will be recorded in the calibration and maintenance logbook, or in the field logbook, or on the appropriate field form.

5.3.4 Turbidity Meter

The turbidity meter calibration will be checked at the start of each sampling day per manufacturer's instructions. A manufacturer's standard, included with the meter, will be used as the calibration standard. A known standard of 5 nephelometric turbidity units (NTUs) may be used as the default calibration standard. Calibration check and recalibration results will be recorded in the calibration and maintenance logbook, or in the field logbook, or on the appropriate field form.

5.3.5 Dissolved Oxygen Meter

The dissolved oxygen meter calibration will be checked at the start of each sampling day per manufacturer's instructions. Calibration will be performed using either the damp cloth method or a saturated solution method. Calibration check and recalibration results will be recorded in the calibration and maintenance logbook, or in the field logbook, or on the appropriate field form.

5.4 Equipment List

The following is a list of equipment or items that may be needed to conduct equipment calibration, calibration verification, and maintenance activities:

- Instruments to be calibrated, appropriate calibration standards, and manufacturer's instruction manuals (as applicable):
  - PID, spare lamp, span gas
  - Multi-parameter or single parameter water quality meter(s)
  - pH buffer solutions (pH 4, 7, and 10)
  - Conductivity calibration standard
  - Dissolved oxygen calibration standard
- Squirt bottles filled with distilled water
- Paper towels
- Bucket
- Spare batteries for instruments
- Tools
- Calibration and maintenance logbook
- Field logbook
- Appropriate field forms
- Watch
- Calculator
- Black pens
- Clipboard

5.5 Equipment Cleaning and Decontamination

Equipment will be thoroughly cleaned and/or decontaminated according to the procedures in SOP LHAAP-F-8, *Field Equipment Cleaning and Decontamination*. Decontamination minimizes potential cross contamination in the field that could introduce errors into sampling results. Cleaning minimizes the risk of transferring contaminants from the site upon completion of field activities.

5.6 Waste Handling

Waste materials shall be properly managed by field personnel. The decontamination activities described in this SOP may generate a variety of wastes, including ordinary trash and cleanup materials (e.g., paper towels, rinse water, etc.). Procedures and guidelines for waste handling are identified in the project’s Waste Management Plan for Investigation Derived Waste.

5.7 Documentation and Recordkeeping

Documentation of calibration and maintenance activities shall be in accordance with SOP LHAAP-F-1, *Field Documentation*. Data recorded in logbooks or on field forms provide information on the proper acquisition of data and are a permanent record of calibration and maintenance activities. Documentation must be correct, complete, consistent, and adequate for scientific interpretation and reconstruction of field activities.

To safeguard field documentation, logbooks, field forms, and calibration documentation shall be maintained and archived following the guidelines identified in SOP LHAAP-F-1, *Field Documentation*. Field documentation and training records shall be archived in the project's Technical Document Control Center (T-DCC).

6.0 POTENTIAL HAZARDS

Potential hazards associated with field equipment calibration and maintenance activities may include but are not limited to the following:

- Electrical shock
- Cuts
- Burns

All work conducted under this SOP will be performed in accordance with the project Health and Safety Plan, Accident Prevention Plan, and Activity Hazard Analysis.

7.0 TRAINING

The project's Field Operations Leader will conduct equipment calibration, calibration verification, and maintenance training as needed. Training will include a step-by-step walk through of this SOP and associated project-specific field forms to ensure that personnel fully understand how to calibrate, verify calibration, and maintain field equipment. Upon completion of the training session, records documenting the scope and identifying the date, instructor, and attendees shall be archived in the project's T-DCC.

8.0 REFERENCES

AGEISS' field operation SOPs and the following references were reviewed prior to writing this SOP:

Nielsen, D. M. 1991. Practical Handbook of Ground-Water Monitoring: Chelsea, MI, Lewis Publishers, Inc.

U.S. Army Corps of Engineers. 2001. Engineering Manual 200-1-3. Requirements for the Preparation of Sampling and Analysis Plans.

U.S. Environmental Protection Agency. 1986, September. RCRA Groundwater Monitoring Technical Enforcement Guidance Document. OSWER - 9950.1.

AGEISS INC. ENGINEERING & ENVIRONMENTAL SERVICES

FIELD STANDARD
OPERATING PROCEDURE

TITLE **SOIL SAMPLING**	NUMBER LHAAP-F-3 REVISION 0 (03/15/13)
CONTRACT **W912BV-10-D-2010** TASK ORDER **04**	PAGE 1 of 9

1.0 PURPOSE

This document establishes procedures for surface and subsurface soil sampling in support of Task Order 0004, under the Tulsa U.S. Army Corps of Engineers (USACE) Contract W912BV-10-D-2010. This guidance is provided to ensure that field activities are conducted in a technically sound and consistent manner and that the resulting field data are technically adequate, accurate, and complete. Procedures described in this Standard Operating Procedure (SOP) are consistent with USACE guidelines presented in Engineer Manual (EM) 1110-1-4000.

2.0 SCOPE

This SOP applies to surface and subsurface soil sampling conducted during field investigations at Longhorn Army Ammunition Plant (LHAAP), Karnack, Texas, in support of an installation-wide Baseline Ecological Risk Assessment (BERA) Addendum. Additional soil samples are being collected to address data gaps resulting from the removal of unusable analytical data from the primary dataset. Replacement sample locations were selected from the pool of locations where explosives analytical data were deemed by the U.S. Environmental Protection Agency to be unusable for environmental decision-making. A total of 198 soil samples will be collected from 105 sample points located at three terrestrial exposure units that have been delineated at LHAAP based on common historical uses and similar ecological habitat. Locations of the 105 sample points are presented in the *Baseline Ecological Risk Assessment Addendum, Longhorn Army Ammunition Plant, Karnack, Texas, Uniform Federal Policy for Quality Assurance Project Plan* (AGEISS 2013), hereafter referred to as the project UFP-QAPP.

3.0 DEFINITIONS

Site Identification (Site ID) – A unique alpha-numeric identifier used to identify a specific field location of interest (e.g., a sampling site). Soil sample points at LHAAP are identified according to their location in one of the following terrestrial units or sub-areas, with a number indicating the site within that subarea: the Low Impact Sub-Area (LISA), Industrial Sub-Area (ISA), and Waste Sub-Area (WSA). Therefore Site ID LHAAP-LISA11 refers to site 11 within the LISA.

Sample Number – A unique alpha-numeric identifier used to identify a specific sample. The sample numbers established for the 105 sample points during previous environmental investigations will be retained for this investigation. To distinguish the replacement sample data collected during this investigation from the original sample data, an "R" will be appended to the existing sample number. The R will be followed by SS to indicate a replacement surface sample or SB to indicate a replacement subsurface sample.

4.0 RESPONSIBILITY

AGEISS Inc. (AGEISS) staff and subcontractor personnel that are part of the integrated project team (collectively referred to as the AGEISS Team) shall adhere to this SOP during the conduct of field investigations. AGEISS' Project Manager is responsible for implementation and oversight to ensure compliance. AGEISS' Field Operations Leader will manage field activities in accordance with the SOP guidelines. A technical representative from CB&I (formerly Shaw Environmental & Infrastructure Group [Shaw]) will assist with identifying soil sampling locations at LHAAP prior to initiating soil sampling activities.

AGEISS' Project Quality Control (QC) Manager shall verify that the procedures in this SOP are followed by the AGEISS Team. Only personnel with the appropriate qualifications, based on education, previous experience, or on-the-job-training combined with supervision by another qualified person, shall perform these procedures.

5.0 PROCEDURES

This section describes logistical aspects of the field investigation including right of entry and procedures for sample point identification and soil sample collection. In addition, the procedures for recording soil lithology, obtaining global positioning system (GPS) measurements, cleaning and decontamination of sampling equipment, waste handling, and documentation and recording of field data are also discussed.

5.1 Right of Entry

AGEISS shall gain access to the property from the Government through execution of a Right of Entry letter and/or coordination with the Tulsa District USACE Project Manager and LHAAP Site Manager regarding proposed dates of field work.

5.2 Sample Point Identification and Clearance

As discussed in the project UFP-QAPP, a total of 16, 170, and 12 soil samples will be collected from the LISA, ISA, and WSA, respectively, and analyzed for explosives compounds. Of the 105 sample points that have been identified, surface samples will be collected at 104 locations and subsurface samples will be collected at 94 locations. Surface soils are considered in this investigation to comprise the interval from ground surface to 0.5 feet (ft) below ground surface (bgs) whereas subsurface soils are deeper than 0.5 ft bgs.

The 105 soil locations have been indicated on a map for each sub-area prepared by CB&I and presented in the UFP-QAPP. Prior to implementing soil sampling activities at LHAAP, the AGEISS field team will use a portable GPS unit to locate the sample points in the field based on the sample location maps and GPS coordinate data for each sample point provided by CB&I. The field team will follow procedures detailed in the SOP LHAAP-F-9, *Global Positioning System Measurements*. Once the sample point is identified, the field team will mark each sample point with a pin flag labeled with the Site ID. In cases where a sampling location is inaccessible, the field team will locate the replacement sample point as close as possible to the original location and document the distance and direction from the original sample point in the field logbook. AGEISS will ensure all sample points are cleared for utilities prior to conducting any subsurface sampling.

5.3 Soil Sampling

AGEISS will assume the lead on the required field work, with support from CB&I. CB&I will provide one person with knowledge of the site to assist and be part of the AGEISS field team. The Field Operations Leader will support the sampling crew (a 2-person team), rotate in on sampling as needed, and conduct sample management.

Surface soils are classified in this investigation as soils between the ground surface and 0.5 ft bgs; subsurface soils are located below 0.5 ft bgs. Surface samples are classified as discrete samples that do not require compositing. Subsurface samples will be collected by combining an entire sample interval of soil material.

5.3.1 Surface Soil Samples

Use the following procedures to collect surface soil samples from the 0 to 0.5 ft bgs depth interval for lithologic description and chemical analysis:

1) Locate the sample point by pin flag. Using the portable GPS unit, confirm that the sample point GPS measurement matches the sample point coordinate data written on the pin flag.

2) If a thick, matted root zone, gravel, concrete, etc. is present at or near the ground surface, remove it before collecting the soil sample. The depth measurement for the sample begins at the top of the soil horizon, immediately following any removed materials.

3) Don a clean pair of new, disposable gloves each time a new sample is collected.

4) Soil samples will be screened for hazardous constituents by the on-site Health and Safety Officer using a photoionization detector (PID).

5) Record soil lithology on a field data sheet according to the procedure described in Section 5.4.

6) Surface soil samples for chemical analysis will be collected using a clean stainless steel spoon or trowel and placed directly into the appropriate sample containers following project requirements identified in the project UFP-QAPP. Clean the exterior of the sample containers and complete sample labels using waterproof black ink.

7) After being labeled, wrap the sample containers according to laboratory specified procedures and store in a cooler with sufficient ice to maintain the temperature at 4 ± 2 degrees Celsius, pending sample packaging and shipment to the laboratory in a cooler.

8) Collect the required number and type of field QC samples to meet project requirements as identified in the project UFP-QAPP. Field QC sample types and collection procedures are defined in SOP LHAAP-F-6, *Field Quality Control Samples*.

9) Decontaminate sampling equipment between samples in accordance with the procedures specified in Section 5.7.

10) Complete the chain-of-custody (COC) form for each sample and keep it with the sample until received by the laboratory. Sample labeling, custody, sample packing, and shipping procedures are defined in SOP LHAAP-F-7, *Sample Handling, Labeling, Packaging, and Custody*.

5.3.2 Subsurface Soil Samples

Subsurface samples will be collected from the 0.5 to 3 ft depth interval using a direct push drilling rig. The drilling rig will be track-mounted allowing it to access confined areas or areas with a soft substrate that would otherwise be inaccessible to a truck-mounted drilling rig. Soil cores are collected using a tube type solid wall or split spoon sampler, either with or without a disposable liner. The sample is then extruded from the tube sampler, or in the case of the split spoon sampler, removed by opening the sampler. The soil core is placed in a temporary container for compositing prior to collecting the sample for chemical analysis.

A hand auger may be used for locations that are inaccessible to the drilling rig. A hand auger assembly consists of a stainless steel auger bucket with cutting heads attached to a tee handle. The bucket is advanced by simultaneously pushing and turning using the attached handle. The bucket is advanced to the appropriate depth, the bucket is retrieved from the auger hole, and the contents are placed in a stainless steel bowl. Depending on the size of the auger bucket, multiple auger buckets of soil may need to be collected to obtain a quantity of material that is representative of the entire 0.5 to 3 ft sample interval. In this case, each auger bucket of soil will be placed in a temporary container for compositing prior to collecting the sample for chemical analysis.

Use the following procedures to collect subsurface soil samples for lithologic description and chemical analysis:

1) Following removal of the surface soil material, advance the sampling tube, split spoon sampler, or hand auger to the appropriate depth.

2) Place each soil core or auger bucket of soil into a temporary holding container as it is collected. The container must be clean, dry, and air tight.

3) Don a clean pair of new, disposable gloves each time a new sample is collected.

4) Soil samples will be screened for hazardous constituents by the on-site Health and Safety Officer using a PID.

5) Record soil lithology on a field data sheet according to the procedure described in Section 5.4.

6) Once the required depth interval of soil has been collected, place an equal quantity of soil from each temporary container into a large stainless steel mixing bowl. Use a clean stainless steel spoon or trowel to transfer the soil.

7) Stir the entire composite sample using a stainless steel spoon or trowel until it is as homogeneous as possible. Soil samples must be thoroughly mixed to ensure that the sample is as representative as possible of the sample media.

8) Spread the sample as evenly as possible in the bowl and quarter it.

9) Fill the appropriate sample containers by taking an equal portion of soil from each quarter and placing directly into the appropriate sample containers following project requirements identified in the project UFP-QAPP.

Follow the surface soil sample collection steps 6 through 10 above (Section 5.3.1). At the completion of sampling activities, soil cuttings will be returned to the borehole.

5.4 Recording Soil Lithology

The Field Geologist will describe the lithology and record the information on the field data sheet (Attachment 1, Soil Sampling Form). Per the requirements specified in Chapter 4 of the USACE EM 1110-1-4000, the following soil parameters will be described:

Table 4-1
SOIL PARAMETERS FOR LOGGING

PARAMETER	EXAMPLE
Classification	Sandy clay
Depositional environment and formation, if known	Glacial till, Twin Cities Formation
ASTM D 2488 Group Symbol	CL (field estimate)
Secondary components and estimated percentages	Sand: 25 percent Fine sand 5 percent Coarse sand 20 percent
Color (Soil color charts such as Munsell Soil or the Geological Society of America (GSA) Rock Color Chart are helpful for describing the color of soil samples. If a color chart is used, give both narrative and numerical description and note which chart was used. Suggested standard colors can be found in Spigolon 1993)	Gray: (Gr) (7.5 YR 5.0 (Munsell))
Plasticity	Low plasticity
Consistency (cohesive soil)	Very soft, soft, medium stiff, very stiff, hard
Density (noncohesive soil)	Loose, medium loose, dense, very dense
Moisture content Use a relative term. Avoid a percentage unless a value has been measured.	Dry, moist, wet, saturated
Structure and orientation	No apparent bedding: numerous vertical, iron-stained, tight fractures
Grain angularity	Rounded

Source: EM 1110-1-4000

In addition, include the following parameters on the field data sheets:

- **Sample interval** – Record the depth of the soil sample in ft bgs.
- **Sample type** – Record as grab sample type for soil samples collected from a discrete depth interval, say 0.0 to 0.5 ft bgs. Record as composite sample type for cored or hand augered soil samples that require compositing of soil material.
- **PID reading** – Record, if applicable.

5.5 Global Positioning System Measurements

Use the following procedure to measure and record the location of each sample point:

1) Use a hand-held global positioning system (GPS) unit to identify the location of each sample point based on the sample location maps and GPS coordinate data for each sample point provided by CB&I.

2) Record GPS coordinates on the Soil Sampling Form (Attachment 1). Procedures for obtaining and documenting GPS coordinates are identified in SOP LHAAP-F-9, *Global Positioning System Measurements*. A sketch map of

the location will be drawn in the field log book if needed. Sample locations may also be noted directly on the site map.

5.6 Equipment List

The following is a list of equipment or items that may be needed to conduct soil sampling activities:

- Field logbook
- Pin flags
- Blank Soil Sampling Forms
- Sample labels and chain-of-custody forms
- Custody seals
- Tape measure (in tenths of ft)
- Waterproof black pens and felt tip markers
- Stainless steel spoons or trowels
- Hand augers
- Stainless steel bowls
- Sample containers
- Duct tape
- Putty knife or trowel
- Cooler with ice
- Bubble wrap
- Clear packing tape and dispenser
- Grain size distribution chart and Munsell color chart
- Equipment bucket
- Hand lens
- Trash bags
- Paper towels
- Decontamination equipment (water from an approved source, buckets, brushes, anionic detergent, etc.)
- Copies of the site map
- Clip board
- Personal protective equipment (PPE)
- PID and calibration gas
- Paint marker
- Drums for decontamination water
- Folding table and chairs
- Plastic sheeting
- Distilled water and squirt bottle

5.7 Equipment Cleaning and Decontamination

Prior to arrival at each soil sampling location, sampling equipment such as stainless steel trowels and spoons and hand augers, will be cleaned and stored in a manner which will prevent contamination prior to use. Procedures identified in SOP LHAAP-F-8, *Field Equipment Cleaning and Decontamination*, shall be followed.

Following completion of soil sampling activities, equipment will be thoroughly decontaminated or cleaned according to the procedures in SOP LHAAP-F-8. Decontamination minimizes potential cross contamination in the field that could introduce errors into sampling results. Cleaning minimizes the risk of transferring contaminants from the site upon completion of field activities.

5.8 Waste Handling

Waste materials will be properly managed by field personnel. The soil sampling activities described in this SOP may generate a variety of wastes, including ordinary trash, PPE, cleanup materials (e.g., paper towels, plastic sheets, etc.), potentially contaminated disposable equipment, and/or decontamination water. Process knowledge, knowledge of past site activities, and soil analytical results may be used to help categorize investigation derived waste for proper disposal. Procedures and guidelines for waste handling are identified in the project's Waste Management Plan for Investigation Derived Waste.

5.9 Documentation and Recordkeeping

Documentation of soil sampling activities shall be in accordance with SOP LHAAP-F-1, *Field Documentation*. Data recorded in logbooks or on field forms provide information on the proper acquisition of data and will be a permanent record of these activities. Documentation must be correct, complete, consistent, and adequate for scientific interpretation and reconstruction of field activities.

To safeguard field documentation, logbooks, field forms, and electronic data shall be maintained and archived following the guidelines identified in SOP LHAAP-F-1, *Field Documentation*. Field documentation and training records shall be archived in the project's Technical Document Control Center (T-DCC).

6.0 POTENTIAL HAZARDS

Potential hazards associated with field activities at LHAAP may include but are not limited to the following:

- Contact with contaminated groundwater/soil
- Access issues (e.g., thick vegetation)
- Cuts, strains from operating and decontaminating sampling equipment

All work conducted under this SOP will be conducted in accordance with the project Health and Safety Plan, Accident Prevention Plan, and Activity Hazard Analysis.

7.0 TRAINING

The Program QC Manager (or his/her designee such as the project's Field Operations Leader) will conduct training as needed. Training will include a step-by-step walk through of this SOP and associated project-specific field forms and equipment to ensure that personnel fully understand how to conduct soil sampling. Upon completion of the training session, records documenting the scope and identifying the date, instructor, and attendees shall be archived in the program/project's T-DCC.

8.0 REFERENCES

AGEISS' field operation SOPs and the following references were reviewed prior to writing this SOP:

AGEISS Inc. 2013. Baseline Ecological Risk Assessment Addendum, Longhorn Army Ammunition Plant, Karnack, Texas, Uniform Federal Policy for Quality Assurance Project Plan.

AGEISS Inc. and CB&I. 2013. Data Gap Memorandum for Explosives in Soil at the Longhorn Army Ammunition Plant, Karnack, TX.

Aller, L. 1989. Handbook of Suggested Practices for the Design and Installation of Ground-Water Monitoring Wells. EPA Number 600/4-89/034.

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

9.0 ATTACHMENTS

The SOP includes the following attachment:

Attachment 1 Soil Sampling Form

Attachment 1. Soil Sampling Form

SOIL SAMPLING FORM

Project Name: ______________________ Date: ______________

Site ID: ______________________ Time Start: ______________

Sampling Personnel: ______________________ Time Finish: ______________

______________________ Sample Depth: ______________

______________________ Sample Time: ______________

GPS Coordinates

UTM (Northing)	UTM (Easting)	UTM Zone/Map Datum	WAAS (Y/N)	GPS Accuracy Value (w/unit)

Soil Observations

Depth	USCS Symbol	Munsell Color	Moisture Content	PID	**Soil Description** (Lithology name, estimated grain percentages, consistency/density, plasticity, surface vegetation, soil organic material, anthropogenic debris, disturbance, and coarse lithic material)

Sample Information

Sample Type	Sample Label Number

TITLE **SEDIMENT SAMPLING**	NUMBER LHAAP-F-4 REVISION 0 (03/15/13)
CONTRACT **W912BV-10-D-2010** TASK ORDER **04**	PAGE 1 of 9

1.0 PURPOSE

This document establishes procedures for sediment sampling in support of Task Order 0004, under the Tulsa U.S. Army Corps of Engineers (USACE) Contract W912BV-10-D-2010. This guidance is provided to ensure that field activities are conducted in a technically sound and consistent manner and that the resulting field data are technically adequate, accurate, and complete. Procedures described in this Standard Operating Procedure (SOP) are consistent with USACE guidelines presented in Engineer Manual (EM) 1110-1-4000.

2.0 SCOPE

This SOP applies to sediment sampling conducted during field investigations at Longhorn Army Ammunition Plant (LHAAP), Karnack, Texas, in support of an installation-wide Baseline Ecological Risk Assessment (BERA) Addendum. Additional sediment samples are being collected to address data gaps resulting from the removal of unusable analytical data from the primary dataset. Eight sediment samples will be collected at Harrison Bayou, one of the four watersheds at LHAAP identified as aquatic ecological exposure units.

3.0 DEFINITIONS

Petite Ponar sampler – A scaled-down clamshell type sampling device designed for all types of substrates. A Ponar sampler self-activates its closure mechanism after it penetrates into the bottom material. Although Ponar samplers are typically heavy (45 pounds) and require a winch to operate, the petite Ponar sampler weighs less than 25 pounds and can be used on a line without a winch.

Site Identification (Site ID) – A unique identifier used to identify a specific field location of interest (e.g., a sampling site). Sediment sample locations are presented in the *Baseline Ecological Risk Assessment Addendum, Longhorn Army Ammunition Plant, Karnack, Texas, Uniform Federal Policy for Quality Assurance Project Plan* (AGEISS 2013), hereafter referred to as the project UFP-QAPP. The following Site ID will be used to identify the sediment sampling locations, where HB refers to Harrison Bayou and ABERA denotes samples collected as part of the BERA Addendum investigation: LHAAP-HB-ABERA.

Sample Number – A unique alpha-numeric identifier used to identify a specific sample. Sediment samples at LHAAP are identified according to their Site ID, followed by a number that refers to the location at Harrison Bayou, and SD to denote sediment. Therefore, Sample Number LHAAP-HB-ABERA-01SD refers to the sediment sample collected at location 01 at Harrison Bayou.

4.0 RESPONSIBILITY

AGEISS Inc. (AGEISS) staff and subcontractor personnel that are part of the integrated project team (collectively referred to as the AGEISS Team) shall adhere to these SOP guidelines during the conduct of field investigations. AGEISS' Project Manager is responsible for implementation and oversight to ensure compliance. AGEISS' Field Operations Leader will manage field activities in accordance with the SOP guidelines. A technical representative from CB&I (formerly Shaw Environmental & Infrastructure Group [Shaw]) will assist with identifying sediment sampling locations at LHAAP prior to initiating sampling activities.

AGEISS' Project Quality Control (QC) Manager shall verify that the procedures in this SOP are followed by the AGEISS Team. Only personnel with the appropriate qualifications, based on education, previous experience, or on-the-job-training combined with supervision by another qualified person, shall perform these procedures.

5.0 PROCEDURES

This section describes logistical aspects of the field investigation including right of entry and procedures for sample point identification and sediment sample collection. In addition, the procedures for recording water and weather conditions, sediment characterization, obtaining global positioning system (GPS) measurements, cleaning and decontamination of sampling equipment, waste handling, and documentation and recording of field activities are also discussed.

5.1 Right of Entry

AGEISS shall gain access to the property from the Government through execution of a Right of Entry letter and/or coordination with the Tulsa District USACE Project Manager and LHAAP Point of Contact (POC) regarding proposed dates of field work.

5.2 Sample Point Identification

The general locations of the eight sediment sampling points have been indicated on a map prepared by CB&I and are presented in the UFP-QAPP. Sediment sampling activities will be limited to Harrison Bayou. Prior to implementing sediment sampling activities at LHAAP, the AGEISS field team will locate the sample points in the field based on the sample location maps prepared by CB&I. CB&I will provide one person with knowledge of the site to assist with identifying the sediment sampling points. The field team will document the sample points using the procedures detailed in the SOP LHAAP-F-8, *Global Positioning System Measurements*. Once the sample point is identified, the field team will mark each sample point with a pin flag labeled with the Site ID. In cases where a sample point is inaccessible, the field team will locate the replacement sample point as close as possible to the original location and document the distance and direction from the original sample point in the field logbook.

5.3 Water and Weather Conditions

Prior to sample collection, the following visual observations of the water body and weather will be recorded on the Sediment Sampling Form (Attachment 1), as applicable:

- Water body name and size
- Water color
- Stream flow rate
- Air temperature
- Wind speed and direction

General observations of water and weather conditions may also include the following parameters, as applicable:

- Presence of oil or sheen on the water surface
- Debris noted on the water surface
- Water level (e.g., tide level, higher or lower than normal pool or stage level, etc.)
- Water state (e.g., for lakes, ponds, estuaries, etc.):
    - Calm
    - Light and variable
    - Small waves, not breaking
    - Scattered whitecaps
    - Numerous whitecaps
    - Moderate waves, many whitecaps
    - Large waves, whitecaps everywhere
- Cloud cover (e.g., clear, overcast, or variable)

- Precipitation (e.g., drizzle, rain, heavy rain, squally, or frozen precipitation)
- In addition to the information noted above, all of the data fields on the field form must be completed. In the event that a particular data field does not apply, a notation indicating this fact should be noted in the space provided (e.g., "NA" for not applicable).

5.4 Sediment Sampling

AGEISS will assume the lead on the required field work, with support from CB&I. The Field Operations Leader will support the sampling crew (two people), rotate in on sampling as needed, and conduct sample management.

Sediment samples will be collected from 0 to 0.5 feet below ground surface. Sampling should proceed from downstream to upstream locations so that disturbance from sampling does not affect sample quality. The physical location of the field personnel when collecting a sediment sample may dictate the equipment to be used. Wading is the preferred method for reaching a shallow water sampling location, particularly if the stream has a noticeable current. However, wading may disrupt bottom sediments causing biased results; therefore samples should be collected facing upstream. Sampling devices shall be selected for use based on the depth of water at the sample location. It is anticipated that a scoop or trowel will be used if there is little to no water, and a petite ponar sampler (clamshell-type device) if there is water in the drainage.

Scoops/Trowels – If the sampling location is dry or with only a little water, the sediment may be collected using a stainless steel scoop or trowel. If the location is shallow and wadeable, the sample may be collected by wading into the water body and while facing upstream (into the current), scooping the sample along the bottom of the water body in the upstream direction using a stainless steel scoop. Excess water may be removed/drained from the scoop. Because this may result in the loss of some fine-grained particle sized material, care should be taken to minimize the loss of the fine-grained material.

At locations that are too deep to wade, but less than 8 feet deep, a stainless steel scoop attached to a piece of conduit can be used from the banks, if the water body is narrow. Again, care should be taken to minimize the loss of the fine particle sizes.

Use the following procedure to collect sediment samples for lithologic description and chemical analysis:

1) Locate the sample point by pin flag. Using the portable GPS unit, confirm that the sample point GPS measurement matches the sample point coordinate data written on the pin flag.

2) If a thick, matted root zone, gravel, wood debris, etc. is present on the substrate, remove it before collecting the sediment sample. The depth measurement for the sample begins immediately beneath any removed materials.

3) Don a clean pair of new, disposable gloves each time a new sample is collected.

4) Sediment samples will be screened for hazardous constituents by the on-site Health and Safety Officer using a photoionization detector (PID).

5) Collect the sediment sample using a clean stainless steel scoop or trowel and place it directly in the appropriate sample container following project requirements identified in the project UFP-QAPP.

6) Take care to exclude as much air space as possible. Surficial water from the sediment sample may be added to eliminate air space.

7) Clean the exterior of the sample container and complete the sample label using waterproof black ink.

8) After being labeled, wrap the sample container according to laboratory specified procedures and store in a cooler with sufficient ice to maintain the temperature at 4 ± 2 degrees Celsius, pending sample packaging and shipment to the laboratory in a cooler.

9) Collect the required number and type of field QC samples to meet project requirements as identified in the project UFP-QAPP. Field QC sample types and collection procedures are defined in SOP LHAAP-F-6, *Field Quality Control Samples*.

10) Decontaminate sampling equipment between samples in accordance with the procedures specified in Section 5.8.

11) Complete the chain-of-custody (COC) form for each sample and keep it with the sample until received by the laboratory. Sample labeling, custody, sample packing, and shipping procedures are defined in SOP LHAAP-F-7, *Sample Handling, Labeling, Packaging, and Custody*.

Petite Ponar Sampler – The Ponar sampler is a clamshell-type scoop activated by a counter-lever system. The shell is opened, latched in place, and slowly lowered to the bottom. When tension is released on the lowering cable, the latch releases and the lifting action of the cable on the lever system closes the clamshell. The Petite Ponar sampler is a scaled-down version weighing less than 25 pounds. It can be attached to a hand line and lowered without a winch. It can be used on all sediment substrate types.

Ponars are relatively safe and easy to use, prevent escape of material with end plates, reduce shock waves, and have a combination of the advantages of other sampling devices. They penetrate deeper and seal better than spring-activated types (e.g., Ekman samplers). Penetration depths will usually not exceed several inches in sand. Greater penetration is possible in fine-grained material, up to the full depth of the sampler for soft sediments. Ponar samplers are not capable of collecting undisturbed samples. As a result, material in the first centimeter of sediment cannot be separated from the rest of the sample. Ponars can become buried in soft sediment. Method References include: ASTM E1391 and EPA/540/P-91/005, SOP 2016.

Use the following procedure when sampling sediments using a Petite Ponar sampling device:

1) Place plastic sheeting around the area where the sampler will be emptied to keep sampled material in place.

2) Determine the depth to the bottom using the weighted line or depth finder and then mark the sample's line at the distance representative of approximately 1 meter from the bottom with chalk.

3) Attach the line to the sampler and, if applicable, the messenger line. If the messenger has a separate line, make sure it is at least as long as the tag line. Do not place the messenger on the line at this time.

4) Carefully open and lock the sampler. From this point on, handle it only by the tag line and take care not to strike it on the release mechanism.

5) Attach the free end of the tag line to a secure holding place to keep from losing the sampler.

6) Being careful not to contact the sampler, slowly lower it into the water until the 1 meter-to-bottom mark is reached. Make sure that the rope/line does not become entangled.

7) Slow the descent further and continue until the bottom is contacted. Contact with the bottom will be evidenced when the descent stops and slack appears in the line.

8) Slack in the line should activate the closure mechanism. If using a messenger-type system, thread the messenger onto the tag or trip line and allow it to fall and trip the device.

9) Free the device from the bottom by pulling straight up on the tag line, and slowly raise it until it is about 1 foot from the surface while being careful not to allow the rope/line coils to entangle on anything.

10) Prepare and clear the sample receiving area, and then slowly raise the sampler out of the water.

11) Allow clear water to drain, and swing the sampler onto the pan in the receiving area once the clear liquids are drained. Do not allow the fine particles to also exit the sampler.

12) If a messenger was used, remove it from the line to keep from accidentally tripping the device when retrieving the sample. Carefully open and lock the sampler and allow the sample to fill the pan. Put the sampler aside for cleaning and decontamination.

13) Use a clean stainless steel spoon or trowel to place the sample into the sample container as described above.

5.5 Sediment Characterization

Sediment samples will be screened for hazardous constituents by the on-site Health and Safety Officer at the time of collection. After being cleared, the sediment samples will be described according to project specifications. This information will be documented on the Sediment Sampling Form (Attachment 1). The following parameters may be described as applicable:

- Sediment sample depth
- Water depth above sediment sample
- Munsell color
- Texture
- Composition
- Particle size
- Visual observations

The remainder of this section provides a brief description of these parameters, where appropriate:

- **Sediment Sample Depth** – Sample depth will be measured from the sediment/water interface to the depth of the collected sediment sample.
- **Munsell Color** – Munsell color charts will be used to provide an accurate and consistent description of sediment color. The hue, value, and chroma of the selected Munsell color should be noted on the field form along with the actual name of the selected color as noted in the Munsell book. For example, "10YR 5/4 - Dark Yellowish Brown."
- **Particle Size** – Estimated percentages of primary and secondary components (based on grain size) will be recorded for each sediment sample described. The percentage of silts and clays in a sample can be estimated in the field by marking a line on a clear jar and them marking one-third of the way up to that line on the jar with another line. Fill the jar to the top line with sediment, vigorously shake the jar, and set it aside to settle. After settling for 10 minutes, an estimate of the particle size distribution can be visually estimated by observing the sediment stratification in the jar. If the fines stop below the one-third (30 percent) line, then the silt/clay fraction is likely to be less than 30 percent.
- **Visual observations** – Presence of odors; organic material; benthic organisms; anthropogenic debris; and identifiable materials such as coal fines, metallic chips, oil and grease, etc.

The following terms may be useful in describing the sediment/substrate:

Sand	Particles 0.06-2.0 millimeters (mm) in diameter, possessing a gritty texture when rubbed between fingers. Loose materials (not cohesive) that often cannot be molded into shapes (non-plastic).
Silt	Particles 0.004-0.06 mm in diameter, generally fine material possessing a greasy or smooth, talc-like feel when rubbed between fingers. Non-plastic and not cohesive.
Clay	Particles less than 0.004 mm in diameter, which forms a dense, gummy surface that is difficult to penetrate with tools (hardpan). Clay is both plastic and cohesive.
Marl	Calcium carbonate, usually greyish-white, often containing fragments of mollusc shells.
Detritus	Dead, unconsolidated organic material including sticks, wood, leaves, and other partially decayed coarse plant material.
Peat	Partially decomposed plant materials characterized by an acidic pH; parts of plants such as Sphagnum moss sometimes visible.
Muck	Black, extremely fine, flocculant material composed of completely decomposed organic material (excluding sewage).
Sludge	Organic matter that is decidedly of human or animal origin.

In addition to the information noted above, all of the data fields on the field form must be completed. In the event that a particular data field does not apply, a notation indicating this fact should be noted in the space provided (e.g., “NA” for not applicable).

5.6 Global Positioning System Measurements

The location of each sediment sample will be identified by field personnel using a hand-held GPS unit during sampling activities. GPS coordinates will be recorded on the applicable field form. Procedures for obtaining and documenting GPS coordinates are identified in SOP LHAAP F-9, *Global Positioning System Measurements*. Note: If a sketch map of the location is also required, the map should be drawn in the field logbook.

5.7 Equipment List

The following is a list of equipment or items that may be needed to conduct sediment sampling activities:

- Field logbook
- Blank sediment sample forms
- Sample labels and COC forms
- Custody seals
- Black pens and felt tip markers
- Stainless steel spoons, scoops, or trowels
- Stainless steel bowls
- Sample containers
- Cooler with ice
- Bubble wrap
- Clear packing tape and dispenser
- Grain size distribution chart and Munsell color chart
- Equipment bucket
- Hand lens
- Trash bags
- Paper towels
- Decontamination equipment (water from an approved source, non-phosphate detergent, buckets, brushes, etc.)
- Copies of the site map

- Clip board
- Personal protective equipment (PPE)
- PID and calibration gas
- Folding table and chairs
- Plastic sheet
- Distilled water and squirt bottle

In addition to the equipment listed above, the following may also be needed when sampling sediments using clamshell-type devices:

- Petite Ponar sampling device
- Rope or line with graduations
- Weighted line with graduations to determine depth to bottom, or depth finder if available
- Separate line for messenger if applicable
- Carpenter’s chalk
- Plastic or metal shallow pan, to empty sampler into – decontaminated or dedicated

5.8 Equipment Cleaning and Decontamination

Prior to arrival at each sediment sampling point, equipment will be cleaned and stored in a manner that will prevent contamination prior to use (e.g., stainless steel spoons, scoops, or trowels; stainless steel mixing bowls; etc). Procedures identified in SOP LHAAP-F-8, *Field Equipment Cleaning and Decontamination*, shall be followed. Petite Ponar sampling devices shall be decontaminated on the inside and outside while open and closed to remove all particles. Dry and return the sampler to its “closed” position when completed.

Following completion of sampling activities, equipment will be thoroughly decontaminated or cleaned according to the procedures in SOP LHAAP-8. Decontamination minimizes potential cross contamination in the field that could introduce errors into sampling results. Cleaning minimizes the risk of transferring contaminants from a site upon completion of field activities.

5.9 Waste Handling

Waste materials will be properly managed by field personnel. The sediment sampling activities described in this SOP may generate a variety of wastes, including ordinary trash, PPE, cleanup materials (e.g., paper towels, plastic sheets, etc.), and decontamination water. Process knowledge, knowledge of site activities, and sediment analytical results will be used to help categorize investigation derived waste for proper disposal. Procedures and guidelines for waste handling are identified in the project’s Waste Management Plan for Investigation Derived Waste.

5.10 Documentation and Recordkeeping

Documentation of sediment sampling activities shall be in accordance with SOP LHAAP-1, *Field Documentation*. Data recorded in logbooks or on field forms provide information on the proper acquisition of data and are a permanent record of these activities. Documentation must be correct, complete, consistent, and adequate for scientific interpretation and reconstruction of field activities.

To safeguard field documentation, the logbooks, field forms, and electronic data shall be maintained and archived following the guidelines identified in SOP LHAAP-1, *Field Documentation*. Field documentation and training records shall be archived in the project’s Technical Document Control Center (T-DCC).

6.0 POTENTIAL HAZARDS

There are potential hazards associated with some types of sediment sampling equipment. For example, Ponar sampling devices may be heavy when filled with sediment and water and difficult to lift and place in a boat. In addition, personal flotation devices shall be used if sampling is conducted from a boat. Potential hazards associated with sediment sampling field activities at LHAAP may include but are not limited to the following:

- Contact with contaminated surface water/sediment
- Access issues (e.g., steep stream banks, thick vegetation, etc.)
- Cuts, pinches, lifting injuries from sampling equipment
- Drowning
- Severe weather accompanied by lightning or flash flooding

All work conducted under this SOP will be conducted in accordance with the project Health and Safety Plan, Accident Prevention Plan, and Activity Hazard Analysis.

7.0 TRAINING

The Program QC Manager (or his/her designee such as the project's Field Operations Leader) will conduct sediment sampling and characterization training as needed. Training will include a step-by-step walk through of this SOP and associated project-specific field forms and equipment to ensure that personnel fully understand how to conduct sediment sampling and characterization. Upon completion of the training session, records documenting the scope and identifying the date, instructor, and attendees shall be archived in the program/project's T-DCC.

8.0 REFERENCES

AGEISS' field operation SOPs and the following references were reviewed prior to writing this SOP:

AGEISS Inc. 2013. Baseline Ecological Risk Assessment Addendum, Longhorn Army Ammunition Plant, Karnack, Texas, Uniform Federal Policy for Quality Assurance Project Plan.

AGEISS Inc. and CB&I. 2013. Data Gap Memorandum for Explosives in Sediment and Surface Water at the Longhorn Army Ammunition Plant, Karnack, TX.

American Society of Testing and Materials (ASTM) E1391 – 03(2008). Standard Guide for Collection, Storage, Characterization, and Manipulation of Sediments for Toxicological Testing and for Selection of Samplers Used to Collect Benthic Invertebrates. U.S. Army Corps of Engineers. 2001, February 1. Engineer Manual 200-1-3. Requirements for the Preparation of Sampling and Analysis Plans.

U.S. Environmental Protection Agency, Region 4. 2010, September 8. Science and Ecosystem Support Division (SESD) Operating Procedure for Sediment Sampling. SESDPROC-200-R2.

U.S. Environmental Protection Agency. 1991. Compendium of ERT Surface Water and Sediment Sampling Procedures: Sediment Sampling. EPA/540/P-91/005, SOP 2016.

9.0 ATTACHMENTS

This SOP contains the following attachment:

Attachment 1 Sediment Sampling Form

Attachment 1. Sediment Sampling Form

SEDIMENT SAMPLING FORM

Site ID: ______________________ **Project Name:** ______________________

Date: ______________ **Start Time:** ______________ **Finish Time:** ______________

Sampling Personnel: ______________________________________

UTM (Northing): ______________________ **UTM (Easting):** ______________________

UTM Zone/Map Datum: __________ **WAAS (Y/N):** _____ **GPS Accuracy Value (w/unit):** __________

Water Body Name: ______________________________ **Stream Mile Location:** __________

Weather and Water Conditions

Air Temperature (°C): __________ **Water Color:** ______________________

Wind Direction: ______________ **Oil/Sheen on Water Surface:** ______________________

Wind Speed: ______________ **Debris in Water:** ______________________

Stream Flow Rate (ft/sec): __________ **Water Body Size:** ______________________

Water Conditions: ______________________________________

Weather Conditions: ______________________________________

Analytical Sample Information

Sample Time: ______________ **Sample Collection Device:** ______________________

Water Depth above Sediment Sample (ft): __________ **Sediment Sample Depth (ft):** __________

Sample Number: ______________________________________

Preservation/Remarks: ______________________________________

Sediment/Substrate Description

Munsell Color: ______________________________________

Texture/Composition/Particle Size: ______________________________________

____

____

Visual Observations (e.g., odor, organic material, debris, etc.): ______________________

____

____

°C	degrees Celsius	ft/sec	feet per second	WAAS	Wide Area Augmentation System
ft	feet	UTM	Universal Transverse Mercator		

TITLE **SURFACE WATER SAMPLING**	NUMBER REVISION	LHAAP-F-5 0 (08/21/2013)
CONTRACT **W912BV-10-D-2010** TASK ORDER **04**	PAGE	1 of 8

1.0 PURPOSE

This document establishes procedures for surface water sampling in support of Task Order 0004, under the Tulsa U.S. Army Corps of Engineers (USACE) Contract W912BV-10-D-2010. This guidance is provided to ensure that field activities are conducted in a technically sound and consistent manner and that the resulting field data are technically adequate, accurate, and complete. Procedures described in this Standard Operating Procedure (SOP) are consistent with USACE guidelines presented in Engineer Manual (EM) 1110-1-4000.

2.0 SCOPE

This SOP applies to surface water sampling conducted during field investigations at Longhorn Army Ammunition Plant (LHAAP), Karnack, Texas, in support of an installation-wide Baseline Ecological Risk Assessment Addendum investigation (BERA Addendum). Additional surface water samples are being collected to address data gaps resulting from the removal of unusable analytical data from the primary dataset. Five surface water samples will be collected at Harrison Bayou, one of the four watersheds at LHAAP identified as aquatic ecological exposure units.

3.0 DEFINITIONS

Site Identification (Site ID) – A unique identifier used to identify a specific field location of interest (e.g., a sampling site). Surface water sample locations are presented in the *Baseline Ecological Risk Assessment Addendum, Longhorn Army Ammunition Plant, Karnack, Texas, Uniform Federal Policy for Quality Assurance Project Plan* (AGEISS 2013), hereafter referred to as the project UFP-QAPP. The following Site ID will be used to identify the surface water sampling locations, where HB refers to Harrison Bayou and ABERA denotes samples collected as part of the BERA Addendum investigation: LHAAP-HB-ABERA.

Sample Number – A unique alpha-numeric identifier used to identify a specific sample. Surface water samples at LHAAP are identified according to their Site ID, followed by a number that refers to the location at Harrison Bayou, and SW to denote surface water. Therefore, Sample Number LHAAP-HB-ABERA-01SW refers to the surface water sample collected at location 01 at Harrison Bayou.

Surface Water Bodies – Classified into two primary types: flowing and standing. Flowing bodies include industrial effluent, municipal wastewater, rivers, sewers, leachate seeps, streams, etc. Standing bodies include lagoons, ponds, nonaqueous (e.g., surface impoundments), lakes, etc.

4.0 RESPONSIBILITY

AGEISS Inc. (AGEISS) staff and subcontractor personnel that are part of the integrated project team (collectively referred to as the AGEISS Team) shall adhere to these SOP guidelines during the conduct of field investigations. AGEISS' Project Manager is responsible for implementation and oversight to ensure compliance. AGEISS' Field Operations Leader will manage field activities in accordance with the SOP guidelines. A technical representative from CB&I (formerly Shaw Environmental & Infrastructure Group [Shaw]) will assist with identifying surface water sampling locations at LHAAP prior to initiating sampling activities.

AGEISS' Project Quality Control (QC) Manager shall verify that the procedures in this SOP are followed by the AGEISS Team. Only personnel with the appropriate qualifications, based on education, previous experience, or on-the-job-training combined with supervision by another qualified person, shall perform these procedures.

5.0 PROCEDURES

This section describes logistical aspects of the field investigation including right of entry and procedures for sample point identification and surface water sample collection. In addition, the procedures for recording water and weather conditions, obtaining global positioning system (GPS) measurements, cleaning and decontamination of sampling equipment, waste handling, and documentation and recording of field activities are also discussed.

5.1 Right of Entry

AGEISS shall gain access to the property from the Government through execution of a Right of Entry letter and/or coordination with the Tulsa District USACE Project Manager and LHAAP Point of Contact (POC) regarding proposed dates of field work.

5.2 Sample Point Identification

The general locations of the five surface water sampling points have been indicated on a map prepared by CB&I and are presented in the UFP-QAPP. Surface water sampling activities will be limited to Harrison Bayou. The five surface water samples will be collected from a subset of eight proposed sediment sample locations, assuming water is present. Prior to implementing surface water sampling activities at LHAAP, the AGEISS field team will locate the sample points in the field based on the sample location maps prepared by CB&I. CB&I will provide one person with knowledge of the site to assist with identifying the sediment and surface water sampling points. The field team will document the sample points using the procedures detailed in the SOP LHAAP-F-9, *Global Positioning System Measurements*.

5.3 Surface Water Sampling

AGEISS will assume the lead on the required field work, with support from CB&I. The Field Operations Leader will support the sampling crew (two people), rotate in on sampling as needed, and conduct sample management.

Regardless of the method used, precautions should be taken to ensure that the sample collected is representative of the water body. Surface water samples will be collected from areas with flow or recent runoff. Sampling from still or standing water, or water pooled in small areas of the drainage, will be avoided when possible. Care should be taken not to disturb bottom sediment, thus biasing the surface water sample. Sampling should proceed from downstream to upstream locations so that disturbance from sampling does not affect sample quality. Additionally, when collecting surface water and sediment samples at the same location, the surface water sample must be collected before the sediment sample.

Sample the downstream areas first and move in an upstream direction when collecting surface water samples from multiple locations along the same water body. If sediments have been disturbed, wait until after the sediment plume has subsided. When the site has recovered, conduct sampling activities in the following order:

- Record GPS coordinates and visual observations
- Collect chemical analytical samples
- Measure water quality parameters

The physical location of the field personnel when collecting a sample may dictate the equipment to be used. For these shallow depth surface water samples, direct dipping of the sample container into the stream is preferred. Collecting samples in this manner is possible when sampling from accessible locations, such as stream banks, or by wading or from low platforms, such as small boats or piers. Wading or streamside sampling from banks, however, may cause the re-suspension of bottom deposits and bias the sample (as well as potential cross contamination from personnel's shoes/clothing). Wading is acceptable if the stream has a noticeable current, and the samples are collected while facing upstream. If the stream is too deep to wade, or if the sample must be collected from more than one water depth, or if the sample must be collected from an elevated platform (bridge, pier, etc.), supplemental sampling equipment must be used.

Surface water samples will typically be collected either by directly filling the container from the water body being sampled or by decanting the water from a collection device such as a stainless steel scoop or other device. Disposable or non-disposable sampling equipment may be used to collect samples for water quality or chemical analysis. However, when collecting samples for chemical analysis stainless steel, Teflon coated, or disposable equipment shall be used. During sample collection, if transferring the sample from a collection device, ensure that the device does not come in contact with the sample containers.

5.3.1 Sampling with a Sample Container

The following procedure should be used when sampling surface water using a sample container recommended sampling procedure follows:

1) Don a pair of clean gloves.

2) Spread new plastic sheeting on the ground at each sampling location to keep sampling equipment clean, decontaminated and to prevent cross-contamination. If access to a sampling location is restricted, locate a boat, barge, or other stable working platform adjacent to the area to be sampled.

3) Submerge the sample container with the cap in place with minimal surface disturbance so that the open end is pointing upstream.

4) Allow the device to fill slowly and continuously using the cap to regulate the speed of water entering the bottle.

5) Retrieve the sample container from the surface water with minimal disturbance.

6) Verify that a PTFE liner is present in the cap. Secure the cap tightly.

7) Clean the exterior of the sample container and complete the sample label using waterproof black ink.

8) After being labeled, wrap the sample container according to laboratory specified procedures and store in a cooler with sufficient ice to maintain the temperature at 4 ± 2 degrees Celsius, pending sample packaging and shipment to the laboratory in a cooler.

9) Collect the required number and type of field QC samples to meet project requirements as identified in the project UFP-QAPP. Field QC sample types and collection procedures are defined in SOP LHAAP-F-6, *Field Quality Control Samples*.

5.3.2 Scoops

Stainless steel scoops provide a means of collecting surface water samples from water bodies that are too deep to access by wading. They have a limited reach of about 8 feet and if samples from distances too far to access using this method are needed, a mobile platform, such as a boat may be required. Stainless steel scoops are useful for reaching out into a water body to collect a surface sample. The scoop may be used directly to collect and transfer a surface water sample to the sample container, or it may be attached to an extension to access the selected sampling location.

5.3.3 Dippers and Pond Samplers

The pond sampler consists of an adjustable clamp attached to the end of a two- or three-piece telescoping aluminum or fiberglass pole that serves as the handle. The clamp is used to secure a sampling beaker. Dippers and pond samplers perform similar functions, except that the length of the dipper is smaller. With the pond sampler, samples can be obtained at distances as far as 10 feet from the edge of the stream bank.

Use the following procedure when sampling surface water using a scoop, dipper or pond sampler:

1) Assemble the dipper or pond sampler. If appropriate, make sure that the sample container and the bolts and nuts that secure the clamp to the pole are tightened properly.

2) Collect samples by slowly submerging the precleaned scoop, dipper or pond sampler with minimal surface disturbance. Make sure that the open end is pointed upstream.

3) Retrieve the scoop, dipper or pond sampler from the surface water with minimal disturbance.

4) Remove the cap from the sample bottle and slightly tilt the mouth of the bottle below the edge of the scoop/dipper/sampler.

5) Empty the scoop/dipper/sampler slowly, allowing the sample stream to flow gently down the inside wall of the sample bottle with minimal entry turbulence.

6) Continue delivery of the sample until the sample bottle is filled.

7) Check that a PTFE liner is present in the cap; tightly secure the cap.

8) Follow the surface water sample labeling and handling steps 7 through 9 above in Section 5.3.1.

9) Decontaminate sampling equipment between samples in accordance with the procedures specified in Section 5.7.

10) Complete the chain-of-custody (COC) form for each sample and keep it with the sample until received by the laboratory. Sample labeling, custody, sample packing, and shipping procedures are defined in SOP LHAAP-F-7, *Sample Handling, Labeling, Packaging, and Custody*.

5.4 Water Quality Characterization

Water quality parameters will be measured and visual observations recorded according to project specifications. This information will be documented on the Surface Water Sampling Form (Attachment 1). The following parameters may be measured or described, as applicable:

- ♦ Field Measurements (see guidance in SOP LHAAP-F-2, *Field Equipment Calibration and Maintenance*)
  - Specific conductance
  - pH
  - Dissolved oxygen
  - Salinity
  - Turbidity
  - Water temperature
- ♦ Visual Observations
  - Water body size
  - Water color

- Stream flow rate
- Air temperature
- Wind speed and direction

General observations of water and weather conditions may also include the following parameters, as applicable:

- Presence of oil or sheen on the water surface
- Debris noted on the water surface
- Water level (e.g., higher or lower than normal pool or stage level, etc.)
- Cloud cover (e.g., clear, overcast, or variable)
- Precipitation (e.g., drizzle, rain, heavy rain)

In addition to the information noted above, all of the data fields on the field form must be completed. In the event that a particular data field does not apply, a notation indicating this fact should be noted in the space provided (e.g., "NA" for not applicable).

5.5 Global Positioning System Measurements

The location of each surface water sample will be identified by field personnel using a hand-held GPS unit during sampling activities. GPS coordinates will be recorded on the applicable field form. Procedures for obtaining and documenting GPS coordinates are identified in SOP LHAAP-F-9, *Global Positioning System Measurements*. Note: If a sketch map of the location is also required, the map will be drawn in the field log book.

5.6 Equipment List

The following is a list of equipment or items that may be needed to conduct surface water sampling activities:

- Field logbook
- Blank Surface Water Sampling forms
- Sample labels and COC forms
- Custody seals
- Black pens and felt tip markers
- Stainless steel scoops, dippers, and pond samplers
- Sample containers
- Cooler with ice
- Bubble wrap
- Clear packing tape and dispenser
- Equipment bucket
- Trash bags
- Paper towels
- Decontamination equipment (water from an approved source, nonphosphate detergent, buckets, brushes, etc.)
- Copies of the site map
- Clip board
- Personal protective equipment (PPE)
- Plastic sheets
- Distilled water and squirt bottle

5.7 Equipment Cleaning and Decontamination

Prior to arrival at each surface water sampling point, sampling equipment will be cleaned and stored in a manner that will prevent contamination prior to use (e.g., stainless steel scoops and dippers, etc.). Following completion of sampling activities, equipment will be thoroughly decontaminated or cleaned according to the procedures in SOP LHAAP-F-8, *Field Equipment Cleaning and Decontamination*. Decontamination minimizes potential cross contamination in the field that could introduce errors into sampling results. Cleaning minimizes the risk of transferring contaminants from a site upon completion of field activities.

5.8 Waste Handling

Waste materials will be properly managed by field personnel. The surface water sampling activities described in this SOP may generate a variety of wastes, including ordinary trash, PPE, cleanup materials (e.g., paper towels, plastic sheets, etc.), and decontamination water. Process knowledge and knowledge of site activities will be used to help categorize investigation derived waste for proper disposal. Procedures and guidelines for waste handling are identified in the project's Waste Management Plan for Investigation Derived Waste.

5.9 Documentation and Recordkeeping

Documentation of surface water sampling activities shall be in accordance with SOP LHAAP-F-1, *Field Documentation*. Data recorded in logbooks or on field forms provide information on the proper acquisition of data and are a permanent record of these activities. Documentation must be correct, complete, consistent, and adequate for scientific interpretation and reconstruction of field activities.

To safeguard field documentation, the logbooks, field forms, and electronic data shall be maintained and archived following the guidelines identified in SOP LHAAP-F-1, *Field Documentation*. Field documentation and training/audit records shall be archived in the project's Technical Document Control Center (T-DCC).

6.0 POTENTIAL HAZARDS

Potential hazards associated with surface water sampling field activities at LHAAP may include but are not limited to the following:

- Contact with contaminated surface water/sediment
- Access issues (e.g., steep stream banks, thick vegetation, etc.)
- Cuts, pinches, lifting injuries from sampling equipment
- Drowning
- Severe weather such as lightning strikes or flash flooding

All work conducted under this SOP will be conducted in accordance with the project Health and Safety Plan, Accident Prevention Plan, and Activity Hazard Analysis.

7.0 TRAINING

The Program QA Manager (or his/her designee such as a project's Field Team Leader) will conduct surface water sampling and characterization training as needed. Training will include a step-by-step walk through of this SOP and associated project-specific field forms and equipment to ensure that personnel fully understand how to conduct surface water sampling and characterization. Upon completion of the training session, records documenting the scope and identifying the date, instructor, and attendees shall be archived in the program/project's T-DCC.

8.0 REFERENCES

AGEISS' field operation SOPs and the following references were reviewed prior to writing this SOP:

AGEISS Inc. 2013. Baseline Ecological Risk Assessment Addendum, Longhorn Army Ammunition Plant, Karnack, Texas, Uniform Federal Policy for Quality Assurance Project Plan.

AGEISS Inc. and CB&I. 2013. Data Gap Memorandum for Explosives in Sediment and Surface Water at the Longhorn Army Ammunition Plant, Karnack, TX.

U.S. Army Corps of Engineers. 2001, February 1. Engineer Manual 200-1-3. Requirements for the Preparation of Sampling and Analysis Plans.

U.S. Environmental Protection Agency. 1991. Compendium of ERT Surface Water and Sediment Sampling Procedures: Sediment Sampling. EPA/540/P-91/005, SOP 2016.

U.S. Environmental Protection Agency, Region 4. 2007, November 1. Science and Ecosystem Support Division (SESD) Operating Procedure for Surface Water Sampling. SESDPROC-201-R1.

9.0 ATTACHMENTS

This SOP contains the following attachment:

Attachment 1 Surface Water Sampling Form

Attachment 1. Surface Water Sampling Form

SURFACE WATER SAMPLING FORM

Site ID: ______________________ **Project Name:** ______________________

Date: ______________ **Start Time:** ______________ **Finish Time:** ______________

Sampling Personnel: ______________________________________

UTM (Northing): ______________________ **UTM (Easting):** ______________________

UTM Zone/Map Datum: __________ **WAAS (Y/N):** _____ **GPS Accuracy Value (w/unit):** __________

Water Body Name: ______________________________ **Stream Mile Location:** __________

<u>Weather and Water Conditions</u>

Air Temperature (°C): ______________ **Water Color:** ______________________

Wind Direction: ______________ **Oil/Sheen on Water Surface:** ______________________

Wind Speed: ______________ **Debris in Water:** ______________________

Stream Flow Rate (ft/sec): __________ **Water Body Size/Depth:** ______________________

Water Conditions: ______________________________________

Weather Conditions: ______________________________________

<u>Analytical Sample Information</u>

Sample Time: ______________ **Sample Collection Device:** ______________________

Sample Depth (ft below water surface): ______________ **Distance from Bank/Shore:** ______________

Sample Number: ______________________________________

Preservation/Remarks: ______________________________________

____

<u>Field Measurements</u>

Specific Conductivity (µS/cm): ______________ **pH:** __________ **Turbidity (NTU):** ______________

DO: ______________________ **Water Temperature (ºC):** ______________________

Visual Observations (e.g., odor, organic material, debris, etc.): ______________________

____

____

°C	degrees Celsius	ft/sec	feet per second	uS/cm	microsiemens per centimeter
DO	Dissolved oxygen	NA	not applicable	UTM	Universal Transverse Mercator
ft	feet	NTU	Nephelometric turbidity units	WAAS	Wide Area Augmentation System

TITLE **FIELD QUALITY CONTROL SAMPLES**	NUMBER LHAAP-F-6 REVISION 0 (03/15/13)
CONTRACT **W912BV-10-D-2010** TASK ORDER **04**	PAGE 1 of 5

1.0 PURPOSE

This document establishes procedures for field quality control (QC) sample collection in support of Task Order 0004, under the Tulsa U.S. Army Corps of Engineers (USACE) Contract W912BV-10-D-2010. This guidance is provided to ensure that field activities are conducted in a technically sound and consistent manner and that the resulting field data are technically adequate, accurate, and complete. Procedures described in this Standard Operating Procedure (SOP) are consistent with USACE guidelines presented in Engineer Manual (EM) 1110-1-4000.

2.0 SCOPE

This SOP applies to the collection of field QC samples during field investigations at Longhorn Army Ammunition Plant (LHAAP), Karnack, Texas, in support of an installation-wide Baseline Ecological Risk Assessment (BERA) Addendum. Additional soil, sediment, and surface water samples are being collected to address data gaps resulting from the removal of unusable analytical data from the primary dataset.

3.0 DEFINITIONS

Accuracy – A measure of the overall agreement of a measurement to a known value; includes a combination of random error (precision) and systematic error (bias) components of both sampling and analytical operations.

Bias – The systematic or persistent distortion of a measurement process that causes errors in one direction.

Blank – A sample subjected to the usual analytical or measurement process to establish a zero baseline or background value. It is sometimes used to adjust or correct routine analytical results. A blank sample is intended to contain none of the analytes of interest. A blank is used to detect contamination during sample handling, preparation, and/or analysis.

Duplicate – A collocated or homogenized sample subjected to the same preparation and analytical scheme as the primary sample. Duplicates are used to assess precision of a given analysis.

Matrix Spike/Matrix Spike Duplicate (MS/MSD) – A collocated or homogenized replicate which is clearly identified as associated with its primary environmental sample and is used to verify the applicability and effectiveness of the analytical procedures in the project matrix.

Precision – The measure of agreement among repeated measurements of the same property under identical or substantially similar conditions; calculated as either the range or as the standard deviation.

Spike – A substance that is added to an MS/MSD environmental sample to increase the concentration of the target analyte by a known amount; it is used to assess measurement accuracy (spike recovery). Spike duplicates are used to assess measurement precision.

4.0 RESPONSIBILITY

AGEISS Inc. (AGEISS) staff and subcontractor personnel that are part of the integrated project team (collectively referred to as the AGEISS Team) shall adhere to these SOP guidelines during the conduct of field investigations. AGEISS' Project Manager is responsible for implementation and oversight to ensure compliance. AGEISS' Field Operations Leader will manage field activities in accordance with the SOP guidelines.

AGEISS' Project QC Manager shall verify that the procedures in this SOP are followed by the AGEISS Team. Only personnel with the appropriate qualifications, based on education, previous experience, or on-the-job-training combined with supervision by another qualified person, shall perform these procedures.

5.0 PROCEDURES

The primary functions of a sampling and analysis program are to obtain accurate, representative environmental samples and to provide defensive analytical data. The quality of field data is assessed through regular collection and analysis of QC samples. This section identifies the type of field QC samples that are required, explains the purpose of each sample type, and provides guidelines for sample collection.

5.1 Field QC Sample Types

The following field QC sample types are used to assess potential errors that can be introduced during sample collection, preparation, storage, transport, and analysis.

- Equipment rinsate blank
- Field duplicate
- MS/MSD
- Temperature blank

5.1.1 Equipment Rinsate Blank

Equipment rinsate blanks will be prepared in the field to evaluate whether decontamination procedures have been sufficient. They will be prepared by pouring or pumping the water used for the final decontamination rinse [i.e., analyte-free (deionized) water or distilled water] through a cleaned reusable or unused disposable sampling device and then transferring the water to the appropriate sample containers. Equipment rinsate blanks shall be handled, packaged, shipped, and analyzed in the same manner as the environmental samples.

The frequency for equipment rinsate blank collection is 5 percent (i.e., one equipment rinsate blank for every 20 environmental samples collected). Equipment rinsate blanks shall be analyzed for all target analytes.

Note: If distilled water is used for field equipment decontamination, then distilled water will be used to prepare the equipment rinsate blank.

5.1.2 Field Duplicate

Field duplicate or split samples are independent samples collected in such a manner that they are equally representative of the parameters of interest at a given point in space and time. They are collected by initially gathering twice as much volume as is normally needed. The sample material is then apportioned, after mixing, if appropriate, into two sets of containers. Both sets of containers are submitted for analyses with one set designated as the "primary" sample and the other as the "field duplicate." Field duplicate samples will be handled, preserved, packaged, shipped, and analyzed in the same manner as the associated environmental samples.

The number of field duplicate samples will be equal to 5 percent of the total number of environmental samples collected (i.e., one field duplicate sample for every 20 environmental samples collected). The field duplicate sample shall be analyzed for the same target analytes as the associated primary environmental sample. Sample locations where field duplicate samples will be collected will be determined randomly in the field.

5.1.3 Matrix Spike and Matrix Spike Duplicate

Spike samples are used to validate the accuracy of the analytical technique. A known concentration of a substance of interest (spiking compound) is added to a sample in the laboratory prior to analysis. The laboratory performs analyses on an MS and MSD sample as specified on sample labels and chain-of-custody forms. In addition to the regular sample volume collected at a site, where MS/MSD samples are to be collected, one complete set of sample containers is also required for the MS sample, and a third set is required for the MSD samples. MS/MSD samples shall be handled, preserved, packaged, and shipped in the same manner as the associated environmental sample.

The number of MS and MSD samples collected will each equal 5 percent of the total number of environmental samples (i.e., one set of MS and one set of MSD samples for every 20 environmental samples collected). The sample sites for the MS/MSD samples will be randomly selected in the field. The MS and MSD samples will be analyzed for the same target analytes as the associated primary environmental sample.

5.1.4 Temperature Blank

Each sample cooler that is shipped to the laboratory will contain a temperature blank. A temperature blank is a container (e.g., 40 milliliter) of water packaged along with field samples in a shipping cooler that will represent the temperature of the incoming cooler upon receipt at the laboratory. Use of a temperature blank within a shipping container enables the receiving laboratory to assess the temperature of the shipment without disturbing any project field samples.

5.2 Sample Handling, Packing, and Custody

Each sample for chemical analysis will be placed in the appropriate container following project requirements identified in the *Baseline Ecological Risk Assessment Addendum, Longhorn Army Ammunition Plant, Karnack, Texas, Uniform Federal Policy for Quality Assurance Project Plan* (AGEISS 2013). The exterior of the sample containers will then be cleaned and a water resistant adhesive label will be attached to the container. Labels will be completed using waterproof black ink.

After being labeled, sample containers will be wrapped in bubble wrap and stored in a cooler, pending sample packaging and shipment to the laboratory. Samples for chemical analysis will be stored at 4 ± 2 degrees Celsius.

Chain-of-custody (COC) forms will be completed by field personnel for each sample and kept with the sample until received by the laboratory. Sample labeling, custody, sample packing, and shipping procedures are defined in SOP LHAAP-F-7, *Sample Handling, Labeling, Packaging, and Custody*.

5.3 Equipment List

The following is a list of equipment or items that may be needed to collect field QC samples:

- ♦ Field logbook
- ♦ Field sampling forms
- ♦ Sample labels and COC forms
- ♦ Custody seals
- ♦ Indelible black pens and felt tip markers
- ♦ Distilled water
- ♦ Equipment for sample collection as identified in SOPs LHAAP-F-3, LHAAP-F-4 and LHAAP-F-5
- ♦ Sample containers
- ♦ Cooler with ice
- ♦ Bubble wrap

- Clear packing tape and dispenser
- Equipment bucket
- Trash bags
- Paper towels
- Decontamination equipment (water from an approved source, distilled water, buckets, brushes, etc.)
- Copies of the site map
- Clipboard
- Personal protective equipment (PPE) and air monitoring equipment
- Plastic sheet

5.4 Equipment Cleaning and Decontamination

Equipment will be thoroughly decontaminated or cleaned according to the procedures in SOP LHAAP-F-8, *Field Equipment Cleaning and Decontamination*. Decontamination minimizes potential cross contamination in the field that could introduce errors into sampling results. Cleaning minimizes the risk of transferring contaminants from a site upon completion of field activities.

5.5 Waste Handling

Waste materials must be properly managed by field personnel. The sampling activities described in this SOP may generate a variety of wastes, including ordinary trash, PPE, cleanup materials (e.g., paper towels, plastic sheets, etc.), and decontamination water. Process knowledge and knowledge of site activities will be used to help categorize investigation derived waste for proper disposal. Procedures and guidelines for waste handling are identified in the project's Waste Management Plan for Investigation Derived Waste.

5.6 Documentation and Recordkeeping

Documentation of field QC sampling activities shall be in strict accordance with SOP LHAAP-F-1, *Field Documentation*. Data recorded in logbooks or on field forms provide information on the proper acquisition of data and are a permanent record of sampling activities. Documentation must be correct, complete, consistent, and adequate for scientific interpretation and reconstruction of field activities.

To safeguard field documentation, the logbooks, field forms, and electronic data shall be maintained and archived following the guidelines identified in SOP LHAAP-F-1, *Field Documentation*. Field documentation and training records shall be archived in the project's Technical Document Control Center (T-DCC).

6.0 TRAINING

The Project QC Manager or Field Operations Leader will conduct field QC sample training as needed. Training will include a step-by-step walk through of this SOP to ensure that personnel fully understand how to collect or use field QC samples. Upon completion of the training session, records documenting the scope and identifying the date, instructor, and attendees shall be archived in the program/project's T-DCC.

7.0 REFERENCES

AGEISS' field operation SOPs and the following references were reviewed prior to writing this SOP:

AGEISS Inc. 2013. Baseline Ecological Risk Assessment Addendum, Longhorn Army Ammunition Plant, Karnack, Texas, Uniform Federal Policy for Quality Assurance Project Plan.

AGEISS Inc. and CB&I. 2013. Data Gap Memorandum for Explosives in Sediment and Surface Water at the Longhorn Army Ammunition Plant, Karnack, TX.

AGEISS Inc. and CB&I. 2013. Data Gap Memorandum for Explosives in Soil at the Longhorn Army Ammunition Plant, Karnack, TX.

U.S. Army Corps of Engineers. 2001, February 1. Engineer Manual 200-1-3. Requirements for the Preparation of Sampling and Analysis Plans.

U.S. Environmental Protection Agency, Region 4. 2010, October 15. Science and Ecosystem Support Division (SESD) Operating Procedure for Field Sampling Quality Control. SESDPROC-011-R3.

TITLE	SAMPLE HANDLING, LABELING, PACKAGING, AND CUSTODY	NUMBER LHAAP-F-7 REVISION 0 (03/15/13)
CONTRACT TASK ORDER	W912BV-10-D-2010 04	PAGE 1 of 18

1.0 PURPOSE

This document establishes procedures for sample handling, labeling, packaging, and custody in support of Task Order 0004, under the Tulsa U.S. Army Corps of Engineers (USACE) Contract W912BV-10-D-2010. This guidance is provided to ensure that field activities are conducted in a technically sound and consistent manner and that the resulting field data are technically adequate, accurate, and complete. Procedures described in this Standard Operating Procedure (SOP) are consistent with USACE guidelines presented in Engineer Manual (EM) 1110-1-4000.

2.0 SCOPE

This SOP applies to sample handling, labeling, packaging, and custody conducted during field investigations at Longhorn Army Ammunition Plant (LHAAP), Karnack, Texas, in support of an installation-wide Baseline Ecological Risk Assessment Addendum investigation (BERA Addendum). Additional soil, sediment, and surface water samples are being collected to address data gaps resulting from the removal of unusable analytical data from the primary dataset. A total of 198 replacement soil samples will be collected at three terrestrial exposure units or Sub-Areas that were delineated at LHAAP based on common historical uses and similar ecological habitat. Attachment 4 identifies the replacement soil samples to be collected in support of the BERA.

Eight sediment samples will be collected at Harrison Bayou, one of the four watersheds at LHAAP identified as aquatic ecological exposure units. A surface water sample will be collected at five of the sediment sampling locations. Soil and sediment sample locations are presented in the *Baseline Ecological Risk Assessment Addendum, Longhorn Army Ammunition Plant, Karnack, Texas, Uniform Federal Policy for Quality Assurance Project Plan* (AGEISS 2013), hereafter referred to as the project UFP-QAPP.

3.0 DEFINITIONS

Site Identification (Site ID) – A unique identifier used to identify a specific field location of interest (e.g., a sampling site). Soil sample points at LHAAP are identified according to their location in one of the following terrestrial units or sub-areas, with a number indicating the site within that subarea: the Low Impact Sub-Area (LISA), Industrial Sub-Area (ISA), and Waste Sub-Area (WSA). Therefore Site ID LHAAP-LISA-11 refers to site 11 within the LISA subarea.

Sediment and surface water sample points will be identified according to their location in Harrison Bayou, one of four watersheds at LHAAP identified as aquatic exposure units. The following Site ID will be used to identify the sediment and surface water sampling locations, where HB refers to Harrison Bayou and ABERA denotes samples collected as part of the BERA Addendum investigation: LHAAP-HB-ABERA.

Sample Number – A unique alpha-numeric identifier used to identify a specific sample. For the soil samples, the sample numbers established for the 105 soil sample points during previous environmental investigations will be retained for this investigation. To distinguish the replacement soil sample data collected during this investigation from the original sample data, an “R” will be appended to the existing sample number. The R will be followed by SS to indicate a replacement surface sample or SB to indicate a replacement subsurface sample.

Sediment and surface water samples will be identified according to their Site ID, followed by a number that refers to the location at Harrison Bayou, and SD to denote a sediment sample or SW to denote a surface water sample. Therefore, Sample Number LHAAP-HB-ABERA-01SD refers to the sediment sample collected at location 01 at Harrison Bayou, and Sample Number LHAAP-HB-ABERA-01SW refers to the surface water sample collected at the same location.

4.0 RESPONSIBILITY

AGEISS Inc. (AGEISS) staff and subcontractor personnel that are part of the integrated project team (collectively referred to as the AGEISS Team) shall adhere to these SOP guidelines during the conduct of field investigations. AGEISS' Project Manager is responsible for implementation and oversight to ensure compliance. AGEISS' Field Operations Leader will manage field activities in accordance with the SOP guidelines. A technical representative from CB&I (formerly Shaw Environmental & Infrastructure Group [Shaw]) will assist with identifying soil sampling locations at LHAAP prior to initiating soil sampling activities.

AGEISS' Project Quality Control (QC) Manager shall verify that the procedures in this SOP are followed by the AGEISS Team. Only personnel with the appropriate qualifications, based on education, previous experience, or on-the-job-training combined with supervision by another qualified person, shall perform these procedures.

5.0 PROCEDURES

Guidelines for sample handling, labeling, packaging, and custody are described in this section.

5.1 Sample Handling

Samples will be collected and handled in a manner that ensures sample integrity as well as personal safety. For example, sampling personnel will, at a minimum, don a clean pair of new disposable gloves each time a new sample is collected. Gloves will also be worn when personnel subsequently handle sample containers during processing, labeling, and packaging activities. This section presents guidelines for containerizing and processing samples.

5.1.1 Containers

Each sample will be placed in an appropriate container following requirements identified in the UFP-QAPP. Sample containers will be chosen to be compatible with the media and analytes of interest. The laboratory will provide certified clean containers for field sampling activities. Upon completion of sampling activities un-used sample containers will be examined by the Field Operations Leader to determine whether bottles should be discarded, recycled, or returned to the laboratory.

5.1.2 Collection Order and Handling Considerations

Approximately 200 soil samples, not including QC samples, will be collected and analyzed for explosives compounds. Sediment and surface water samples, which will be collected at Harrison Bayou, will be collected at the farthest downstream location proceeding to upstream locations. Eight sediment and five surface water samples, not including QC samples, will be collected and analyzed for explosives compounds.

5.1.3 Preservation

The purpose of sample preservation is to prevent or retard the degradation or modification of chemicals in samples during transit and storage, thus preserving sample integrity and representativeness. Efforts to preserve the integrity of the samples will be initiated at the time of sampling and will continue until analyses are performed. Samples will be preserved in the field using ice; sample preservation will be documented in the field logbook and on the chain-of-custody (COC) form.

5.2 Labeling

Sample containers will be appropriately labeled and COC forms will be completed in the field at the time of sample collection. The exterior of the sample containers will be cleaned and a water resistant adhesive label will be attached to the container. Labels will be completed using waterproof black ink. Preprinted labels prepared by AGEISS or provided by the laboratory may be used if available. An example of a sample label that may be applied to sample containers is shown in Attachment 1.

Each sample container will receive a distinct sample number. The following fields will be filled out on each sample label.

- Site ID
- Sample number
- Project code
- Sample type
- Depth
- Date
- Time
- Analyses required
- Preservative/remarks
- Name/signature or initials

Sample identification will be conducted in a manner that facilitates database entry, sorting, tracking, etc. Maintaining site and sample location identification are integral to sample representativeness, integrity, and custody. Sample label fields are defined below and include guidelines for associated codes and identifiers.

- **Site ID** –Site IDs are defined in Section 3.0.
- **Sample Number** – Sample numbers are defined in Section 3.0.
- **QC Samples** – will be designated by specific codes as below:

Code	Definition
FD	Field duplicate
MS	Matrix spike
MSD	Matrix spike duplicate
RB	Equipment rinsate blank
TMP	Temperature blank

- **Project Code -** An assigned project number or short version of the project name, in this case, LHAAP.
- **Sample Type -** A four-letter code defining the sample type, as defined below:

Code	Definition	Definition and Use
COMP	Composite	Composite sample with material combined over a depth interval from 0.5 to 3 feet below ground surface
GRAB	Grab	Soil, sediment, or surface water sample collected using manual methods (e.g., using a scoop, spoon, etc.) and associated QC samples; and for associated equipment rinsate blank

- **Depth -** The depth from which samples were collected will be recorded to the nearest 0.1 foot. Note: Use “NA” for equipment rinsate blanks since depth is not applicable.
- **Date -** The date on which the sample was collected. Use the following format: 12/10/12.
- **Time -** The four-digit, 24-hour time at which the sample was collected.
- **Analyses Required -** Analyses to be performed on the sample volume contained in the specific container to which the sample label is affixed.

- **Preservatives/Remarks –** Notations regarding the type of preservative used or pertinent observations. The following code is applicable:

Code	Definition
Ice	Denotes that sample was placed in a cooler with ice

- **Name/Signature -** Name and signature of the person collecting the sample. Note: If space is limited, initials may be used in place of a signature.

Sampling information recorded in field logbooks shall be consistent with sample labels and COC records.

5.3 Sample Custody

COC procedures will provide documentation of the handling of each sample from the time it is collected until it is destroyed. Sample custody shall be maintained from collection through laboratory analysis so that the samples' physical possession is known at all points of the project. A COC form will be completed by field personnel as samples are collected and kept with the associated samples. An example of a COC form is shown in Attachment 2. This sample custody identification and control process helps to ensure that:

- All samples are uniquely identified.
- Correct samples are analyzed and are traceable through their COC records to their reported analytical results.
- Samples are protected from loss or damage.
- Any alteration of samples (e.g., preservation) is documented.
- Complete custody and possession records are maintained.

The COC record remains with the sample at all times and bears the name of the person assuming responsibility for the samples (e.g., field personnel). The responsible person is tasked with ensuring secure and appropriate handling of the containers and samples. When transferring sample custody, the relinquishing individual and receiving individual will each sign, date, and record the time on the COC record. To simplify the COC record and eliminate potential litigation problems, as few people as possible should handle the sample or physical evidence during the investigation.

5.3.1 Chain-of-Custody Form

All samples for a specific Site ID will be listed on the same COC form. The following fields will be filled out on the COC form (Attachment 2).

- Sample date and time*
- Site ID*
- Matrix
- Depth*
- Sample number*
- Sample type*
- Container type/number
- Analysis required*
- Preservative/remarks*
- Signature/name*
- Relinquished by
- Received by

These fields are defined below or in Section 5.2 (i.e., for those fields that are noted with an *). It is absolutely imperative that sample information recorded on the COC form is consistent with that presented on the sample labels. Sampling information recorded in field logbooks should also be consistent with sample labels and COC records.

- **Matrix** – Type of sample matrix (i.e., soil, sediment, or surface water.).
- **Container Type/Number** – Type of container used (i.e., 125 ml glass jar) and number of containers per analysis per sample (i.e., 1).
- **Relinquished by** – Signature of the person relinquishing custody of the samples and the associated date/time.
- **Received by** - Signature of the person receiving custody of the samples and the associated date/time.

5.3.2 Custody Seal

Custody seals will be placed on each sample cooler to ensure that the cooler has not been tampered with prior to arrival at the laboratory. A custody seal will also be affixed to the sample cooler and the cooler placed in a locked, controlled access area any time the cooler is out of the authorized person's immediate control. An example of a custody seal is shown in Attachment 3.

Custody seals will be affixed to the lid and side of the sample cooler such that the seals will be torn or broken when the cooler is opened. The custody seal will be filled out by sampling personnel prior to placement and will contain the following information:

- Project code (i.e., LHAAP)
- Date
- Time
- Signature

5.4 Sample Packaging and Transport

Sample containers will be temporarily stored in coolers and then formally packaged for transport to the off-site laboratory. To expedite analysis and to minimize the possibility of exceeding holding times, samples will be transported to the laboratory as soon as possible after collection, preferably shipped the same day as collected. It is assumed for purposes of this SOP that the samples to be packaged and transported are defined as environmental samples (i.e., low-concentration samples).

5.4.1 Temporary Storage

After being labeled, sample containers for chemical analysis will be stored in a cooler (e.g., Coleman™ or other sturdy cooler) with wet ice, pending final packaging for transport to the off-site laboratory. Glass containers will be wrapped in bubble wrap to prevent bottle breakage. Samples for chemical analysis will be stored at 4 ± 2 degrees Celsius (°C). The COC forms which were prepared during sample collection will be kept with the applicable samples in the associated coolers.

5.4.2 Final Packaging and Transport

The procedures listed below shall be followed for final packaging and transport of environmental samples:

1) Check each sample container within a sample cooler against the COC to verify that all the information on the sample label is consistent with the information on the COC (i.e., sample date, time, depth, sampling personnel name, Site ID, label number, analysis required etc.). Also review the information on the COC and sample label against the field logbook for errors or omissions.

2) After sampling information has been verified, check each container to make sure that the lid is fastened securely and then dry (if necessary). Wrap glass containers in protective bubble wrap. Containers may be placed inside zip-type plastic bags. Store the containers on wet ice to maintain the samples at 4 ± 2°C. Do not use blue ice packs or dry ice to keep the samples cold. Do not freeze the samples.

3) In preparation for transport of samples, prepare a cooler (e.g., Coleman™ or other sturdy cooler) by taping shut the outlet port with duct tape on the inside and outside of the cooler. Line the inside of the cooler using a plastic garbage bag. These procedures are to prevent leakage due to ice melting or sample bottle breakage during transport.

4) Place verified samples in a prepared transport cooler. Make sure that the contents of the cooler matches the COC exactly. If corrections are necessary, strike out errors using a single line, and initial and date any corrections.

5) Place three to four bags of wet ice (use double Ziploc™ bags) in the cooler around the bagged samples to maintain them at the required temperature of 4 ± 2°C.

6) Add packing material (e.g., packing peanuts or bubble wrap) to fill remaining voids between bottles to avoid sample breakage.

7) Once ice and sample containers are packed, close the garbage bag by twisting the bag shut and securing the twisted end with duct tape.

8) Tape the original COC record to the top of the inside lid of the cooler in a Ziploc™ bag (to keep the COC dry).

9) Review the COC record to verify that the correct progression of sample possession has been followed. Possession of the samples begins with the sample team and continues through laboratory analysis. Transfers of possession require the relinquisher and the receiver to sign, date, and record the time of transfer on the COC. For example, if samples are being packed by someone other than the sampler (e.g., a sample coordinator), the possession of the samples must be "relinquished by" the sampler and "received by" the sample packer indicated by each of their signatures in the appropriate boxes. Custody of the samples is transferred from the person packing the samples to the courier service or field person transporting the samples to the laboratory. If a courier service is used to transport the samples then the name of the courier service is filled in the "received by" box on the COC. For example, if FedEx is used as the transport courier, then "FedEx" should be written in the "received by" box.

10) Transport samples to the laboratory on a daily basis to ensure that sample holding times are not exceeded.

11) Make copies of the completed COC form shipped with the samples for field and office records. Send a copy of the completed COC to the Project Manager and Project Chemist so they can track sample shipment and confirm receipt at the laboratory.

12) Tape the cooler shut using nylon strapping or packing tape, making sure to wrap around the entire cooler several times over each hinge.

13) Fill out two custody seals and place them on the lid and side of the cooler in such a way that it is necessary to break the seals to open the cooler. Cover the seals with clear packing tape to ensure that they remain firmly adhered to the cooler during shipment. This procedure ensures that the contents are not violated during shipping. The last person to sign the COC form for each cooler signs and dates the custody seals. Coolers must not be left unattended unless they are custody sealed and placed in a locked, controlled-access location.

14) Place an address label on top of each cooler being transported by courier to the laboratory. Make sure that "This Way Up" arrows and "Fragile" labels are placed on the cooler and that any miscellaneous old shipping labels are removed.

15) If using a courier service to transport the samples to the laboratory, keep a copy of the transport services receipt with the copy of the COC form to document the progression of sample possession.

16) Upon receipt of shipment at the laboratory, a designated laboratory sample custodian will accept custody of the samples and verify that information on the sample labels match the COC record.

17) The AGEISS team Project Chemist will confirm that the laboratory received the samples in satisfactory condition the following day. Samples that are potentially lost or damaged during shipment can be tracked and located or can be recollected if necessary.

5.5 Equipment List

The following is a list of equipment or items that may be needed to conduct sample handling, labeling, packaging, and custody activities:

- Field logbook
- Field forms
- Sample labels and COC forms
- Custody seals
- Shipping container checklist
- Laboratory notification checklist
- Sample shipping documents (e.g., air bills)
- Indelible black pens and felt tip markers
- Analyte-free (deionized) water and distilled water
- Sample containers
- Cooler with ice
- Bubble wrap
- Ziploc™ bags
- Clear packing tape and dispenser
- Equipment bucket
- Trash bags
- Paper towels
- Decontamination equipment (water from an approved source, buckets, brushes, etc.)
- Copies of the site map
- Clipboard
- Personal protective equipment (PPE)
- Plastic sheet

5.6 Equipment Cleaning and Decontamination

Equipment will be thoroughly decontaminated or cleaned according to the procedures in SOP LHAAP-F-8, *Field Equipment Cleaning and Decontamination*. Decontamination minimizes potential cross contamination in the field that could introduce errors into sampling results. Cleaning minimizes the risk of transferring contaminants from a site upon completion of field activities.

5.7 Waste Handling

Waste materials shall be properly managed by field personnel. The sample handling, labeling, packaging, and custody activities described in this SOP may generate a variety of wastes, including ordinary trash, PPE, cleanup materials (e.g., paper towels, plastic sheets, etc.), and decontamination water. Process knowledge and knowledge of site activities will be used to help categorize investigation derived waste for proper disposal. Procedures and guidelines for waste handling are identified in the project's Waste Management Plan for Investigation Derived Waste.

5.8 Documentation and Recordkeeping

Documentation of sample handling, labeling, packaging, and custody activities shall be in strict accordance with SOP LHAAP-F-1, *Field Documentation*. Data recorded in logbooks or on field forms provide information on the proper acquisition of data and are a permanent record of these activities. Documentation must be correct, complete, consistent, and adequate for scientific interpretation and reconstruction of field activities.

To safe guard field documentation, the logbooks, field forms, and electronic data shall be maintained and archived following the guidelines identified in SOP LHAAP-F-1, *Field Documentation*. Field documentation and training records shall be archived in the project's Technical Document Control Center (T-DCC).

6.0 TRAINING

The Program QC Manager or the Field Operations Leader will conduct sample handling, labeling, packaging, and custody training as needed. Training will include a step-by-step walk through of this SOP and associated project-specific field forms and equipment to ensure that personnel fully understand how to conduct sample handling, labeling, packaging, and custody activities. Upon completion of the training session, records documenting the scope and identifying the date, instructor, and attendees shall be archived in the program/project's T-DCC.

7.0 REFERENCES

AGEISS' field operation SOPs and the following references were reviewed prior to writing this SOP:

AGEISS Inc. 2013. Baseline Ecological Risk Assessment Addendum, Longhorn Army Ammunition Plant, Karnack, Texas, Uniform Federal Policy for Quality Assurance Project Plan.

AGEISS Inc. and CB&I. 2013. Data Gap Memorandum for Explosives in Sediment and Surface Water at the Longhorn Army Ammunition Plant, Karnack, TX.

AGEISS Inc. and CB&I. 2013. Data Gap Memorandum for Explosives in Soil at the Longhorn Army Ammunition Plant, Karnack, TX.

U.S. Army Corps of Engineers. 2001, February 1. Engineer Manual 200-1-3. Requirements for the Preparation of Sampling and Analysis Plans.

U.S. Environmental Protection Agency, Region 4. 2010, October 15. Science and Ecosystem Support Division (SESD) Operating Procedure for Field Sampling Quality Control. SESDPROC-011-R3.

U.S. Environmental Protection Agency, Region 4. 2011, April 20. SESD Operating Procedure for Packing, Marking, Labeling and Shipping of Environmental and Waste Samples. SESDPROC-209-R2.

8.0 ATTACHMENTS

This SOP contains the following attachments:

Attachment 1 Example Sample Label
Attachment 2 Example Chain-of-Custody Form
Attachment 3 Example Custody Seal
Attachment 4 Table of Replacement Soil Samples for the BERA Addendum Investigation at LHAAP

Attachment 1. Example Sample Label

<table>
<tr><td rowspan="4">ANALYSES REQUIRED</td><td>SAMPLE NO:</td><td>SITE ID:</td></tr>
<tr><td>SAMPLE TYPE:</td><td>PROJECT CODE:</td></tr>
<tr><td>DEPTH:</td><td rowspan="2">PRESERVATIVES/
REMARKS:</td></tr>
<tr><td>DATE:</td></tr>
<tr><td>NAME/INITIALS:</td><td>TIME:</td><td>AGEISS Inc.
1202 Bergen Parkway,
Suite 310
Evergreen, CO 80439
(303) 674-5059</td></tr>
</table>

Attachment 2. Example Chain-of-Custody Form

AGEISS Inc.
1202 Bergen Parkway, Suite 310
Evergreen, CO 80439
(303) 674-5059

Chain-of-Custody Record

COC NUMBER: ___________
LABORATORY: ___________
LAB TASK ORDER: ___________
SAMPLE ROUND: ___________

Sampling Personnel (signature/printed name):	Project Code: LHAAP	Sample Date:	Site ID:
		Matrix:	Depth:

SAMPLE TIME	SAMPLE NUMBER	SAMPLE TYPE	CONTAINER TYPE / NUMBER	ANALYSIS REQUIRED	PRESERVATIVE/REMARKS

Relinquished by:	Date/Time	Received by:	Relinquished by:	Date/Time	Received by:
Relinquished By:	Date/Time	Received by:	Relinquished By:	Date/Time	Received by:
Relinquished by:	Date/Time	Received by:	Relinquished by:	Date/Time	Received by:
Airbill Number:					

Attachment 3. Example Custody Seal

CUSTODY SEAL		
AGEISS Inc. 1202 Bergen Parkway, Suite 310 Evergreen, CO 80439 (303) 674-5059	Date:	Time:
	Signature:	
	Project Code:	

Attachment 4. Table of Replacement Soil Samples for the BERA Addendum Investigation at LHAAP

Site ID	Number of Surface Soil (0-0.5 ft) Samples	Number of Subsurface Soil (0.5-3 ft) Samples	Total Number of Samples	Original Sample Location	Collection Date	Depth (ft bgs)	ABERA Replacement Sample Number
Low Impact Sub-Area							
LHAAP-LISA-11	3	3	6	11SB03	3/3/93	0 – 2	11SB03R-SS 11SB03R-SB
				11SB05	3/4/93	0 – 2	11SB05R-SS 11SB05R-SB
				11SD13	3/31/93	0 – 0	11SD13R-SS 11SD13R-SB
LHAAP-LISA-27	2	2	4	27SB34	3/19/93	0 – 3	27SB34R-SS 27SB34R-SB
				27SB38	3/20/93	0 – 2	27SB38R-SS 27SB38R-SB
LHAAP-LISA-54	3	3	6	XXSB15	3/9/93	0 – 2	XXSB15R-SS XXSB15R-SB
				XXSB17	3/9/93	0 – 2	XXSB17R-SS XXSB17R-SB
				XXSB20	3/10/93	0 – 2.5	XXSB20R-SS XXSB20R-SB
		LISA Total:	**16**				
Industrial Sub-Area							
LHAAP-ISA-01	5	5	10	01A-SB02	12/14/93	0 – 0 2.5 – 2.5	01A-SB02R-SS 01A-SB02R-SB
				01A-SB04	12/13/93	0 – 0 2.5 – 2.5	01A-SB04R-SS 01A-SB04R-SB
				01-SD09	3/18/93 3/31/93	0 – 0 0 – 0	01-SD09R-SS 01-SD09R-SB
				01SB23	3/15/93	0 – 2.5	01SB23R-SS 01SB23R-SB
				01SB28	3/19/93 3/17/93	0 – 0 0 – 2.5	01SB28R-SS 01SB28R-SB
LHAAP-ISA-04	2	2	4	LHSMW01	9/30/94	0 – 0.5	LHSMW01R-SS LHSMW01R-SB
				LHSMW02	9/30/94	0 – 0.5	LHSMW02R-SS LHSMW02R-SB

Site ID	Number of Surface Soil (0-0.5 ft) Samples	Number of Subsurface Soil (0.5-3 ft) Samples	Total Number of Samples	Original Sample Location	Collection Date	Depth (ft bgs)	ABERA Replacement Sample Number
LHAAP-ISA-29	12	12	24	29SD01	4/29/93	0 – 0.5	29SD01R-SS 29SD01R-SB
				29SB05	5/27/93	0 – 2	29SB05R-SS 29SB05R-SB
				29SB07	5/19/93	0 – 2	29SB07R-SS 29SB07R-SB
				29SB08	5/27/93	0 – 2	29SB08R-SS 29SB08R-SB
				29SB09	5/28/93	0 – 2	29SB09R-SS 29SB09R-SB
				29SB11	5/25/93	0 – 2	29SB11R-SS 29SB11R-SB
				29SD10	4/28/93	0 – 0.5	29SD10R-SS 29SD10R-SB
				29WL02	5/13/93	0 – 0	29WL02R-SS 29WL02R-SB
				29SB14	5/30/93	0 – 2	29SB14R-SS 29SB14R-SB
				29SB15	6/3/93	0 – 2	29SB15R-SS 29SB15R-SB
				29SB12	5/30/93	0 – 2	29SB12R-SS 29SB12R-SB
				29SB13	5/29/93	0 – 2	29SB13R-SS 29SB13R-SB
LHAAP-ISA-32	8	8	16	32SB13	6/3/93	0 – 2	32SB13R-SS 32SB13R-SB
				32SB03	5/25/93	0 – 2	32SB03R-SS 32SB03R-SB
				32SB06	6/1/93	0 – 2	32SB06R-SS 32SB06R-SB
				32SB14	8/16/04	0 – 1	32SB14R-SS 32SB14R-SB
				32SS03	7/26/98	0 – 0.5 1 – 3	32SS03R-SS 32SS03R-SB
				32SS04	7/26/98	0 – 0.5 1 – 3	32SS04R-SS 32SS04R-SB
				32WL01	5/17/93	0 – 0	32WL01R-SS 32WL01R-SB

Site ID	Number of Surface Soil (0-0.5 ft) Samples	Number of Subsurface Soil (0.5-3 ft) Samples	Total Number of Samples	Original Sample Location	Collection Date	Depth (ft bgs)	ABERA Replacement Sample Number
				32SD06	4/30/93	0 – 0.5	32SD06R-SS 32SD06R-SB
LHAAP-ISA-35A (58)	5	5	10	LH-S723-01	6/26/93	0.5 – 1.5	LH-S723-01R-SS LH-S723-01R-SB
				LH-S111-01	7/8/93	0 – 2 2 – 4	LH-S111-01R-SS LH-S111-01R-SB
				LH-S112-01	7/8/93	0 – 2	LH-S112-01R-SS LH-S112-01R-SB
				LH-S113-01	8/4/93	0.5 – 2	LH-S113-01R-SS LH-S113-01R-SB
				LH-S117-01	8/4/93	0.5 – 2	LH-S117-01R-SS LH-S117-01R-SB
LHAAP-ISA-35C (53)	5	5	10	LHSMW67	10/5/94	0 – 0.5	LHSMW67R-SS LHSMW67R-SB
				LHSMW68	10/5/94	0 – 0.5	LHSMW68R-SS LHSMW68R-SB
				LHSMW69	10/5/94	0 – 0.5	LHSMW69R-SS LHSMW69R-SB
				LHSMW70	10/5/94	0 – 0.5	LHSMW70R-SS LHSMW70R-SB
				LHSMW71	10/5/94	0 – 0.5	LHSMW71R-SS LHSMW71R-SB
LHAAP-ISA-46	20	20	40	LH-S30-01	6/25/93	0.5 – 2.5	LH-S30-01R-SS LH-S30-01R-SB
				LH-S32-01	6/25/93	0.5 – 2.5	LH-S32-01R-SS LH-S32-01R-SB
				LH-S14-02	7/8/93	0.5 – 1.5	LH-S14-02R-SS LH-S14-02R-SB
				LH-S16-01	7/8/93	0.5 – 1.5	LH-S16-01R-SS LH-S16-01R-SB
				LH-S22-01	6/25/93	0.5 – 2.5	LH-S22-01R-SS LH-S22-01R-SB
				LH-S27-01	6/24/93	0.5 – 2	LH-S27-01R-SS LH-S27-01R-SB
				LH-S05-01	7/9/93	0 – 2	LH-S05-01R-SS LH-S05-01R-SB
				LH-S29-01	6/25/93	0.5 – 2.5	LH-S29-01R-SS LH-S29-01R-SB

Site ID	Number of Surface Soil (0-0.5 ft) Samples	Number of Subsurface Soil (0.5-3 ft) Samples	Total Number of Samples	Original Sample Location	Collection Date	Depth (ft bgs)	ABERA Replacement Sample Number
				LH-S026-01	8/8/93	0.5 – 1	LH-S026-01R-SS LH-S026-01R-SB
				LH-S025-01	8/6/93	0.5 – 1	LH-S025-01R-SS LH-S025-01R-SB
				LH-S19-01	8/6/93	1 – 1.5 1.5 – 2	LH-S19-01R-SS LH-S19-01R-SB
				LH-S021-01	8/6/93	1 – 1.5	LH-S021-01R-SS LH-S021-01R-SB
				LH-S43-01	6/26/93	0.5 – 1 1.5 – 2	LH-S43-01R-SS LH-S43-01R-SB
				LH-S41-01	6/25/93	0.5 – 1 1.5 – 2	LH-S41-01R-SS LH-S41-01R-SB
				LH-S08-01	7/12/93	0.5 – 1.5	LH-S08-01R-SS LH-S08-01R-SB
				LH-S06-01	7/9/93	0 – 2 0 – 2	LH-S06-01R-SS LH-S06-01R-SB
				LH-S12-01	7/11/93	0 – 2	LH-S12-01R-SS LH-S12-01R-SB
				LH-S10-01	6/26/93	0 – 2 0 – 2	LH-S10-01R-SS LH-S10-01R-SB
				LH-S11-01	6/25/93	0.5 – 2.5 0 – 2	LH-S11-01R-SS LH-S11-01R-SB
				46SD02	11/9/98	0 – 0	46SD02R-SS 46SD02R-SB
LHAAP-ISA-47	23	23	46	LH-S93-01	7/24/93	0.5 – 1	LH-S93-01R-SS LH-S93-01R-SB
				LH-S92-01	7/23/93	0.5 – 1	LH-S92-01R-SS LH-S92-01R-SB
				LH-S88-01	7/22/93	0.5 – 2	LH-S88-01R-SS LH-S88-01R-SB
				LH-S89-02	7/21/93	0.5 – 2	LH-S89-02R-SS LH-S89-02R-SB
				LH-S86-01	7/27/93	0.5 – 2	LH-S86-01R-SS LH-S86-01R-SB
				LH-S83-01	7/23/93	0.5 – 2	LH-S83-01R-SS LH-S83-01R-SB
				LH-S82-01	7/23/93	0.5 – 2	LH-S82-01R-SS LH-S82-01R-SB

Site ID	Number of Surface Soil (0-0.5 ft) Samples	Number of Subsurface Soil (0.5-3 ft) Samples	Total Number of Samples	Original Sample Location	Collection Date	Depth (ft bgs)	ABERA Replacement Sample Number
				LH-S73-01	6/26/93	0.5 – 1.5	LH-S73-01R-SS LH-S73-01R-SB
				LH-DL74-01	6/26/93	2 – 2.7	LH-DL74-01R-SS LH-DL74-01R-SB
				LH-DL75-01	6/26/93	2 – 2.5	LH-DL75-01R-SS LH-DL75-01R-SB
				LH-S77-01	6/26/93	0.5 – 1.5 1.5 – 3	LH-S77-01R-SS LH-S77-01R-SB
				LH-S71-01	7/24/93	1 – 1.5	LH-S71-01R-SS LH-S71-01R-SB
				LH-S61-01	8/6/93	0.5 – 3	LH-S61-01R-SS LH-S61-01R-SB
				LH-S59-01	7/21/93	0.5 – 1	LH-S59-01R-SS LH-S59-01R-SB
				LH-S58-01	6/26/93	0.5 – 1.5	LH-S58-01R-SS LH-S58-01R-SB
				LH-S55-01	7/12/93	0 – 2	LH-S55-01R-SS LH-S55-01R-SB
				LH-S121-01	8/4/93	0.5 – 1.5	LH-S121-01R-SS LH-S121-01R-SB
				LH-S44-01	7/10/93	0.5 – 1.5	LH-S44-01R-SS LH-S44-01R-SB
				H-DL45-01	7/10/93	2.3 – 3	H-DL45-01R-SS H-DL45-01R-SB
				LH-S47-01	7/9/93	0.5 – 1.5 2.2 – 3.2	LH-S47-01R-SS LH-S47-01R-SB
				LH-S49-01	7/9/93	0.5 – 1.5	LH-S49-01R-SS LH-S49-01R-SB
				LH-S48-01	7/27/93	0.5 – 1	LH-S48-01R-SS LH-S48-01R-SB
				LH-S50-01	7/28/93 7/27/93	0.5 – 1.5 0.5 – 1.5	LH-S50-01R-SS LH-S50-01R-SB
LHAAP-ISA-48	5	5	10	LH-S94-01	8/20/93	0.5 – 1.5	LH-S94-01R-SS LH-S94-01R-SB
				LH-S95-01	6/26/93	0.5 – 1.5	LH-S95-01R-SS LH-S95-01R-SB
				LH-S97-01	6/26/93	0.5 – 1.5	LH-S97-01R-SS LH-S97-01R-SB

Site ID	Number of Surface Soil (0-0.5 ft) Samples	Number of Subsurface Soil (0.5-3 ft) Samples	Total Number of Samples	Original Sample Location	Collection Date	Depth (ft bgs)	ABERA Replacement Sample Number
				LH-S98-01	6/26/93	0.5 – 1.5 1.5 – 3	LH-S98-01R-SS LH-S98-01R-SB
				LH-S100-01	6/26/93	0.5 – 1.5 1.5 – 3	LH-S100-01R-SS LH-S100-01R-SB
		ISA Total:	**170**				
Waste Sub-Area							
LHAAP-WSA-12	4	1	5	12SB01 (DS)	6/1/1993	1 – 2	12SB01 (DS)R-SS 12SB01 (DS)R-SB
				12WW05 (SS)	4/19/1993	0.5 – 1.5	12WW05 (SS)R-SS 12WW05 (SS)R-SB
				12WW01 (SS)	4/27/1993	0 – 2	12WW01 (SS)R-SS 12WW01 (SS)R-SB
				12WW02 (SS)	2/4/1988	0 – 2	12WW02 (SS)R-SS 12WW02 (SS)R-SB
					2/4/1990	0 – 2	
					4/28/1993	0 – 2	
				12WW07 (SS)	4/19/1993	0 – 2	12WW07 (SS)R-SS 12WW07 (SS)R-SB
LHAAP-WSA-16	1	0	1	16SD02 (SS)	4/14/1993	0 – 1	16SD02 (SS)R-SS
LHAAP-WSA-18	6	0	6	18SD03 (SS)	5/2/1993	0 – 0.5	18SD03 (SS)R-SS
				18SD04 (SS)	5/2/1993	0 – 0.5	18SD04 (SS)R-SS
				18SD05 (SS)	5/2/1993	0 – 0.5	18SD05 (SS)R-SS
				18SD06 (SS)	5/2/1993	0 – 0.5	18SD06 (SS)R-SS
				18SD07 (SS)	5/2/1993	0 – 0.5	18SD07 (SS)R-SS
				18SD08 (SS)	5/2/1993	0 – 0.5	18SD08 (SS)R-SS
		WSA Total:	**12**				
		TOTAL FOR ALL SUB-AREAS:	**198**				

TITLE	**FIELD EQUIPMENT CLEANING AND DECONTAMINATION**	NUMBER REVISION	LHAAP-F-8 0 (03/15/13)
CONTRACT TASK ORDER	**W912BV-10-D-2010** **04**	PAGE	1 of 5

1.0 PURPOSE

This document establishes procedures for field equipment cleaning and decontamination in support of Task Order 0004, under the Tulsa U.S. Army Corps of Engineers (USACE) Contract W912BV-10-D-2010. This guidance is provided to ensure that field activities are conducted in a technically sound and consistent manner and that the resulting field data are technically adequate, accurate, and complete. Procedures described in this Standard Operating Procedure (SOP) are consistent with USACE guidelines presented in Engineer Manual (EM) 1110-1-4000.

2.0 SCOPE

This SOP applies to field equipment cleaning and decontamination conducted during field investigations at Longhorn Army Ammunition Plant (LHAAP), Karnack, Texas, in support of an installation-wide Baseline Ecological Risk Assessment Addendum investigation (BERA Addendum).

3.0 DEFINITIONS

Field Cleaning – The process of cleaning dirty equipment such that it can be transported off-site in a condition that will minimize the risk of transferring contaminants from a site.

Decontamination – The process of cleaning dirty equipment to the degree to which it can be re-used, with appropriate quality assurance (QA)/quality control (QC), in the field.

4.0 RESPONSIBILITY

AGEISS Inc. (AGEISS) staff and subcontractor personnel that are part of the integrated project team (collectively referred to as the AGEISS Team) shall adhere to these SOP guidelines during the conduct of field investigations. AGEISS' Project Manager is responsible for implementation and oversight to ensure compliance. AGEISS' Field Operations Leader will manage field activities in accordance with the SOP guidelines.

AGEISS' Project QC Manager shall verify that the procedures in this SOP are followed by the AGEISS Team. Only personnel with the appropriate qualifications, based on education, previous experience, or on-the-job-training combined with supervision by another qualified person, shall perform these procedures.

5.0 PROCEDURES

Guidelines for equipment decontamination and field cleaning are described in this section. Decontamination minimizes potential cross-contamination in the field that could introduce errors or uncertainty into sampling results. Cleaning minimizes the risk of transferring contaminants from a site upon completion of field activities.

5.1 General Considerations for Contamination Avoidance

The first step in decontamination and field cleaning is to minimize contact with the waste and thus the potential for cross-contamination. Examples include the following:

- ♦ Stress work practices that minimize contact with hazardous substances (i.e., do not walk through areas of obvious contamination; do not directly touch potentially hazardous substances).
- ♦ Protect monitoring instruments and field meters prior to, and if appropriate, after use by bagging. If unit configuration permits, make openings in the bags for sample ports and sensors that must be exposed to the media being measured.

- Wear disposable outer garments and use disposable equipment where appropriate.
- Decontaminate all reusable equipment (e.g., depth measurement devices, sampling devices, etc.) associated with field activities prior to use and between each sampling location to minimize potential cross-contamination.

Whenever possible, disposable sampling equipment should be used to eliminate the potential for cross-contamination. Plastic and personal protective equipment (PPE) will be disposed of between each sampling location. In the event that this is not practical, these materials will be thoroughly decontaminated between locations.

5.2 Potential Hazards

There are potential hazards associated with field equipment cleaning and decontamination activities that are site specific. These hazards may include but are not limited to the following:

- Contact with contaminated media (e.g., soil, sediment, surface water, etc.)
- Cuts, lifting, or pinch injuries from contact with sampling equipment and materials

For information on procedures for working in areas of potential hazards, refer to the project Health and Safety Plan (HASP) and Accident Prevention Plan (APP).

5.3 Decontamination and Field Cleaning

This section identifies procedures for decontaminating or cleaning field equipment, including:

- Sampling equipment
- Field meters and monitoring equipment
- Depth measurement devices
- Sample containers

5.3.1 Sampling Equipment

Decontamination of sampling equipment (e.g., trowels, scoops, spoons, hand augers, etc.) will be performed prior to use and between individual sampling points to minimize potential cross-contamination. The following triple rinse procedure will be used when decontaminating equipment that is used to collect environmental samples:

- Wash with water from an approved source (i.e., approved water) and nonphosphate detergent (such as Liquinox®), using a brush if necessary, to remove particulate matter and surface films.
- Rinse thoroughly with approved water
- Final rinse thoroughly with distilled water
- Air dry in clean area
- Wrap all portable equipment in plastic sheeting or plastic bags for storage or transport to the next location
- Contain decontamination water to the greatest extent possible and containerize prior to completion of onsite activities
- Contain wastewater in Department of Transportation (DOT)-approved 55-gal drums

5.3.2 Field Meters and Monitoring Equipment

Care should be taken when cleaning air monitoring instruments to prevent equipment damage. The following procedure will be followed:

- Carefully wipe clean the main body of the equipment using a sponge, moist towelette, or paper towel. Care should be taken to prevent any equipment damage especially from water. Do not use excessive amounts of water. Do not immerse the equipment in water.
- Secure the equipment for transport to the next location in such a manner as not to introduce any contaminants (e.g., place in a clean plastic bag).

5.3.3 Depth Measurement Devices

Depth measurement devices will be decontaminated prior to use and between individual sampling locations to minimize cross-contamination. The decontamination procedure will consist of rinsing and wiping the portion of the device that contacted portions of the borehole with distilled water. The following procedure will be used:

- Wipe the measuring device with a paper towel soaked with approved water as it is withdrawn from the borehole. Use a squirt/spray bottle that contains distilled water to rinse the tape.
- If gross contamination is evident, the equipment may be further decontaminated by washing with a scrub brush over a bucket and rinsing with distilled water. Wrap the equipment in plastic sheeting or a plastic bag for storage or transport to the next location.

5.3.4 Sample Containers

Sample containers will be cleaned in the field to ensure that potential contaminants are not transported from sampling locations to off-site locations (e.g., contract laboratory, hotel, etc.). The following procedures will be used to clean sample containers:

- Establish a temporary wash station at each sampling location.
- Dress in suitable safety gear as specified in the project's HASP and APP to minimize personal exposure.
- Check that all field sample containers are tightly sealed after they are collected and accounted for.
- Thoroughly rinse each sample container using distilled water and then dry the container using paper towels.
- Label, bubble wrap, and place the sample containers in a storage cooler as specified in SOP LHAAP-F-7, *Sample Handling, Labeling, Packaging, and Custody*. Note: Coolers should be placed on plastic sheeting during sampling activities to ensure that they do not contact the ground surface and potential site contaminants.

5.4 Field Quality Control Samples

Collection of field QC samples is required as part of equipment decontamination activities. The number and type of field QC samples shall meet project requirements as identified in the *Baseline Ecological Risk Assessment Addendum, Longhorn Army Ammunition Plant, Karnack, Texas, Uniform Federal Policy for Quality Assurance Project Plan* (AGEISS 2013), hereafter referred to as the project UFP-QAPP. Field QC sample types and collection procedures are defined in SOP LHAAP-F-6, *Field Quality Control Samples*.

5.5 Equipment List

The following is a list of equipment or items that may be needed to clean or decontaminate field equipment:

- Field logbook
- Nonphosphate detergent (such as Liquinox®)
- Water from an approved source
- Distilled water
- Plastic sheeting
- Knife
- Brushes
- Wash tubs/buckets
- Paper towels
- Moist towelettes/sponges
- Aluminum foil
- Squirt/spray bottle
- Plastic garbage bags
- PPE and appropriate safety and health equipment as specified in the project's HASP and APP
- DOT-approved 55-gal drums
- Paint markers
- Black pens

5.6 Waste Handling

Waste materials must be properly managed by field personnel. The equipment cleaning and decontamination activities described in this SOP may generate a variety of wastes, including ordinary trash, PPE, cleanup materials (e.g., paper towels, plastic sheets, etc.), and decontamination water. Process knowledge and knowledge of site activities will be used to help categorize investigation derived waste for proper disposal. Procedures and guidelines for waste handling are identified in the project's Waste Management Plan for Investigation Derived Waste.

5.7 Documentation and Recordkeeping

Documentation of equipment cleaning and decontamination activities shall be in strict accordance with SOP LHAAP-F-1, *Field Documentation*. Data recorded in logbooks or on field forms provide information on the proper acquisition of data and are a permanent record of these activities. Documentation must be correct, complete, consistent, and adequate for scientific interpretation and reconstruction of field activities.

To safeguard field documentation, logbooks and field forms shall be maintained and archived following the guidelines identified in SOP LHAAP-F-1, *Field Documentation*. Field documentation and training records shall be archived in the project's Technical Document Control Center (T-DCC).

6.0 TRAINING

The Project QC Manager (or his/her designee such as a project's Field Operations Leader) will conduct field equipment cleaning and decontamination training as needed. Training will include a step-by-step walk through of this SOP to ensure that personnel fully understand how to clean or decontaminate field equipment. Upon completion of the training session, records documenting the scope and identifying the date, instructor, and attendees shall be archived in the program/project's T-DCC.

7.0 REFERENCES

AGEISS' field operation SOPs and the following references were reviewed prior to writing this SOP:

AGEISS Inc. 2013. Baseline Ecological Risk Assessment Addendum, Longhorn Army Ammunition Plant, Karnack, Texas, Uniform Federal Policy for Quality Assurance Project Plan.

AGEISS Inc. and CB&I. 2013. Data Gap Memorandum for Explosives in Sediment and Surface Water at the Longhorn Army Ammunition Plant, Karnack, TX.

AGEISS Inc. and CB&I. 2013. Data Gap Memorandum for Explosives in Soil at the Longhorn Army Ammunition Plant, Karnack, TX.

U.S. Army Corps of Engineers. 1998, November 1. Engineer Manual 1110-1-4000. Monitoring Well Design, Installation, and Documentation at Hazardous Toxic, and Radioactive Waste Sites.

U.S. Army Corps of Engineers. 2001, February 1. Engineer Manual 200-1-3. Requirements for the Preparation of Sampling and Analysis Plans.

U.S. Environmental Protection Agency, Region 4. 2011, December 20. Science and Ecosystem Support Division (SESD) Operating Procedure for Field Equipment Cleaning and Decontamination. SESDPROC-205-R2.

This page is intentionally left blank.

1.0 PURPOSE

This document establishes procedures for conducting global positioning system (GPS) measurements in support of Task Order 0004, under the Tulsa U.S. Army Corps of Engineers (USACE) Contract W912BV-10-D-2010. This guidance is provided to ensure that field activities are conducted in a technically sound and consistent manner and that the resulting field data are technically adequate, accurate, and complete. Procedures described in this Standard Operating Procedure (SOP) are consistent with USACE guidelines presented in Engineer Manual (EM) 1110-1-4000.

2.0 SCOPE

This SOP applies to GPS measurements conducted during field investigations at Longhorn Army Ammunition Plant (LHAAP), Karnack, Texas, in support of an installation-wide Baseline Ecological Risk Assessment Addendum investigation (BERA Addendum). Additional soil, sediment, and surface water samples are being collected to address data gaps resulting from the removal of unusable analytical data from the primary dataset. A portable GPS unit will be used to obtain coordinate location data in the field for 198 soil, eight sediment, and five surface water sampling locations.

3.0 DEFINITIONS

Coordinate system – A means of identifying a point on the earth on a planimetric (flat) map. A coordinate system is defined using an x- and y- value or a northing and easting.

Datum – A model of the size and shape of the earth (reference ellipsoid) used to define a coordinate system on the earth.

Latitude/Longitude – A means of identifying a point on the sphere of the earth. Latitude is measured in degrees north or south relative to the equator. Longitude is measured in degrees east or west relative to the prime meridian which runs through Greenwich, England.

Projection – A method of taking the curved surface of the earth and displaying it on a flat surface (a map). Different projections can cause distortions in shape, distance, direction, scale, and area. As a specific example of distortion, the area of Greenland is often distorted on many world maps due to its projection.

Site Identification (Site ID) – A unique alpha-numeric identifier used to identify a specific field location of interest (e.g., a sampling site). The proposed sampling locations at LHAAP are presented in the *Baseline Ecological Risk Assessment Addendum, Longhorn Army Ammunition Plant, Karnack, Texas, Uniform Federal Policy for Quality Assurance Project Plan* (2013), hereafter referred to as the project UFP-QAPP.

4.0 RESPONSIBILITY

AGEISS Inc. (AGEISS) staff and subcontractor personnel that are part of an integrated project team (collectively referred to as the AGEISS Team) shall adhere to these SOP guidelines during the conduct of field investigations. AGEISS' Project Manager is responsible for implementation and oversight to ensure compliance. AGEISS' Field Operations Leader will manage field activities in accordance with the SOP guidelines.

AGEISS' Project Quality Control (QC) Manager shall verify that the procedures in this SOP are followed by the AGEISS Team. Only personnel with the appropriate qualifications, based on education, previous experience, or on-the-job-training combined with supervision by another qualified person, shall perform these procedures.

5.0 PROCEDURES

Trimble hand-held units (Juno or GeoXH) shall be used to locate the soil, sediment, and surface water sample locations at the three LHAAP Sub-Areas and Harrison Bayou.

This SOP presents standardized documentation guidelines for recording GPS coordinates. Operating instructions are not included as these are specific to each manufacturer's GPS unit. Therefore, before using a GPS unit in the field, it is important to become familiarized with the unit by thoroughly reviewing the manufacturer's operating manual and practicing the unit's set-up and operating steps. This section discusses the following topics related to GPS coordinate documentation:

- Selecting a Datum/Projection
- Identifying GPS Coordinates
- Identifying GPS Accuracy
- Documenting GPS Coordinates and Accuracy
- Documenting Information Associated with a GPS Location

5.1 Selecting a Datum/Projection

The three most common datums used for GPS or Geographic Information Systems (GIS) are described below.

- World Geodetic System (WGS) 84 - A world referencing system that is the default standard datum for coordinates stored in GPS equipment.
- North American Datum (NAD) 83 - A datum used in North America that is similar to the WGS84 datum.
- North American Datum (NAD) 27 - An older datum based on the Clarke Ellipsoid of 1866. Due to its age, this datum is not an earth-centered datum based on satellite information, as are WGS84 and NAD83. Its reference base station is located at Meades Ranch in Kansas. A number of older GIS files still use this datum.

The most common projection used for GPS is Universal Transverse Mercator (UTM). This projection is used to define horizontal positions on the earth by creating 6-degree zones, each mapped by the Transverse Mercator projection with a central meridian in the center of the zone. The UTM zone number of a site must be known before this projection can be accurately used. Attachment 1 shows the UTM zones for the contiguous United States. The UTM zone number is shown on all quadrangle maps prepared by the U.S. Geological Survey. The unit of measure for the UTM coordinate system is meters (m).

For LHAAP project GPS work, field personnel shall use the WGS84 datum and UTM projection, Zone 15.

5.2 Identifying GPS Coordinates

Set GPS units used for the project to display the location data using the UTM coordinate system with the map datum set to WGS84. A UTM location point is defined by a set of two coordinates [i.e., an easting (E) and a northing (N) coordinate]. As an example, for UTM Zone 15, the easting coordinate typically includes six digits (e.g., 393982 mE) and the northing coordinate typically includes seven digits (e.g., 3615303 mN). Depending on the make and model of the GPS unit, additional digits may be displayed [e.g., a leading zero for the easting coordinate or a fraction of the measurement unit (such as hundredths of a meter)]. Record all displayed digits in the logbook or field data form.

5.3 Identifying GPS Accuracy

GPS accuracy is defined as the estimated accuracy of the calculated position based on the signal and telemetry of GPS satellites. At least three satellite signals are needed to determine a GPS location. However, four or more satellites provide a more accurate reading. Some GPS units are able to receive data from the Wide Area Augmentation System (WAAS). This system yields greater accuracy by providing data for correcting differentials from the GPS satellites. The GPS unit will identify whether a WAAS satellite is visible to the GPS receiver.

Field personnel should try to obtain the best possible readings given the GPS unit’s capabilities. To obtain a good GPS reading, the GPS unit must have a clear view of the sky. The following general guidelines apply when using a GPS unit:

- Do not lean over the GPS unit while taking a reading as this could block a satellite signal.
- Rotate your body away from the GPS unit or orient the unit differently if experiencing difficulty acquiring enough satellite signals to obtain a good reading.
- Reorient your body or the GPS unit so that additional satellite signals can be received if the unit display indicates that there are more satellites available. This greatly improves the accuracy of the GPS reading.
- Acquire a minimum of four satellite signals before saving/recording the GPS coordinates for a particular location.

The following discussions provide general guidance and standards concerning GPS operation. These general principals apply no matter what GPS equipment is used or how specific functions are accessed on that equipment.

5.3.1 Trimble GPS Receiver

The TerraSync software loaded into the Trimble GPS unit allows for a variety of settings that help ensure collected data are of consistent quality. Set the Trimble GPS unit to the following parameters for satellite control, data logging, and real-time corrections.

Satellite control

1. Set the Trimble GPS unit to only use data that has a Positional Dilution of Precision (PDOP) of 6.0 or less. PDOP is a measure of the quality of GPS positions based on the geometry of the satellites used to compute the position; the lower the PDOP, the more accurate the position.

2. Set the Trimble unit to disregard data from satellites with Signal-to-Noise Ratio (SNR) below 6.0. In the event that a set of coordinates must be obtained under canopy cover, the minimum SNR may have to be lowered. SNR is a measure of the information content of the satellite signal relative to the signal’s noise; higher SNR values describe higher quality satellite information. Field personnel must reset the SNR to 6.0 when returning to open terrain.

3. Set the Trimble unit to a 15º elevation mask so that only data from satellites above this elevation are used. A satellite’s elevation above the horizon is correlated to atmospheric and multipath (i.e., where a satellite signal arrives at a receiver by more than one route) signal degradation; data from satellites low on the horizon may be of very poor quality.

4. Ensure a minimum of four satellites meet the above criteria before obtaining coordinate data. A greater number of available satellites will yield more accurate coordinates. The number of satellites that meet the above criteria is clearly displayed on the Trimble GPS unit.

Data logging

The Trimble GPS unit logs a series of positions at each location, and averages these positions to determine the coordinates of the location. In general, the more positions that are logged, the greater the accuracy of the resulting coordinates. In practice, however, the law of diminishing returns dictates the optimal number of positions needed for an accurate set of coordinates (i.e., collecting positions beyond a certain point will not yield greater accuracy). Additionally, collecting too many positions will fill up the GPS unit's memory.

1. In open terrain with at least four satellites, wait for a minimum of seven positions to be logged before saving/recording a position. In open terrain, increases in accuracy decline after 3 to 10 positions have been logged, depending on the number and geometry of satellites available.

   Under canopy cover, use an external antenna and a minimum of 50 positions logged to obtain data that meet minimum accuracy standards.

2. Navigate to a GPS screen that shows the coordinates after saving the data electronically. The coordinates available for hand recording are not the result of position averaging, as are the data saved electronically, but are instantaneous coordinate estimates. These values will likely be fluctuating as field personnel attempt to record them. Therefore, record a representative set of coordinates. Although data captured in this manner will be inferior to those captured electronically, they are invaluable in the event that the electronic data is lost. The current PDOP is displayed on the same screen as the coordinates.

Real-time corrections

Set the Trimble GPS unit to receive and apply real-time differential corrections from WAAS satellites to improve the accuracy of coordinate data when WAAS satellites are available. A flashing radio icon appears at the top of the Trimble GPS screen when the unit is attempting to acquire WAAS data, and the locations of WAAS satellites are indicated by airplane-shaped icons on the Skyplot. Once WAAS data are acquired, the radio icon stops flashing and is accompanied by an airplane-shaped icon; coordinates recorded at this point will incorporate WAAS positioning corrections.

In the event that WAAS satellites are unavailable (the radio icon will continue to flash), attempt to determine if this condition is correctable by examining the position of the WAAS satellite on the Skyplot. If reorienting the GPS unit makes a WAAS satellite(s) visible to the unit, this should be done. However, if WAAS unavailability is due to low satellite elevation above the horizon or other uncorrectable conditions, record coordinate data in the uncorrected mode.

Summary of Coordinate Data Quality Standards for Trimble GPS Units

Field personnel using Trimble GPS units will be given reference documents regarding configuration details and unit use, and will be trained in the use of the units prior to performing field activities. The following is a summary of the coordinate data quality standards discussed in this section.

- PDOP $\leq$ 6.0
- SNR $\geq$ 6.0
- Elevation Mask = 15º
- Minimum number of satellites = four
- Minimum number of logged positions before saving/recording GPS coordinates, open terrain = seven
- Minimum number of logged positions before saving/recording GPS coordinates, canopy cover = 50
- WAAS differential corrections, when available

5.3.2 Documenting GPS Coordinates and Accuracy

To document a particular location point in a logbook or on a field data form, record the UTM zone, easting and northing coordinates (all digits displayed), and if applicable any of the following:

- Whether WAAS satellites were used to obtain the GPS coordinates
- Any condition that could prevent or impair an accurate position reading (e.g., not enough satellites available, weather or known solar activity, heavy canopy cover, etc.)
- PDOP value
- SNR value if lowered from the standard setting of 6.0
- Data filename of file that stores electronic GPS positions, using the following guidelines:
  - A new file is used each day on each GPS unit.
  - One file created in the morning can be added to all day.
  - Filenames are assigned by GPS unit.
  - Filenames are structured as follows: RMMDDHHX, where:
    - R – Fixed alpha character (each unit will be assigned a different alpha character to distinguish between data files)
    - MM – Month of file creation
    - DD – Day of file creation
    - HH – Hour of file creation
    - X – Alpha character that increments within the hour for multiple files created within that hour

    Using the above filename structure, R012109A would be the first file created during the 9 AM hour on January 21st.
  - At the end of each field day, download data files that contain coordinates collected that day to a laptop computer, and then delete the data files from the GPS unit.

The following example shows the required information for documenting a single GPS location where an estimated position error (EPE) (i.e., GPS accuracy estimate) is displayed and a WAAS satellite is available:

UTM Zone 15 WGS84, 493793 mE, 5417883 mN (EPE: 8 ft; WAAS)

If numerous GPS coordinates are being recorded in a logbook or on a field data form for a particular location (i.e., Site ID), such as several waypoints along a transect, it is not necessary to repeat the UTM zone with each GPS coordinate entry. In this case, identify the UTM zone once as an initial entry in the logbook or on the field data form. The UTM zone must be noted at least once each day in the logbook and on each field data form that is used. Similarly, if the same Trimble GPS unit is used by an individual on a particular day, it is not necessary to repeat the data filename with each GPS coordinate entry. In this case, identify the data filename once as an initial entry in the logbook or on the field data form. The data filename must be noted at least once each day in the logbook and on each field data form that is used. If the Trimble GPS units are shared by several field personnel on a particular day, each person must record the active filename in their logbook or on the appropriate field data form as soon as they take custody of the GPS unit.

During a field survey numerous GPS coordinate readings may be collected each day. These readings can be stored in the GPS unit's memory as waypoints with the unit sequentially assigning a waypoint number to each GPS reading (i.e., 1, 2, 3, 4, etc.). The waypoint numbers are recorded with the associated GPS coordinates in the logbook or on the field data form.

The following example shows the required information for documenting multiple GPS coordinates with associated waypoints for a particular Site ID when using a Trimble GPS unit that displays coordinates to a hundredth of a meter.

Site ID BIO-5 **Data Filename: R012109A**

Waypoint	UTM Zone 15 WGS84 Coordinates		PDOP	WAAS Available
	Easting (m)	Northing (m)		
1	493793.10	5417883.99	5.4	Y
2	493682.44	5417761.32	5.8	N
3	493497.73	5417521.65	4.6	Y
4	493398.68	5417496.88	5.2	Y

Note: The coordinates shown are an example only. They do not correspond to coordinates from the LHAAP project.

In the above example, recording GPS data in a logbook or on a field data form and storing the data electronically provides data duplication in the event that the GPS unit malfunctions before the electronic data can be downloaded to a laptop computer. See SOP LHAAP-F-1, *Field Documentation*, regarding guidelines for preparing duplicate copies of field documentation.

5.3.3 Documenting Information Associated with a GPS Location

The GPS unit may provide a number of additional field measurements (e.g., distance, elevation, etc.). In this case, set the GPS unit to display distance in meters and elevation in feet unless specified differently by the client in the field. Record these or any additional field measurements or observations in a logbook or on a field data form following the documentation guidelines identified in SOP LHAAP-F-1, *Field Documentation*. Northings and eastings should be measured in meters at LHAAP because the projection is defined as UTM Zone 15.

5.4 Equipment List

The following is a list of equipment or items that may be needed to conduct GPS measurements:

- GPS unit
- External antenna
- Laptop computer, software, and data cable for downloading electronic data from the GPS unit to the computer
- Manufacturer's instruction manual
- Spare batteries for the GPS unit
- Field logbook
- Field forms
- Watch
- Black pens
- Trash bags
- Paper towels
- Copies of the site map
- Clip board
- Distilled water

5.5 Equipment Cleaning and Decontamination

GPS equipment will be thoroughly cleaned according to the procedures in SOP LHAAP-F-8, *Field Equipment Cleaning and Decontamination*. Cleaning minimizes the risk of transferring contaminants from a site upon completion of field activities.

5.6 Waste Handling

Waste materials must be properly disposed of by field personnel. Conducting GPS measurements described in this SOP may generate a variety of wastes, including ordinary trash or cleanup materials. Procedures and guidelines for waste handling are identified in the project's Waste Management Plan for Investigation Derived Waste.

5.7 Documentation and Recordkeeping

Documentation of GPS coordinates shall be in strict accordance with SOP LHAAP-F-1, *Field Documentation*. Data recorded in logbooks or on field forms provide information on the proper acquisition of data and are a permanent record of these activities. Documentation must be correct, complete, consistent, and adequate for scientific interpretation and reconstruction of field activities.

To safeguard field documentation, the logbooks, field forms, and electronic data shall be maintained and archived following the guidelines identified in SOP LHAAP-F-1, *Field Documentation*. Field documentation and training records shall be archived in the project's Technical Document Control Center (T-DCC).

6.0 TRAINING

The Project QC Manager or Field Operations Leader will conduct GPS training as needed. Training will include a step-by-step walk through of this SOP and associated equipment to ensure that personnel fully understand how to conduct GPS measurements. Upon completion of the training session, records documenting the scope and identifying the date, instructor, and attendees shall be archived in the program/project's T-DCC.

7.0 REFERENCES

AGEISS' field operation SOPs and the following references were reviewed prior to writing this SOP:

AGEISS Inc. and CB&I. 2013. Data Gap Memorandum for Explosives in Sediment and Surface Water at the Longhorn Army Ammunition Plant, Karnack, TX.

AGEISS Inc. and CB&I. 2013. Data Gap Memorandum for Explosives in Soil at the Longhorn Army Ammunition Plant, Karnack, TX.

AGEISS Inc . 2013. Baseline Ecological Risk Assessment Addendum, Longhorn Army Ammunition Plant, Karnack, Texas, Uniform Federal Policy for Quality Assurance Project Plan.

Trimble Navigation Limited. Date unknown. Owner's Manual and Guidance Documents for the Trimble GeoExplorer CE Series Handheld Datalogger and Integrated GeoXT Global Positioning System Receiver.

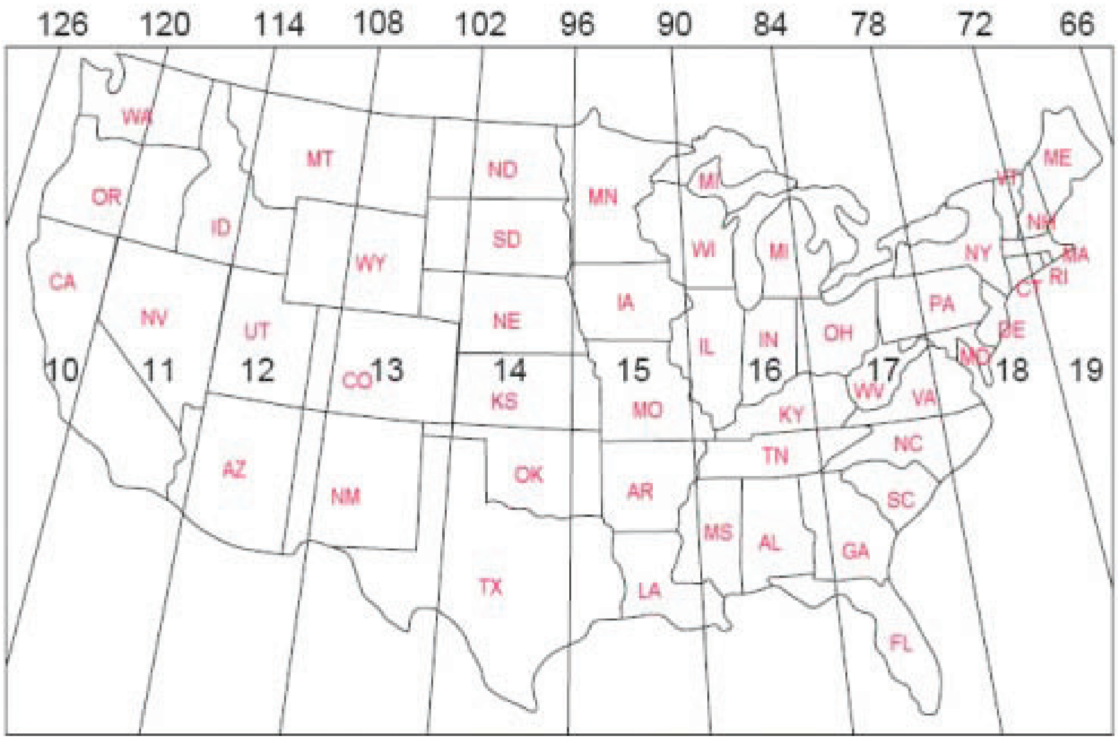
U.S. Environmental Protection Agency, Region 4. 2011, April 20. Science and Ecosystem Support Division (SESD) Operating Procedure for Global Positioning System. SESDPROC-110-R3.

8.0 ATTACHMENTS

This SOP contains the following attachment:

Attachment 1 Universal Transverse Mercator Zones

Attachment 1. Universal Transverse Mercator Zones



Source: http://gps.logicallsolutions.net/images/UTM_US.jpg

APPENDIX D

Analytical Standard Operating Procedures

STANDARD OPERATING PROCEDURE NITROAROMATICS AND NITRAMINES BY HIGH PERFORMANCE LIQUID CHROMATOGRAPHY METHOD 8330

Issue/Implementation Date: 15 September 2012

Last Review Date: 15 September 2012

Microbac Laboratories, Inc.
Ohio Valley Division
158 Starlite Drive
Marietta, Ohio 45750

Approved By:

Michael D. Cochran, Semi-Volatile Supervisor — Date: 9/6/12

Wade T. DeLong, Quality Assurance Officer — Date: 9-7-12

Leslie S. Bucina, Laboratory Manager — Date: 9/7/12

Document Control # 278

Issued to: Document Master File

Table of Contents

1.0 SCOPE AND APPLICATION

1.1 Methods 8330A and 8330B are designed to determine trace level concentrations of explosives and their residues in solid, soil and water samples. A list of target analytes appears in Tables 1 and 2. PETN may also be analyzed by modifications of this method presented in Appendix II.

1.2 This SOP also contains special analytical procedures to comply with the unique requirements presented in DoD's "Guide for Implementing SW-846 Method 8330B", July 7, 2008. The laboratory will use the LIMS to indicate when the special Department of Defense Quality Systems Manual procedures must be followed.

1.3 The method involves analysis with a High Performance Liquid Chromatograph of samples that have been prepared using a Solid-Phase Extraction for aqueous samples or solvent extracted for soil/solid samples.

1.4 The RL for this method is approximately 0.1 mg/kg (wet weight) for soil/sediment samples and 0.25 ug/L for water samples. RLs will be proportionately higher for sample extracts that required dilution to avoid detector saturation. RLs for projects following the DoD/EDQW will be set at three times the MDL.

1.5 This method is restricted to use by or under the supervision of analysts experienced in the use of HPLC and interpretation of chromatographs. Each analyst must demonstrate the ability to generate acceptable results with this method.

1.6 Definitions and Acronyms

The following is a list of terms, definitions, and acronyms referenced in this SOP that are unique to the method.

CCV	Continuing Calibration Verification
COA	Certificate of Analysis
DoD/EDQW	Department of Defense Quality Systems Manual
HMX	Octahydo-1,3,5,7-tetranitro-1,3,5,7-tetrazocine
HPLC	High Performance Liquid Chromatography
ICAL	Initial Calibration
ICV	Initial Calibration Verification
LCS	Laboratory Control Sample
LCV	Low Calibration Verification
LOD	Limit of Detection
LOQ	Limit of Quantitation

LQAP	Laboratory Quality Assurance Program
MDL	Method Detection Limit
MS	Matrix Spike
MSD	Matrix Spike Duplicate
NCR	Nonconformance Report
PETN	Pentaerythritol tetranitrate
RDX	Hexahydro-1,3,5-trinitro-1,3,5-triazine
RL	Reporting Limit
RSD	Relative Standard Deviation
SOP	Standard Operating Procedure
SPE	Solid Phase Extraction
QC	Quality Control

For a more comprehensive list of common terms and definitions, consult Appendix A in Microbac SOP LQAP.

2.0 SAFETY PRECAUTIONS

2.1 Methanol and acetonitrile solvents are used in this method. Both solvents are extremely hazardous and must be used only with proper ventilation and personal protective equipment including gloves. A fume hood is in place to ensure operation safety.

2.2 Explosive Standards

The lab will only use low-level explosive standards while performing this method. The levels, which are 1000 ppm or less, should pose no danger. If neat standards are used the analyst is reminded of the dangers associated with handling high-level explosive compounds. These compounds are shock sensitive and care must be taken to ensure safe handling. Explosive shields should be used.

3.0 SAMPLE PRESERVATION AND STORAGE

3.1 Sample size and collection requirements are beyond the scope of the SOP; refer to Microbac Extraction lab SOPs and SW-846 for details.

3.2 After the samples have been extracted, they must be stored at ≤ 6° C until the instrumental analysis can proceed. The samples must be analyzed within 40 days from the day of the extraction.

4.0 METHOD PERFORMANCE

4.1 Table 1 summarizes the performance data for water analysis; Table 2 summarizes performance data for soil/solid waste analysis. These tables include the analyte list, ranges for accuracy and precision, nominal laboratory RL, and the current laboratory MDLs.

4.2 The laboratory performed an initial assessment of the MDL using the procedures outlined in 40 CFR Part 136. Results are filed electronically at H:\DATA\COMMON\MDL.

4.3 The LOD, or verified MDL, are presented in Tables 1 and 2 and were established using verification procedures outlined in Microbac SOP 45.

4.4 The LOQ are the nominal laboratory RLs and were established as per Microbac SOP 45.

4.5 Method performance data for PETN can be found in Tables 5 and 6.

4.6 Precision and accuracy data were derived from an initial demonstration of capability using spiked control samples. The laboratory uses results from LCS to assess precision/accuracy and to annually evaluate the associated control limits.

4.7 Project specific QA objectives may be found in the appropriate statement-of-work or QAPP.

5.0 INTERFERENCES AND CORRECTIVE ACTION

5.1 All possible measures are taken to eliminate interferences from glassware and other equipment. Possible interferences from this source include artifact peaks and elevated baselines.

5.2 Only HPLC grade solvents are used.

5.3 Tetryl may decompose rapidly in methanol/water solutions or with the presence of heat.

6.0 EQUIPMENT AND SUPPLIES

6.1 HPLC and related equipment:

- Agilent 1100 or 1200 series HPLC system

- Quaternary HPLC pump
- Autosampler unit
- UV-Diode Array Detector
- Vacuum Degasser
- HP 3D Chemstation Software for LC
- Primary column: Phenomenex Ultracarb 5u ODS (20) column (250 x 4.60 mm)/with guard cartridge system or equivalent
- Confirmation column: Dionex Acclaim E2 5u (250 x 4.60 mm) column or equivalent

6.2 Filter - 0.45 um

6.3 Syringe (gas tight) - 10 uL, 100 uL, 1 mL

7.0 STANDARDS AND REAGENTS

7.1 All purchased stock standards and reagents are logged into the LIMS system and assigned certificate of analysis (COA) numbers. All intermediate and working solutions are similarly logged into the LIMS and assigned STD or RGT numbers. Detailed information regarding solution concentrations, aliquot volumes and final volumes and concentrations are included under the STD or RGT number.

7.2 Water - HPLC grade (J.T. Baker 4218-03 or equivalent)
Methanol - HPLC grade (J.T. Baker 9093-33 or equivalent)
Acetonitrile - HPLC grade (J.T. Baker 9017-03 or equivalent)

7.3 Commercial surrogate stock, 1,2-dinitrobenzene, at 1000 ug/mL in MeOH is purchased from Accustandard (M-8330-SS) or equivalent.

7.4 Stock calibration standard: Commercial standards at 1000 ug/mL in MeOH:AcCN (1:1) are purchased from Accustandard: M-8330-A-10X (mix A), M-8330-B-R-10-X (mix B) and M-8330-ADD-1 (nitroglycerin).

7.4.1 50 microliters each of each standard mix and 50 microliters of surrogate stock (7.4) are added to a 10 mL volumetric flask, which is partially filled with HPLC grade acetonitrile. The flask is filled to the mark with acetonitrile, stoppered, and inverted three (3) times to mix before the contents are transferred to an amber bottle with a teflon lined cap. This intermediate alternate source standard contains 5000 ug/L of each explosive and the surrogate, 1,2-dinitrobenzene. This intermediate standard can be stored at 4º C and used for up to one month.

7.4.2 A dilution solvent, which resembles the eluent, and/or the final extract solvent is prepared for use in diluting the calibration standards. 10 mL of acetonitrile is placed into a 40 mL amber vial and mixed with 10 mL of HPLC water.

7.4.3 Calibration standards are prepared in amber vials from the intermediate standard using the following scheme:

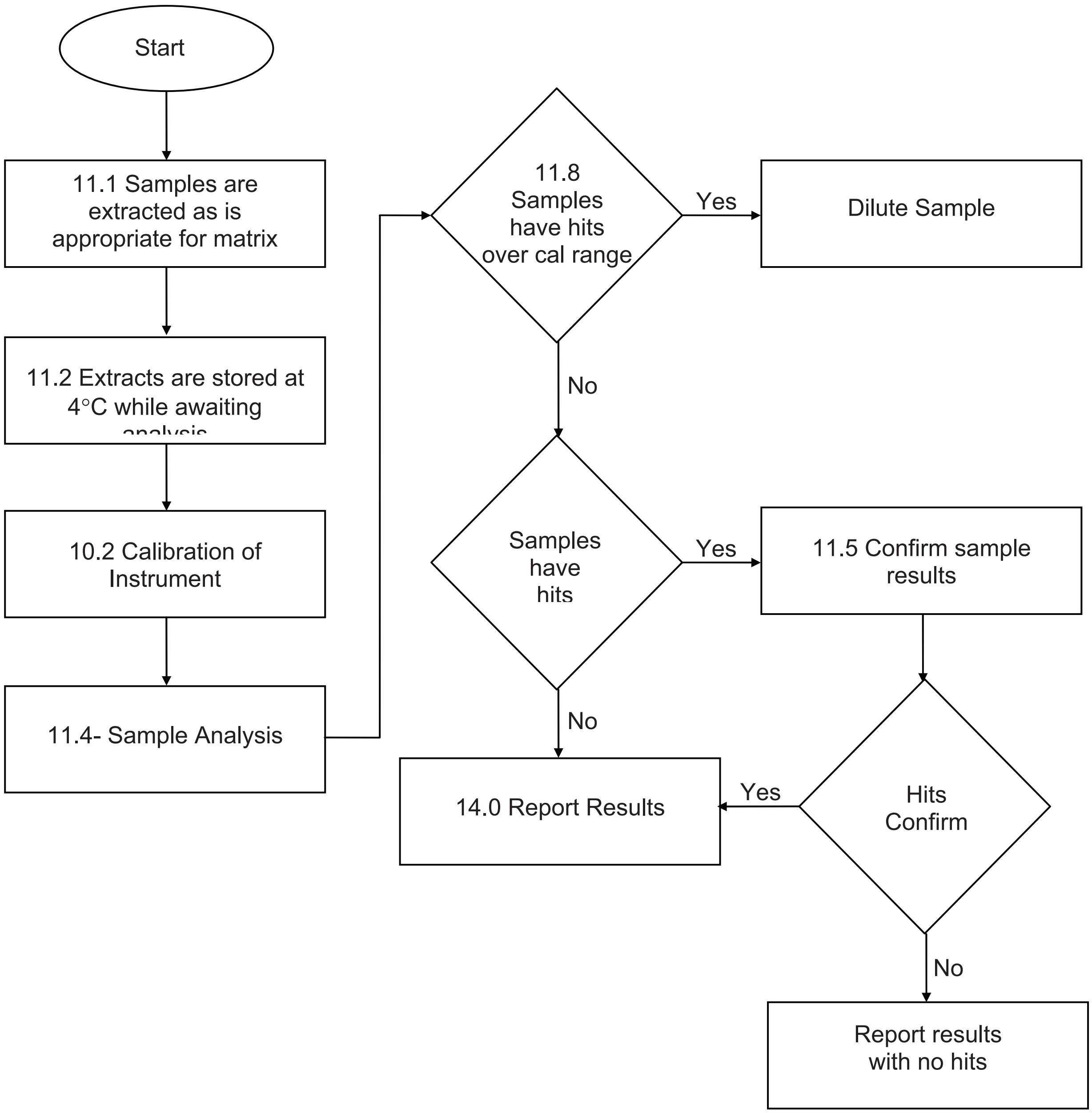
Calibration Std. #	Concentration	Preparation
6	2500 ug/L	600 uL of intermediate (7.6) plus 600 uL HPLC H_2O
5	1000 ug/L	400 uL of std. 6 plus 600 uL of solution 7.7
4	500 ug/L	400 uL of std. 5 plus 400 uL of solution 7.7
3	100 ug/L	200 uL of std. 4 plus 800 uL of solution 7.7
2	50 ug/L	100 uL of std. 4 plus 900 uL of solution 7.7
1	25 ug/L	400 uL of std. 2 plus 400 uL of solution 7.7

7.5 ICV standards at 100 ug/mL are purchased from Supelco (8330 Mix A #4-7283, 8330 Mix B #4-7284, Nitroglycerin #31498 or equivalents).

7.5.1 200 uL each of mix A, mix B and nitroglycerin (7.4) are added to a 10 mL volumetric flask, which is partially filled with HPLC grade acetonitrile. 20 uL of surrogate stock (7.5) is also added to the volumetric flask. The flask is filled to the mark with acetonitrile, stoppered, and inverted three (3) times to mix before the contents are transferred to an amber bottle with a teflon lined cap. This intermediate alternate source standard contains 2000 ug/L of each explosive and the surrogate, 1,2-dinitrobenzene. This intermediate standard can be stored at 4° C and used for up to one month.

The ICV standard is prepared in amber vials using an intermediate dilution. First, 600 uL of the intermediate alternate source standard (7.5) is added to a vial with 600 uL of HPLC grade water and mixed yielding a 1000 ug/L standard. Then, 600 uL of this 1000 ug/L standard is added to a vial with 600 uL of dilution solvent (7.4.2) and mixed yielding the 500 ug/L ICV standard.

8.0 DIAGRAM OR TABLE TO OUTLINE PROCEDURES



9.0 SAMPLE PREPARATION

9.1 The preparation of the samples is beyond the scope of this SOP. Please refer to Microbac SOP's EXTNT01 and EXTNT02 for details on sample preparation.

10.0 CALIBRATION PROCEDURES

10.1 Recommended HPLC conditions:

Column:	Ultracarb 5u ODS (250 x 4.6 mm)
Injection Volume:	100 uL
Flow Rate:	0.8 mL/min
Eluent (isocratic):	51.9% methanol/48.1% water
UV Detector	254 nm

10.2 The initial calibration is accomplished by injecting 100 uL of each calibration standard. A linear curve is determined for concentration versus peak area count for each analyte. The correlation coefficient must be ≥ 0.995. If this criteria is not met then the problem must be discerned and the calibrations repeated.

10.2.1 The use of a linear regression fit can cause significant bias at the lower calibration points. A weighing factor ($1/X$ or $1/X^2$) may be used to minimize this bias.

10.3 LCV: For DoD projects, the low calibration standard is reanalyzed immediately following the calibration. All target analyte recoveries must be within 80-120% of the true value.

10.4 ICV: After the analysis of the calibration the second source standard at the continuing calibration level is analyzed. The ICV should have a %D ≤ 30. If corrective action is not taken and analysis proceeds with a failing ICV, results for those compounds that fail to meet the %D limit must be qualified as estimated. For DoD/EDQW projects, the %D must be less than 15% for 8330A and less than 20% for 8330B.

10.5 CCV: At the beginning of each daily analysis and after every ten (10) samples, a 500 ug/L continuing calibration verification must be analyzed. This is done to determine if the response of the analytical system has changed. Details for calculating the %D for the CCV can be found in Section 12.0 of this document. The %D should be ≤ 20%. If a CCV fails to meet this criteria, a second CCV may be analyzed. Failure of two consecutive CCV's requires that the problem be discerned and recalibration may be required. Any samples not bracketed between two passing CCV's must be re-analyzed. If only a few analytes fail the CCV criteria, analysis may proceed but the resulting data must be qualified as estimated.

10.5.1 Projects requiring the use of Method 8330A (e.g. South Carolina) require the CCV %D to be ≤ 15%.

10.6 Recommended HPLC conditions for 2nd column confirmation:

Column:	Acclaim Explosives E2 5um 120Å (4.6 x 250mm)
Injection Volume:	100 uL
Flow Rate:	0.80 mL/min
Eluent:	48% MeOH, 17.5% AcCN, 52% water
UV Detector:	254 nm

10.7 The second column is calibrated using the same scheme as indicated for the primary analysis (10.2). The confirmation column must meet the same calibration criteria as the primary column.

NOTE: If there is insufficient resolution of analytes then it will be necessary to process two (2) separate sets of calibration standards. This can be done by modifying the preparation of the intermediate standard (7.5) and the alternate intermediate standard (7.5). In both situations two (2) intermediate standards are made; one from mix A stock standard and one from mix B stock standard. Both intermediate standards are then used to prepare six (6) calibration standards in the same scheme as 10.2.

11.0 ANALYTICAL PROCEDURES

11.1 The instrument(s) are calibrated and the analytical sequence proceeds as follows:

Analytical batch sequence:

ICAL or CCV
Method blank
LCS, LCSD
7 samples (8 if no LCSD; including MS/MSD, sample/sample duplicate)
Solvent rinse (optional)
CCV
10 samples
CCV standard
etc., with a CCV as the last injection of the sequence

11.2 A report of ND (not detected) is a form of quantitation and must therefore adhere to these rules. The list of compounds requested by the client will constitute the target compounds to be analyzed. Calibration standards which fail criteria for compounds not on the target compound list, will not be considered when interpreting the check standard. Only target compounds, as defined by the clients request will be reported.

11.3 Retention time windows are established in accordance with SW-846 Method 8000B. They are established at initial method setup and repeated when there is a column change or a major modification to the method. The width of retention time windows are defined as ± three times the standard deviation of the retention time of a standard analyzed on three consecutive days. The retention time windows are calculated by analyzing three injections of a standard over the course of a 72 hour period, calculating the standard deviation of the target analytes' retention time, and multiplying each of the standard deviations by 3. The retention time window for a particular analyte then is ± this value. The center of the retention time window is the retention time of each analyte taken from the continuing calibration verification standard run at the beginning of a daily sequence.

11.4 After sample analysis, the data system produces a quantitation report listing target analytes and concentrations found in the sample. A compound is considered tentatively identified if it falls within the calculated retention time window.

11.5 Tentatively identified compounds are confirmed either by reanalysis using an Acclaim Explosives E2 column or by UV diode array detector. Second-column confirmation is a requirement for DoD projects.

11.5.1 To confirm a tentatively identified compound using the UV diode array detector, a UV scan from 190 nm to 400 nm is stored during analysis for each chromatographic peak. Any compound, which is tentatively identified because of its presence in the retention time window of a calibrated explosive is then compared to a stored library of the explosive compounds. The Agilent software is directed to perform a spectrum search for each tentatively identified compound. This action produces a table of match quality along with an overlay of the target peak's spectrum with the library spectrum. Match quality will be a number with a maximum value of 1000. Tentatively identified compounds are confirmed if the match number is ≥ 950. If a compound does not confirm at this match level but has resulted in a spectral overlay which has similarities to the library compound then a second column confirmation will be needed. This may occur when sample matrix effects limit the resolution of the analytes spectrum from the background reference. If the match number is < 950 and no spectral similarity is seen then the compound is not confirmed.

11.5.2 To confirm a tentatively identified compound by second column the sample is re-analyzed utilizing an Acclaim Explosives E2 column which yields different retention times for the explosive compounds. If the RPD for the confirmed results are ≥ 40%, report both results and apply the "P" qualifier. For DoD/EDQW samples, report both results and apply the "J" qualifier, if the RPD exceeds 40%. Address all anomalies in the case narrative.

11.6 If the response for any target analyte exceeds the initial calibration range, the sample must be diluted. Dilutions are prepared so that the majority of compounds above the calibration range fall near the midpoint of the calibration. Dilutions are prepared in a 1:1 mix of acetonitrile: water using syringes to transfer aliquots of extract into appropriate amounts of solvent in autosampler vials. Examples are presented below:

Dilution	Amount sample extract (uL)	Amount Solvent (uL)	Final dilution volume (uL)
2x	200	200	400
5x	100	400	500
10x	100	900	1000
20x	50	950	1000

Higher dilutions are prepared by performing serial dilutions, e.g. for a 100x dilution, a 10x dilution is diluted again by a factor of 10.

11.7 After the raw data is processed, it is uploaded into the LIMS.

11.8 The analyst will perform a primary review and data verification, followed by a secondary review by a peer for quality and completeness.

12.0 DETAILS OF CALCULATIONS

12.1 The calibration factor (CF) from the initial calibration is calculated using the formula:

$$CF = \frac{C_s}{A_s}$$

where:

A_s = Peak area for the analyte or surrogate in the external standard
C_s = Concentration of the external standard (ug/L)

12.2 The slope is calculated using the formula:

$$\frac{n\left(\sum_1^n (C_s)(A_s)\right) - \left(\sum_1^n C_s\right)\left(\sum_1^n A_s\right)}{n\left(\sum_1^n C^2{}_s\right) - \left(\sum_1^n C_s\right)^2}$$

12.3 The intercept of the area axis is calculated using the formula:

$$\frac{\left(\sum_1^n A_s{}^2\right)\left(\sum_1^n C_s\right) - \left(\sum_1^n A_s\right)\left(\sum_1^n A_s C_s\right)}{n\left(\sum_1^n C_s{}^2\right) - \left(\sum_1^n C_s\right)^2}$$

12.4 The % drift is calculated using the formula:

$$\%D = \left[\frac{(C_t - C_x)}{C_t}\right]100$$

where:

C_t = True concentration of the analyte or surrogate in the standard
C_x = Measured concentration of analyte or surrogate in the standard

12.5 The % RSD is calculated using the formula:

$$RSD = \left(\frac{s}{\overline{CF}}\right)100$$

where:

s = standard deviation
$\overline{CF}$ = mean calibration factor

12.6 Linear calibration calculations (external standard method)

12.6.1 The response ratio is plotted vs. the concentration ratio giving a linear equation:

$y = mx + b$

where:

y = Response (area) = R
x = Concentration = C_i
And *m* and *b* are the slope and intercept from the regression equation

For a given response ratio we can solve for C_i:

12.6.2 $$C_i = [R - b]/m$$

Use equations 12.8 or 12.9 to calculate the sample concentration, C_x.

12.7 Solving for the concentration in water sample:

For a given concentration, compute the unknown, C_x

$$C_x = (C_i)\left(V_f / V_i\right)(D)(1000)$$

where:

C_i = concentration in the extract (ug/mL)
V_f = final sample (extract) volume (mL)
V_i = initial sample volume (mL)
D = dilution factor
C_x = concentration in the sample (ug/L)

12.8 Solving for the concentration in soil sample:

$$C_x = (C_i)\left(V_f / W_i\right)(D)(1000)$$

where:

C_i = concentration in the extract (ug/mL)
V_f = final sample (extract) volume (mL)
W_i = initial sample weight (g)
D = dilution factor
C_x = concentration of the sample (ug/kg) (as received)

12.9 The LCS recovery is calculated as follows:

$$\%R = \left(\frac{C_x}{C_T}\right)100$$

where:

C_x = the concentration of the analyte in the LCS.
C_t = the theoretical spike concentration.
$\%R$ = percent recovery

12.10 The % Recovery of the matrix spike is calculated using the formula:

$$\%R = \left[\frac{(C_{spk} - C_x)}{C_t}\right]100$$

where:

C_{spk} = the concentration of the analyte in the spiked sample
C_x = the concentration of the analyte in the reference (parent) sample
C_t = the theoretical spike concentration.
$\%R$ = percent recovery

12.11 The relative percent difference is calculated using the formula:

$$RPD = \left[\frac{|C_1 - C_2|}{(C_1 + C_2)}\right]200$$

where:

C_1 = Concentration of the first sample
C_2 = Concentration of the second sample

13.0 QUALITY CONTROL REQUIREMENTS

13.1 The quality control procedures discussed in this section are intended to monitor and control the entire analytical process. Batch quality samples are specified for method blanks (MB), LCS, MS, MSD and surrogate compounds. A batch is defined as a group of samples, which are extracted together. A batch contains a maximum of 20 samples. Additional procedures were defined in Section 8.0 for initial calibration, ICV using a second source, and CCV, and are included in the overall review process. The procedures, required frequency, acceptance criteria, and the required corrective action measures are outlined in Table 4. The MS/MSD samples may be waived if insufficient sample is available. All QC samples must undergo the identical extraction and cleanup procedures as each sample in the batch. A standard containing the analytes of interest is used as the spike in the LCS, MS, and MSD. The LCS, MS and MSD will all be spiked so as to yield a concentration that falls within the mid-point of the curve.

13.2 The method blank cannot contain amounts of any target analytes, which are above the RL. If any target analytes are found in the method blank with concentrations higher than the RL, the entire batch must be re-extracted and the analysis performed again. All blanks are evaluated down to the current MDL for the presence of target analytes. Any amount of target analytes found in the blank at a level greater than the current MDL are reported in the LIMS and these values will appear on the QC summary sheet for the batch. For DoD projects, the blank is evaluated to one-half of the RL.

13.3 The LCS must be evaluated for the acceptance criteria listed in Tables 1 and 2, and for any project specific criteria which may be more, or less, stringent. Upon completion of a batch of samples, LCS summary reports are generated by the analyst, which compare the actual recoveries to the applicable acceptance ranges for the samples in the batch. The standard laboratory limits specified in Tables 1 and 2 are used in the absence of a project QAPP, or program specified control limits. If more than 10% of the LCS analytes are out of the laboratory limits, the analyst must stop the analysis, prepare an NCR, and contact the department supervisor for the appropriate corrective action. If any of the identified project specific chemicals of concern (COC) are outside the control limits, the analyst must stop the analysis and prepare an NCR to be reviewed by the department supervisor. Corrective action consists of re-extraction and re-analysis of the affected samples for, at a minimum, the COC for which a result was derived outside control limits, unless the client's representative and the Quality Assurance Officer (QAO) approve of another course of action.

13.5 A standard reference material (SRM) is used in lieu of the normal soil LCS for all DoD/EDQW projects performed under reference 17.2. The laboratory derived acceptance limits for the SRM (ERA Cat. # 093) are presented in Table 3.

13.6 In order to monitor the extraction efficiency in each sample, a surrogate solution containing 1,2-dinitrobenzene is added to each sample in the extraction batch. The recoveries for this surrogate must fall within the limits given in Tables 1 and 2. If any individual sample has the surrogate outside the given limit, then the sample must be re-extracted. Surrogate limits are listed in Tables 1 and 2.

13.7 Compounds are normally confirmed by diode array detector; however, when required by a specific project i.e. DoD they may be confirmed by re-analysis using an alternate column. If the results between the primary and secondary column vary by more than 40%, the higher of the results is reported unless sample matrix effects (e.g. interfering peaks) are present. The confirmation column must meet all quality control acceptance criteria.

13.8 Triplicate Analysis (DoD/EDQW and other projects as specified)

Selected projects that are conducted in strict accordance with the DoD/EDQW guide, may require triplicate analysis of selected samples. Normally, samples are selected by the client that are expected to contain explosives above the RL. The %RSD for these the reportable analytes must not exceed 20%. Corrective action and/or data flagging must be initiated when these criteria are not met.

13.9 Control of Nonconforming Data

The laboratory implements general procedures to be followed when departures from documented policies, procedures and quality control have occurred. The policies and procedures are found in Section 13.0 of Microbac SOP LQAP (Laboratory Quality Assurance Program), Microbac SOP GP-CAPA (Corrective Action/Preventive Action: Initiating, Tracking and Monitoring) and Microbac SOP GP-RCA (Root Cause Analysis).

13.9.1 Nonconformances Requiring Corrections

A nonconformance occurs when any aspect of the method QC in an analysis, as outlined in Table 4 does not meet acceptance criteria. When nonconforming data occurs the employee initiates an NCR and proceeds with indicated corrections as per Table 4.

All data shall be scrutinized by the analysts for method and project specific compliance. Checklists are utilized and accompany each data batch (Figure 1).

A nonconformance shall be documented in the NCR followed by one or more of the following actions.

- Reanalysis of the sample(s) in question
- Discussion and qualification of data (report and narrative)
- Client notification with approval
- Data qualification (Q-flagging)
- Re-sampling and reanalysis (client decision)

13.9.2 Nonconformances Requiring Corrective Action

Corrective action is required when a nonconformance is recurring, if the correction is ineffective or if the departure is so significant that it negatively effects data quality, sample integrity or customer satisfaction. When an event requiring corrective action is identified, the employee shall initiate a Corrective Action/ Preventive Action form as per Microbac SOP GP-CAPA. The corrective action process includes a root cause analysis as per Microbac SOP GP-RCA, corrections, corrective action(s) and evidence of effectiveness.

13.9.3 Nonconformances Not Requiring Corrections

There are some standard contingencies to the traditional corrections that may be invoked. In many situations it may not be necessary to perform sample reanalysis or re-extraction for the following quality control departures, provided they are not a chronic problem or indicative of a trend, and the laboratory provides documentation in the report narrative and project files. In addition, the employee is required to initiate a NCR to record the event. The data may be reported as per the following exceptions.

- An LCS or surrogate recovery exceeds the upper control limit, but the corresponding sample results are non-detect.
- A method blank is greater than or equal to the reporting limit, but the corresponding sample results are non-detect.
- Surrogate recovery is high and the samples are non-detect.
- The continuing calibration verification (bracketing) is biased high and the samples are non-detect.
- There is insufficient sample volume or weight to perform a corrective action.
- The sample has exceeded holding time.

14.0 DATA REVIEW AND REPORTING REQUIREMENTS

14.1 Data Review

Prior to data entry into the LIMS (either manual or automatic), all data must undergo two (2) levels of review in the department. The primary review is performed by the analyst and the secondary review is performed by either the department supervisor (or a designee) or another qualified analyst.

14.2 Data Reporting

The reporting requirements depend upon the need of the client. Microbac offers four levels of data reporting which are described in some detail below.

14.2.1 Level 1 reporting provides the client with the results for all samples submitted for analysis. No other documents or raw data are provided with this level of report.

14.2.2 Level 2 reporting provides the client with all of the information contained in a Level 1 report plus a summary of all of the QC analysis associated with the samples submitted by the client.

14.2.3 Level 3 reporting is essentially a custom report provided to the client that contains any additional data from the analysis that the client might request.

14.2.4 Level 4 reporting is provided in those cases where the client wishes to perform full data validation. All raw data, lab generated logs, and other associated data are provided.

14.2.5 Results for water samples are reported in ug/L to three significant figures.

14.2.6 Results for soil samples are reported in ug/kg, or mg/kg, on a dry weight basis to three significant figures.

15.0 PREVENTIVE MAINTENANCE

15.1 All extracts analyzed should be put through a 0.45 um filter prior to analysis.

15.2 A guard column may be used. Connect the guard column just before the analytical column.

16.0 WASTE MANAGEMENT AND POLLUTION CONTROL

16.1 Microbac is dedicated to eliminating or minimizing any and all laboratory waste, which requires disposal or contributes to pollution of any type. To that extent Microbac has implemented new technology and converted to micro techniques when available to facilitate these goals.

Each laboratory generates specific waste streams which are segregated and collected in labeled satellite containers. The analysts in each department are responsible for proper disposal of the spent samples and chemical waste in the specified satellite waste collection vessel. The waste management technician checks the satellite containers either daily, or as needed. They are then combined into waste drums in our explosion-proof waste building located outside of the Microbac laboratory facility. These drums are labeled with start date and a manifest is created for each. They are picked up on a regular basis for disposal at a licensed disposal facility.

16.2 This method generates wastes in the form of sample extracts in vials, which are placed in the satellite waste container labeled for Waste Vials/Sample Extracts (D001, F002).

16.3 Laboratory policies and procedures for management of hazardous waste are found in Microbac SOP 33 Laboratory Waste Management and the waste management section of the analytical SOPs contain procedures specific to each method. All laboratory waste is accumulated, stored and disposed in accordance with all federal and state laws and regulations Each employee receives training in the proper handling and disposal of hazardous waste that is specific to their job description. As a hazardous generator, we are subject to inspection from the Ohio EPA.

16.4 The waste streams generated by the HPLC are as follows:

- Non – halogenated solvents (methanol and acetonitrile)
- Solid waste (auto-sampler vials)

17.0 REFERENCES

17.1 SW-846 Method 8330B, Revision 2, October 2006

17.2 Guide for Implementing EPA SW-846 Method 8330B, DoD Environmental Quality Workgroup (EDQW), July 2008.

17.3 SW-846 Method 8330A, Revision 1, February 2007.

17.4 Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, SW-846, Method 8000B, Revision 2, December 1996.

17.5 Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, SW-846, Method 8000C, Revision 3, March 2003.

17.6 Microbac SOP33, "Laboratory Waste Management"

17.7 Microbac SOP LQAP, “Laboratory Quality Assurance Plan”

17.8 Microbac SOP45, “Standard Operating Procedures for Method Validation Procedures”

17.9 Microbac SOP GC-CAPA, “Corrective Action/Preventive Action: Initiating, Tracking and Monitoring”

17.10 Microbac SOP GP-RCA, “Root Cause Analysis”

APPENDIX I
South Carolina Requirements

The state of South Carolina requires the use of Method 8330A for sample analysis.

APPENDIX II
Analysis of PETN

The following changes are made to SOP HPLC02 for the analysis of pentaerythritol tetranitrate (PETN) by HPLC:

1.0 The primary stock standard is purchased from Restek (31600) at a concentration of 1,000 ug/mL. Working standards are made as in Section 7.4 of HPLC02.

2.0 The alternate source stock standard is purchased from AccuStandard (M-8330B-ADD-2) at a concentration of 100ug/ml and prepared as in Section 7.5 of HPLC02.

3.0 Recommended HPLC conditions;

Column:	Restek Pinnacle II C18 100 mm X 4.6 mm
Injection Volume:	100 uL
Flow rate:	1.0 mL/min
Eluent:	52% H2O, 48% Methanol
UV detector:	Diode Array Detector @ 210 nm

4.0 See Table 5 for QA Objectives.

TABLE 1
MICROBAC's OBJECTIVES AND ANALYTICAL METHODS FOR NITROAROMATIC EXPLOSIVES ANALYSES OF WATER SAMPLES

PARAMETER	CAS #	ACCURACY (% RECOVERY)*	PRECISION (% RPD)*	OBSERVED MDL WATER (ug/L)	REPORTING LIMITS WATER (ug/L)
1,3,5-trinitrobenzene	99-35-4	65-140	0-20	0.25	1
1,3-dinitrobenzene	99-65-0	45-160	0-20	0.25	1
2,4,6-trinitrotoluene	118-96-7	30-135	0-20	0.25	1
2,4-dinitrotoluene	121-14-2	60-135	0-20	0.25	1
2,6-dinitrotoluene	606-20-2	60-135	0-20	0.25	1
2-amino-4,6-dinitrotoluene	35572-78-2	50-155	0-20	0.25	1
2-nitrotoluene	88-72-2	45-135	0-20	0.25	1
3-nitrotoluene	99-08-1	50-130	0-20	0.25	1
4-amino-2,6-dinitrotoluene	19406-51-0	55-155	0-20	0.25	1
4-nitrotoluene	99-99-0	50-130	0-20	0.25	1
HMX	2691-41-0	50-125	0-20	0.25	1
Nitrobenzene	98-95-3	50-140	0-20	0.25	1
RDX	121-82-4	50-160	0-20	0.25	1
Tetryl	479-45-8	20-175	0-20	0.25	1
Nitroglycerin	55-63-0	50-150	0-20	0.25	1
1,2-dinitrobenzene (surr)	528-29-0	50-140	-	-	-

* Values are statistically derived from laboratory control samples and are evaluated annually. Actual control limits may vary.

TABLE 2
MICROBAC's OBJECTIVES AND ANALYTICAL METHODS FOR NITROAROMATIC EXPLOSIVES ANALYSES OF SOIL SAMPLES

PARAMETER	CAS #	ACCURACY (% RECOVERY)*	PRECISION (% RPD)*	OBSERVED MDL SOIL (mg/Kg)	REPORTING LIMITS SOIL (mg/Kg)
1,3,5-trinitrobenzene	99-35-4	75-125	0-20	0.1	0.25
1,3-dinitrobenzene	99-65-0	80-125	0-20	0.1	0.25
2,4,6-trinitrotoluene	118-96-7	45-135	0-20	0.1	0.25
2,4-dinitrotoluene	121-14-2	80-125	0-20	0.1	0.25
2,6-dinitrotoluene	606-20-2	80-120	0-20	0.1	0.25
2-amino-4,6-dinitrotoluene	35572-78-2	80-125	0-20	0.1	0.25
2-nitrotoluene	88-72-2	80-125	0-20	0.1	0.25
3-nitrotoluene	99-08-1	75-120	0-20	0.1	0.25
4-amino-2,6-dinitrotoluene	19406-51-0	80-125	0-20	0.1	0.25
4-nitrotoluene	99-99-0	75-125	0-20	0.1	0.25
HMX	2691-41-0	75-125	0-20	0.1	0.25
Nitrobenzene	98-95-3	75-140	0-20	0.1	0.25
RDX	121-82-4	70-130	0-20	0.1	0.25
Tetryl	479-45-8	10-150	0-20	0.1	0.25
Nitroglycerin	55-63-0	50-150	0-20	0.1	0.25
1,2-dinitrobenzene (surr)	528-29-0	50-140	-	-	-

* Values are statistically derived from laboratory control samples and are evaluated annually. Actual control limits may vary.

TABLE 3
STANDARD REFERENCE MATERIAL CONTROL LIMITS

PARAMETER	TRUE VALUE (ug/Kg)	ACCEPTANCE LIMITS (ug/Kg)
4-amino-2,6-dinitrotoluene	946	437-931
2-amino-4,6-dinitrotoluene	650	365-700
1,3-dinitrobenzene	1010	698-1170
2,4-dinitrotoluene	639	410-768
2,6-dinitrotoluene	1320	789-1600
HMX	620	333-715
Nitrobenzene	1400	444-1660
2-nitrotoluene	1460	685-1710
3-nitrotoluene	1020	654-1260
4-nitrotoluene	1840	1150-2270
RDX	586	349-682
1,3,5-trinitrobenzene	701	407-814
2,4,6-trinitrotoluene	810	493-842
Nitroglycerin	1000	603-1150
Pentaerythritol tetranitrate (PETN)	1000	603-1150

TABLE 4
QUALITY CONTROL CRITERIA
NITROAROMATICS AND NITRAMINES
METHOD 8330

Control Item	Frequency	Acceptance Criteria	Corrective Action
Initial Calibration (ICAL)	Initially and upon failure of two consecutive CCV's	Correlation coefficient (R) for linear regression ≥ 0.995.	Evaluate cause; Repeat calibration; Or qualify data and discuss in narrative (1)
Second source calibration verification (ICV)	After each initial calibration	≤ 30% drift; ≤ 15% drift (DoD 8330A) ≤ 20% drift (DoD 8330B) (1)	Re-analyze ICV; upon second failure, repeat initial calibration (1)
Low calibration verification (LCV)	After each initial calibration	Recovery between 80-120% of true value.	Evaluate cause, repeat calibration.
Continuing calibration verification (CCV)	Daily, before sample analysis, every ten samples, and at the end of the analysis sequence	8330A: ≤ 15% drift; 8330B: ≤ 20% drift (1)	Samples bracketed by an unacceptable CCV must be reanalyzed. Repeat initial calibration after two consecutive failures of the CCV (1).
Method Blank (MB)	One per matrix/batch: Maximum of 20 samples per batch	< project reporting limit for each target analyte; (< 1/2 reporting limit for DoD). (1)	Notify supervisor and initiate NCR; Investigate; re-extract/ reanalyze samples or qualify data and address in the report narrative (3)
Laboratory Control Sample (LCS) or Standard Reference Material (SRM)	One per matrix/batch: Maximum of 20 samples per batch	Target compounds within the designated ranges; use project QAPP or standard control criteria (1,2)	Notify supervisor and initiate NCR; Investigate; re-extract/ reanalyze samples or qualify data and address in the report narrative (3)
Matrix Spikes/ Matrix Spike Duplicate (MS/MSD)	One per matrix/batch; maximum of 20 samples per batch	Target compounds within the designated range (1)	Qualify data and/or address in the report narrative.
Surrogate Spike	Every sample, standard, and quality control sample	Recoveries within the designated rages; use project QAPP or standard control criteria (1)	Notify supervisor and initiate NCR; investigate; re-extract/reanalyze sample(s) or qualify data and address in the report narrative (3)

(1) Evaluation criteria are often project specific. Check the project QAPP.
(2) Standard criteria are set at three standard deviations from the mean. 10% marginal failure allowed, otherwise re-extract and re-analyze batch; consult supervisor and project QAPP for any exceptions.
(3) Data will be qualified if sample volume is insufficient for re-extraction/re-analysis.

TABLE 5
MICROBAC'S QA OBJECTIVES AND ANALYTICAL METHODS FOR THE ANALYSIS OF PETN IN WATER SAMPLES

PARAMETER	CAS #	ACCURACY (% RECOVERY)*	PRECISION (%RPD)*	VERIFIED MDL (ug/L)**	REPORTING LIMIT (ug/L)
Pentaerythritol tetranitrate (PETN)	78-11-5	40-130	0-40	0.25	1

TABLE 6
MICROBAC'S QA OBJECTIVES AND ANALYTICAL METHODS FOR THE ANALYSIS OF PETN IN SOIL SAMPLES

PARAMETER	CAS #	ACCURACY (% RECOVERY)*	PRECISION (%RPD)*	VERIFIED MDL (mg/kg)**	REPORTING LIMIT (mg/kg)
Pentaerythritol tetranitrate (PETN)	78-11-5	30-140	0-40	0.1	0.25

*Values are currently nominal, will be derived from laboratory control samples, and may be revised.
**Values are statistically verified annually.

Uncontrolled Copy

FIGURE 1

Checklist ID: 28305

Microbac Laboratories Inc.

Data Checklist

Date: 06-MAY-2008
Analyst: JWR
Analyst: NA
Method: 8330
Instrument: HPLC5
Curve Workgroup: NA
Runlog ID: 22091
Analytical Workgroups: 04-0001,2,3,4 (MDL-Q'S) 04-0660 (WATER & SOIL) 2ND COLUMN RUN

ANALYTICAL	
System Performance Check	X
DFTPP (MS)	NA
Endrin/DDT breakdown (8081/MS)	NA
Pentachlorophenol/benzidine tailing (MS)	NA
Eluent check (IC)/system pressure (HPLC)	X
Window standard (FID)	NA
Initial Calibration	NA
Average RF	NA
Linear regression or higher order curve	NA
Alternate source standard (ICV) % Difference	NA
Continuing Calibration (CCV)	X
% D/% Drift	X
Minimum response factors (MS)	NA
Continuing calibration blank (CCB) (IC)	NA
Special standards	NA
Blanks	X
TCL hits	X
Surrogate recoveries	X
LCS/LCSD (Laboratory Control Sample)	X
Recoveries	X
Surrogate recoveries	X
MS/MSD/Sample duplicates	NA
Recoveries	NA
%RPD	NA
Samples	X
TCL hits	X
Mass spectra (MS/HPLC)/2nd column confirmations (ECD/FID/HPLC)	X
Surrogate recoveries	X
Internal standard areas (MS)	NA
Library searches (MS)	NA
Calculations & correct factors	X
Compounds above calibration range	NA
Reruns	NA
Manual integrations	NA
Project/client specific requirements	X
REPORTING	
Upload batch form	X
KOBRA workgroup dataforms/bench sheets	X
Case narratives	X
Check for completeness	X
Primary Reviewer	JWR
SUPERVISORY/SECONDARY REVIEW	
Check for compliance with method and project specific requirements	X
Check the completeness/accuracy of reported information	X
Data qualifiers	X
Secondary Reviewer	MDC

Primary Reviewer:
08-MAY-2008

Secondary Reviewer:
09-MAY-2008

CHECKLIST1 - Modified 03/05/2008
Generated: MAY-09-2008 09:11:29

Figure 2

Run Log ID: 22091

Microbac Laboratories Inc.
Instrument Run Log

Instrument: HPLC5 Dataset: 050608
Analyst1: JWR Analyst2: NA
Method: 8330 SOP: HPLC02 Rev: 10

Maintenance Log ID: 24069

Column 1 ID: ACCLAIM E2 Column 2 ID: NA
Workgroups: WG270401 WG270402
Internal STD: NA Surrogate STD: STD25780 Calibration STD:

Comments: These are the Second Column Confirmations
Nitroglycerin results were confirmed using Diode Array on the initial analysis of these samples.

Seq.	File ID	Sample Information	Mat	Dil	Reference	Date/Time
1	5L001829.F	Solvent Rinse	1	1		05/06/08 14:02
2	5L001830.F	Solvent Rinse	1	1		05/06/08 14:20
3	5L001831.F	Solvent Rinse	1	1		05/06/08 15:14
4	5L001832.F	WG270490-01 CCV	1	1		05/06/08 16:07
5	5L001833.F	WG270401-01 MRL	7	1		05/06/08 17:27
6	5L001834.F	WG269664-01 BLK	7	1		05/06/08 18:44
7	5L001835.F	WG269664-02 LCS	7	1		05/06/08 19:37
8	5L001836.F	WG269664-03 LCS2	7	1		05/06/08 20:30
9	5L001837.F	L08040003-01 MDL	7	1		05/06/08 21:23
10	5L001838.F	L08040004-01 MDL	7	1		05/06/08 22:17
11	5L001839.F	L08040660-01 10X	7	10		05/06/08 23:10
12	5L001840.F	Solvent Rinse	1	1		05/07/08 00:03
13	5L001841.F	Solvent Rinse	1	1		05/07/08 00:21
14	5L001842.F	Solvent Rinse	1	1		05/07/08 01:14
15	5L001843.F	WG270401-02 MRL	7	1		05/07/08 02:08
16	5L001844.F	WG270490-02 CCV	1	1		05/07/08 03:01
17	5L001845.F	WG270402-01 MRL	1	1		05/07/08 03:54
18	5L001846.F	WG269634-01 BLK	1	1		05/07/08 04:47
19	5L001847.F	WG269634-02 LCS	1	1		05/07/08 05:40
20	5L001848.F	WG269634-03 LCS2	1	1		05/07/08 06:33
21	5L001849.F	L08040001-01 MDL	1	1		05/07/08 07:26
22	5L001850.F	L08040002-01 MDL	1	1		05/07/08 08:18
23	5L001851.F	L08040660-02 100X	1	100		05/07/08 09:11
24	5L001852.F	Solvent Rinse	1	1		05/07/08 10:04
25	5L001853.F	Solvent Rinse	1	1		05/07/08 10:22
26	5L001854.F	Solvent Rinse	1	1		05/07/08 11:16
27	5L001855.F	WG270402-02 MRL	1	1		05/07/08 12:09
28	5L001856.F	WG270490-03 CCV	1	1		05/07/08 13:30

Comments

Seq.	Rerun	Dil	Reason	Analytes

Page: 1 Approved: 09-MAY-08

APPENDIX E

LABORATORY CERTIFICATIONS

Texas Commission on Environmental Quality

NELAP-Recognized Laboratory Accreditation is hereby awarded to

Microbac Laboratories, Inc., Ohio Valley Division

158 Starlite Drive
Marietta, OH 45750-5279

in accordance with Texas Water Code Chapter 5, Subchapter R, Title 30 Texas Administrative Code Chapter 25, and the National Environmental Laboratory Accreditation Program.

The laboratory's scope of accreditation includes the fields of accreditation that accompany this certificate. Continued accreditation depends upon successful ongoing participation in the program. The Texas Commission on Environmental Quality urges customers to verify the laboratory's current location(s) and accreditation status for particular methods and analyses (www.tceq.texas.gov/goto/lab). Accreditation does not imply that a product, process, system or person is approved by the Texas Commission on Environmental Quality.

Certificate Number: T104704254-13-6
Effective Date: 4/1/2013
Expiration Date: 3/31/2014

Executive Director Texas Commission on Environmental Quality

Texas Commission on Environmental Quality

NELAP - Recognized Laboratory Fields of Accreditation

Certificate: T104704254-13-6
Expiration Date: 3/31/2014
Issue Date: 4/1/2013

Microbac Laboratories, Inc., Ohio Valley Division
158 Starlite Drive
Marietta, OH 45750-5279

These fields of accreditation supercede all previous fields. The Texas Commission on Environmental Quality urges customers to verify the laboratory's current accreditation status for particular methods and analyses.

Matrix: ***Non-Potable Water***

Method EPA 1010

Analyte	AB	Analyte ID	Method ID
Ignitability	FL	1780	10116606

Method EPA 110.2

Analyte	AB	Analyte ID	Method ID
Color	FL	1605	10005604

Method EPA 120.1

Analyte	AB	Analyte ID	Method ID
Conductivity	FL	1610	10006403

Method EPA 130.2

Analyte	AB	Analyte ID	Method ID
Total hardness as CaCO3	FL	1755	10007202

Method EPA 150.1

Analyte	AB	Analyte ID	Method ID
pH	FL	1900	10008409

Method EPA 160.1

Analyte	AB	Analyte ID	Method ID
Residue-filterable (TDS)	FL	1955	10009208

Method EPA 160.2

Analyte	AB	Analyte ID	Method ID
Residue-nonfilterable (TSS)	FL	1960	10009606

Method EPA 160.3

Analyte	AB	Analyte ID	Method ID
Residue-total (total solids)	FL	1950	10010001

Method EPA 160.4

Analyte	AB	Analyte ID	Method ID
Residue-volatile	FL	1970	10010409

Method EPA 160.5

Analyte	AB	Analyte ID	Method ID
Residue-settleable	FL	1965	10010807

Method EPA 1664

Analyte	AB	Analyte ID	Method ID

Texas Commission on Environmental Quality

NELAP - Recognized Laboratory Fields of Accreditation

		Certificate:	T104704254-13-6
Microbac Laboratories, Inc., Ohio Valley Division		Expiration Date:	3/31/2014
158 Starlite Drive Marietta, OH 45750-5279		Issue Date:	4/1/2013

These fields of accreditation supercede all previous fields. The Texas Commission on Environmental Quality urges customers to verify the laboratory's current accreditation status for particular methods and analyses.

Matrix: ***Non-Potable Water***

n-Hexane Extractable Material (HEM) (O&G)	FL	1803	10127409
Silica Gel Treated n-Hexane Extractable Material (SGT-HEM)	FL	10220	10127409

Method EPA 180.1

Analyte	AB	Analyte ID	Method ID
Turbidity	FL	2055	10011606

Method EPA 200.7

Analyte	AB	Analyte ID	Method ID
Aluminum	FL	1000	10013806
Antimony	FL	1005	10013806
Arsenic	FL	1010	10013806
Barium	FL	1015	10013806
Beryllium	FL	1020	10013806
Boron	FL	1025	10013806
Cadmium	FL	1030	10013806
Calcium	FL	1035	10013806
Chromium	FL	1040	10013806
Cobalt	FL	1050	10013806
Copper	FL	1055	10013806
Iron	FL	1070	10013806
Lead	FL	1075	10013806
Lithium	FL	1080	10013806
Magnesium	FL	1085	10013806
Manganese	FL	1090	10013806
Molybdenum	FL	1100	10013806
Nickel	FL	1105	10013806
Potassium	FL	1125	10013806
Selenium	FL	1140	10013806
Silica as SiO2	FL	1990	10013806
Silver	FL	1150	10013806
Sodium	FL	1155	10013806
Strontium	FL	1160	10013806

Texas Commission on Environmental Quality

NELAP - Recognized Laboratory Fields of Accreditation

Microbac Laboratories, Inc., Ohio Valley Division
158 Starlite Drive
Marietta, OH 45750-5279

Certificate: T104704254-13-6
Expiration Date: 3/31/2014
Issue Date: 4/1/2013

These fields of accreditation supercede all previous fields. The Texas Commission on Environmental Quality urges customers to verify the laboratory's current accreditation status for particular methods and analyses.

Matrix: ***Non-Potable Water***

Thallium	FL	1165	10013806
Tin	FL	1175	10013806
Titanium	FL	1180	10013806
Vanadium	FL	1185	10013806
Zinc	FL	1190	10013806

Method EPA 200.8

Analyte	AB	Analyte ID	Method ID
Antimony	FL	1005	10014605
Arsenic	FL	1010	10014605
Barium	FL	1015	10014605
Cadmium	FL	1030	10014605
Chromium	FL	1040	10014605
Cobalt	FL	1050	10014605
Copper	FL	1055	10014605
Lead	FL	1075	10014605
Manganese	FL	1090	10014605
Nickel	FL	1105	10014605
Selenium	FL	1140	10014605
Silver	FL	1150	10014605
Thallium	FL	1165	10014605
Vanadium	FL	1185	10014605
Zinc	FL	1190	10014605

Method EPA 245.1

Analyte	AB	Analyte ID	Method ID
Mercury	FL	1095	10036609

Method EPA 300.0

Analyte	AB	Analyte ID	Method ID
Bromide	FL	1540	10053006
Chloride	FL	1575	10053006
Fluoride	FL	1730	10053006
Nitrate as N	FL	1810	10053006

Texas Commission on Environmental Quality

NELAP - Recognized Laboratory Fields of Accreditation

Certificate:	T104704254-13-6
Expiration Date:	3/31/2014
Issue Date:	4/1/2013

Microbac Laboratories, Inc., Ohio Valley Division

158 Starlite Drive
Marietta, OH 45750-5279

These fields of accreditation supercede all previous fields. The Texas Commission on Environmental Quality urges customers to verify the laboratory's current accreditation status for particular methods and analyses.

Matrix: ***Non-Potable Water***

Nitrite as N	FL	1840	10053006
Sulfate	FL	2000	10053006

Method EPA 305.1

Analyte	AB	Analyte ID	Method ID
Acidity, as CaCO3	FL	1500	10054203

Method EPA 310.2

Analyte	AB	Analyte ID	Method ID
Alkalinity as CaCO3	FL	1505	10055206

Method EPA 325.2

Analyte	AB	Analyte ID	Method ID
Chloride	FL	1575	10057202

Method EPA 335.1

Analyte	AB	Analyte ID	Method ID
Amenable cyanide	FL	1510	10060001

Method EPA 335.2

Analyte	AB	Analyte ID	Method ID
Total cyanide	FL	1645	10060409

Method EPA 340.2

Analyte	AB	Analyte ID	Method ID
Fluoride	FL	1730	10062201

Method EPA 350.1

Analyte	AB	Analyte ID	Method ID
Ammonia as N	FL	1515	10063408

Method EPA 351.2

Analyte	AB	Analyte ID	Method ID
Kjeldahl nitrogen - total (TKN)	FL	1795	10065200

Method EPA 353.2

Analyte	AB	Analyte ID	Method ID
Nitrate as N	FL	1810	10067400
Nitrate-nitrite	FL	1820	10067400

Method EPA 354.1

Analyte	AB	Analyte ID	Method ID

Texas Commission on Environmental Quality

NELAP - Recognized Laboratory Fields of Accreditation

Certificate: T104704254-13-6
Expiration Date: 3/31/2014
Issue Date: 4/1/2013

Microbac Laboratories, Inc., Ohio Valley Division

158 Starlite Drive
Marietta, OH 45750-5279

These fields of accreditation supercede all previous fields. The Texas Commission on Environmental Quality urges customers to verify the laboratory's current accreditation status for particular methods and analyses.

Matrix: ***Non-Potable Water***

Nitrite as N	FL	1840	10068607

Method EPA 365.2

Analyte	AB	Analyte ID	Method ID
Orthophosphate as P	FL	1870	10070403

Method EPA 365.4

Analyte	AB	Analyte ID	Method ID
Phosphorus	FL	1910	10071202

Method EPA 375.4

Analyte	AB	Analyte ID	Method ID
Sulfate	FL	2000	10073800

Method EPA 376.1

Analyte	AB	Analyte ID	Method ID
Sulfide	FL	2005	10074201

Method EPA 405.1

Analyte	AB	Analyte ID	Method ID
Biochemical oxygen demand (BOD)	FL	1530	10075602

Method EPA 410.4

Analyte	AB	Analyte ID	Method ID
Chemical oxygen demand (COD)	FL	1565	10077200

Method EPA 415.1

Analyte	AB	Analyte ID	Method ID
Total Organic Carbon (TOC)	FL	2040	10078407

Method EPA 420.1

Analyte	AB	Analyte ID	Method ID
Total phenolics	FL	1905	10079400

Method EPA 6010

Analyte	AB	Analyte ID	Method ID
Aluminum	FL	1000	10155201
Antimony	FL	1005	10155201
Arsenic	FL	1010	10155201
Barium	FL	1015	10155201

Texas Commission on Environmental Quality

NELAP - Recognized Laboratory Fields of Accreditation

Microbac Laboratories, Inc., Ohio Valley Division
158 Starlite Drive
Marietta, OH 45750-5279

Certificate: T104704254-13-6
Expiration Date: 3/31/2014
Issue Date: 4/1/2013

These fields of accreditation supercede all previous fields. The Texas Commission on Environmental Quality urges customers to verify the laboratory's current accreditation status for particular methods and analyses.

Matrix: ***Non-Potable Water***

Beryllium	FL	1020	10155201
Boron	FL	1025	10155201
Cadmium	FL	1030	10155201
Calcium	FL	1035	10155201
Chromium	FL	1040	10155201
Cobalt	FL	1050	10155201
Copper	FL	1055	10155201
Iron	FL	1070	10155201
Lead	FL	1075	10155201
Lithium	FL	1080	10155201
Magnesium	FL	1085	10155201
Manganese	FL	1090	10155201
Molybdenum	FL	1100	10155201
Nickel	FL	1105	10155201
Potassium	FL	1125	10155201
Selenium	FL	1140	10155201
Silica as SiO2	FL	1990	10155201
Silver	FL	1150	10155201
Sodium	FL	1155	10155201
Strontium	FL	1160	10155201
Thallium	FL	1165	10155201
Tin	FL	1175	10155201
Titanium	FL	1180	10155201
Vanadium	FL	1185	10155201
Zinc	FL	1190	10155201

Method EPA 6020

Analyte	AB	Analyte ID	Method ID
Antimony	FL	1005	10156204
Arsenic	FL	1010	10156204
Barium	FL	1015	10156204

Texas Commission on Environmental Quality

NELAP - Recognized Laboratory Fields of Accreditation

	Certificate:	T104704254-13-6
Microbac Laboratories, Inc., Ohio Valley Division	Expiration Date:	3/31/2014
158 Starlite Drive Marietta, OH 45750-5279	Issue Date:	4/1/2013

These fields of accreditation supercede all previous fields. The Texas Commission on Environmental Quality urges customers to verify the laboratory's current accreditation status for particular methods and analyses.

Matrix: ***Non-Potable Water***

Cadmium	FL	1030	10156204
Chromium	FL	1040	10156204
Cobalt	FL	1050	10156204
Copper	FL	1055	10156204
Lead	FL	1075	10156204
Manganese	FL	1090	10156204
Nickel	FL	1105	10156204
Selenium	FL	1140	10156204
Silver	FL	1150	10156204
Thallium	FL	1165	10156204
Vanadium	FL	1185	10156204
Zinc	FL	1190	10156204

Method EPA 608

Analyte	AB	Analyte ID	Method ID
4,4'-DDD	FL	7355	10103603
4,4'-DDE	FL	7360	10103603
4,4'-DDT	FL	7365	10103603
Aldrin	FL	7025	10103603
alpha-BHC (alpha-Hexachlorocyclohexane)	FL	7110	10103603
Aroclor-1016 (PCB-1016)	FL	8880	10103603
Aroclor-1221 (PCB-1221)	FL	8885	10103603
Aroclor-1232 (PCB-1232)	FL	8890	10103603
Aroclor-1242 (PCB-1242)	FL	8895	10103603
Aroclor-1248 (PCB-1248)	FL	8900	10103603
Aroclor-1254 (PCB-1254)	FL	8905	10103603
Aroclor-1260 (PCB-1260)	FL	8910	10103603
beta-BHC (beta-Hexachlorocyclohexane)	FL	7115	10103603
Chlordane (tech.)	FL	7250	10103603
delta-BHC (delta-Hexachlorocyclohexane)	FL	7105	10103603
Dieldrin	FL	7470	10103603

Texas Commission on Environmental Quality

NELAP - Recognized Laboratory Fields of Accreditation

Microbac Laboratories, Inc., Ohio Valley Division
158 Starlite Drive
Marietta, OH 45750-5279

Certificate: T104704254-13-6
Expiration Date: 3/31/2014
Issue Date: 4/1/2013

These fields of accreditation supercede all previous fields. The Texas Commission on Environmental Quality urges customers to verify the laboratory's current accreditation status for particular methods and analyses.

Matrix: ***Non-Potable Water***

Endosulfan I	FL	7510	10103603
Endosulfan II	FL	7515	10103603
Endosulfan sulfate	FL	7520	10103603
Endrin	FL	7540	10103603
Endrin aldehyde	FL	7530	10103603
gamma-BHC (Lindane, gamma-Hexachlorocyclohexane)	FL	7120	10103603
Heptachlor	FL	7685	10103603
Heptachlor epoxide	FL	7690	10103603
Toxaphene (Chlorinated camphene)	FL	8250	10103603

Method EPA 624

Analyte	AB	Analyte ID	Method ID
1,1,1-Trichloroethane	FL	5160	10107207
1,1,2,2-Tetrachloroethane	FL	5110	10107207
1,1,2-Trichloroethane	FL	5165	10107207
1,1-Dichloroethane	FL	4630	10107207
1,1-Dichloroethylene	FL	4640	10107207
1,2-Dichlorobenzene	FL	4610	10107207
1,2-Dichloroethane (Ethylene dichloride)	FL	4635	10107207
1,2-Dichloropropane	FL	4655	10107207
1,3-Dichlorobenzene	FL	4615	10107207
1,4-Dichlorobenzene	FL	4620	10107207
2-Chloroethyl vinyl ether	FL	4500	10107207
Acrolein (Propenal)	FL	4325	10107207
Acrylonitrile	FL	4340	10107207
Benzene	FL	4375	10107207
Bromodichloromethane	FL	4395	10107207
Bromoform	FL	4400	10107207
Carbon tetrachloride	FL	4455	10107207
Chlorobenzene	FL	4475	10107207
Chlorodibromomethane	FL	4575	10107207

Texas Commission on Environmental Quality

NELAP - Recognized Laboratory Fields of Accreditation

Microbac Laboratories, Inc., Ohio Valley Division
158 Starlite Drive
Marietta, OH 45750-5279

Certificate: T104704254-13-6
Expiration Date: 3/31/2014
Issue Date: 4/1/2013

These fields of accreditation supercede all previous fields. The Texas Commission on Environmental Quality urges customers to verify the laboratory's current accreditation status for particular methods and analyses.

Matrix: ***Non-Potable Water***

Chloroethane (Ethyl chloride)	FL	4485	10107207
Chloroform	FL	4505	10107207
cis-1,3-Dichloropropene	FL	4680	10107207
Ethylbenzene	FL	4765	10107207
Methyl bromide (Bromomethane)	FL	4950	10107207
Methyl chloride (Chloromethane)	FL	4960	10107207
Methylene chloride (Dichloromethane)	FL	4975	10107207
Tetrachloroethylene (Perchloroethylene)	FL	5115	10107207
Toluene	FL	5140	10107207
trans-1,2-Dichloroethylene	FL	4700	10107207
trans-1,3-Dichloropropylene	FL	4685	10107207
Trichloroethene (Trichloroethylene)	FL	5170	10107207
Trichlorofluoromethane (Fluorotrichloromethane, Freon 11)	FL	5175	10107207
Vinyl chloride	FL	5235	10107207
Xylene (total)	FL	5260	10107207

Method EPA 625

Analyte	AB	Analyte ID	Method ID
1,2,4-Trichlorobenzene	FL	5155	10107401
1,2-Dichlorobenzene	FL	4610	10107401
1,3-Dichlorobenzene	FL	4615	10107401
1,4-Dichlorobenzene	FL	4620	10107401
2,4,6-Trichlorophenol	FL	6840	10107401
2,4-Dichlorophenol	FL	6000	10107401
2,4-Dimethylphenol	FL	6130	10107401
2,4-Dinitrophenol	FL	6175	10107401
2,4-Dinitrotoluene (2,4-DNT)	FL	6185	10107401
2,6-Dinitrotoluene (2,6-DNT)	FL	6190	10107401
2-Chloronaphthalene	FL	5795	10107401
2-Chlorophenol	FL	5800	10107401
2-Methyl-4,6-dinitrophenol (4,6-Dinitro-2-methylphenol)	FL	6360	10107401

Texas Commission on Environmental Quality

NELAP - Recognized Laboratory Fields of Accreditation

Certificate:	T104704254-13-6
Expiration Date:	3/31/2014
Issue Date:	4/1/2013

Microbac Laboratories, Inc., Ohio Valley Division

158 Starlite Drive
Marietta, OH 45750-5279

These fields of accreditation supercede all previous fields. The Texas Commission on Environmental Quality urges customers to verify the laboratory's current accreditation status for particular methods and analyses.

Matrix: ***Non-Potable Water***

2-Nitrophenol	FL	6490	10107401
3,3'-Dichlorobenzidine	FL	5945	10107401
4-Bromophenyl phenyl ether (BDE-3)	FL	5660	10107401
4-Chloro-3-methylphenol	FL	5700	10107401
4-Chlorophenyl phenylether	FL	5825	10107401
4-Nitrophenol	FL	6500	10107401
Acenaphthene	FL	5500	10107401
Acenaphthylene	FL	5505	10107401
Anthracene	FL	5555	10107401
Benzidine	FL	5595	10107401
Benzo(a)anthracene	FL	5575	10107401
Benzo(a)pyrene	FL	5580	10107401
Benzo(b)fluoranthene	FL	5585	10107401
Benzo(g,h,i)perylene	FL	5590	10107401
Benzo(k)fluoranthene	FL	5600	10107401
bis(2-Chloroethoxy)methane	FL	5760	10107401
bis(2-Chloroethyl) ether	FL	5765	10107401
bis(2-Chloroisopropyl) ether	FL	5780	10107401
bis(2-Ethylhexyl) phthalate (DEHP)	FL	6255	10107401
Butyl benzyl phthalate	FL	5670	10107401
Chrysene	FL	5855	10107401
Dibenz(a,h) anthracene	FL	5895	10107401
Diethyl phthalate	FL	6070	10107401
Dimethyl phthalate	FL	6135	10107401
Di-n-butyl phthalate	FL	5925	10107401
Di-n-octyl phthalate	FL	6200	10107401
Fluoranthene	FL	6265	10107401
Fluorene	FL	6270	10107401
Hexachlorobenzene	FL	6275	10107401
Hexachlorobutadiene	FL	4835	10107401

Texas Commission on Environmental Quality

NELAP - Recognized Laboratory Fields of Accreditation

Certificate:	T104704254-13-6
Expiration Date:	3/31/2014
Issue Date:	4/1/2013

Microbac Laboratories, Inc., Ohio Valley Division

158 Starlite Drive
Marietta, OH 45750-5279

These fields of accreditation supercede all previous fields. The Texas Commission on Environmental Quality urges customers to verify the laboratory's current accreditation status for particular methods and analyses.

Matrix: ***Non-Potable Water***

Hexachlorocyclopentadiene	FL	6285	10107401
Hexachloroethane	FL	4840	10107401
Indeno(1,2,3-cd) pyrene	FL	6315	10107401
Isophorone	FL	6320	10107401
Naphthalene	FL	5005	10107401
Nitrobenzene	FL	5015	10107401
n-Nitrosodimethylamine	FL	6530	10107401
n-Nitrosodi-n-propylamine	FL	6545	10107401
n-Nitrosodiphenylamine	FL	6535	10107401
Pentachlorophenol	FL	6605	10107401
Phenanthrene	FL	6615	10107401
Phenol	FL	6625	10107401
Pyrene	FL	6665	10107401

Method EPA 7196

Analyte	AB	Analyte ID	Method ID
Chromium (VI)	FL	1045	10162206

Method EPA 7470

Analyte	AB	Analyte ID	Method ID
Mercury	FL	1095	10165603

Method EPA 8011

Analyte	AB	Analyte ID	Method ID
1,2-Dibromo-3-chloropropane (DBCP)	FL	4570	10173009
1,2-Dibromoethane (EDB, Ethylene dibromide)	FL	4585	10173009

Method EPA 8015

Analyte	AB	Analyte ID	Method ID
Diesel range organics (DRO)	FL	9369	10173203
Ethanol	FL	4750	10173203
Gasoline range organics (GRO)	FL	9408	10173203
Isopropyl alcohol (2-Propanol, Isopropanol)	FL	4895	10173203
Methanol	FL	4930	10173203
Propylene Glycol	FL	6657	10173203

Texas Commission on Environmental Quality

NELAP - Recognized Laboratory Fields of Accreditation

Microbac Laboratories, Inc., Ohio Valley Division
158 Starlite Drive
Marietta, OH 45750-5279

Certificate: T104704254-13-6
Expiration Date: 3/31/2014
Issue Date: 4/1/2013

These fields of accreditation supercede all previous fields. The Texas Commission on Environmental Quality urges customers to verify the laboratory's current accreditation status for particular methods and analyses.

Matrix: ***Non-Potable Water***

Method EPA 8081

Analyte	AB	Analyte ID	Method ID
4,4'-DDD	FL	7355	10178402
4,4'-DDE	FL	7360	10178402
4,4'-DDT	FL	7365	10178402
Aldrin	FL	7025	10178402
alpha-BHC (alpha-Hexachlorocyclohexane)	FL	7110	10178402
alpha-Chlordane	FL	7240	10178402
beta-BHC (beta-Hexachlorocyclohexane)	FL	7115	10178402
Chlordane (tech.)	FL	7250	10178402
delta-BHC (delta-Hexachlorocyclohexane)	FL	7105	10178402
Dieldrin	FL	7470	10178402
Endosulfan I	FL	7510	10178402
Endosulfan II	FL	7515	10178402
Endosulfan sulfate	FL	7520	10178402
Endrin	FL	7540	10178402
Endrin aldehyde	FL	7530	10178402
Endrin ketone	FL	7535	10178402
gamma-BHC (Lindane, gamma-Hexachlorocyclohexane)	FL	7120	10178402
gamma-Chlordane	FL	7245	10178402
Heptachlor	FL	7685	10178402
Heptachlor epoxide	FL	7690	10178402
Methoxychlor	FL	7810	10178402
Toxaphene (Chlorinated camphene)	FL	8250	10178402

Method EPA 8082

Analyte	AB	Analyte ID	Method ID
Aroclor-1016 (PCB-1016)	FL	8880	10179007
Aroclor-1221 (PCB-1221)	FL	8885	10179007
Aroclor-1232 (PCB-1232)	FL	8890	10179007
Aroclor-1242 (PCB-1242)	FL	8895	10179007
Aroclor-1248 (PCB-1248)	FL	8900	10179007

Texas Commission on Environmental Quality

NELAP - Recognized Laboratory Fields of Accreditation

Microbac Laboratories, Inc., Ohio Valley Division
158 Starlite Drive
Marietta, OH 45750-5279

Certificate: T104704254-13-6
Expiration Date: 3/31/2014
Issue Date: 4/1/2013

These fields of accreditation supercede all previous fields. The Texas Commission on Environmental Quality urges customers to verify the laboratory's current accreditation status for particular methods and analyses.

Matrix: ***Non-Potable Water***

Aroclor-1254 (PCB-1254)	FL	8905	10179007
Aroclor-1260 (PCB-1260)	FL	8910	10179007

Method EPA 8151

Analyte	AB	Analyte ID	Method ID
2,4,5-T	FL	8655	10183003
2,4-D	FL	8545	10183003
2,4-DB	FL	8560	10183003
Dalapon	FL	8555	10183003
Dicamba	FL	8595	10183003
Dichloroprop (Dichlorprop, Weedone)	FL	8605	10183003
Dinoseb (2-sec-butyl-4,6-dinitrophenol, DNBP)	FL	8620	10183003
MCPA	FL	7775	10183003
MCPP	FL	7780	10183003
Pentachlorophenol	FL	6605	10183003
Silvex (2,4,5-TP)	FL	8650	10183003

Method EPA 8260

Analyte	AB	Analyte ID	Method ID
1,1,1,2-Tetrachloroethane	FL	5105	10184404
1,1,1-Trichloroethane	FL	5160	10184404
1,1,2,2-Tetrachloroethane	FL	5110	10184404
1,1,2-Trichloroethane	FL	5165	10184404
1,1-Dichloroethane	FL	4630	10184404
1,1-Dichloroethylene	FL	4640	10184404
1,1-Dichloropropene	FL	4670	10184404
1,2,3-Trichlorobenzene	FL	5150	10184404
1,2,3-Trichloropropane	FL	5180	10184404
1,2,4-Trichlorobenzene	FL	5155	10184404
1,2,4-Trimethylbenzene	FL	5210	10184404
1,2-Dibromo-3-chloropropane (DBCP)	FL	4570	10184404
1,2-Dibromoethane (EDB, Ethylene dibromide)	FL	4585	10184404
1,2-Dichlorobenzene	FL	4610	10184404

Texas Commission on Environmental Quality

NELAP - Recognized Laboratory Fields of Accreditation

Certificate: T104704254-13-6
Expiration Date: 3/31/2014
Issue Date: 4/1/2013

Microbac Laboratories, Inc., Ohio Valley Division

158 Starlite Drive
Marietta, OH 45750-5279

These fields of accreditation supercede all previous fields. The Texas Commission on Environmental Quality urges customers to verify the laboratory's current accreditation status for particular methods and analyses.

Matrix: ***Non-Potable Water***

1,2-Dichloroethane (Ethylene dichloride)	FL	4635	10184404
1,2-Dichloropropane	FL	4655	10184404
1,3,5-Trimethylbenzene	FL	5215	10184404
1,3-Dichlorobenzene	FL	4615	10184404
1,3-Dichloropropane	FL	4660	10184404
1,4-Dichlorobenzene	FL	4620	10184404
1,4-Dioxane (1,4-Diethyleneoxide)	FL	4735	10184404
1-Chlorohexane	FL	4510	10184404
2,2-Dichloropropane	FL	4665	10184404
2-Butanone (Methyl ethyl ketone, MEK)	FL	4410	10184404
2-Chloroethyl vinyl ether	FL	4500	10184404
2-Chlorotoluene	FL	4535	10184404
2-Hexanone (MBK)	FL	4860	10184404
2-Nitropropane	FL	5020	10184404
4-Chlorotoluene	FL	4540	10184404
4-Isopropyltoluene (p-Cymene)	FL	4915	10184404
4-Methyl-2-pentanone (MIBK)	FL	4995	10184404
Acetone (2-Propanone)	FL	4315	10184404
Acetonitrile	FL	4320	10184404
Acrolein (Propenal)	FL	4325	10184404
Acrylonitrile	FL	4340	10184404
Allyl chloride (3-Chloropropene)	FL	4355	10184404
Benzene	FL	4375	10184404
Bromobenzene	FL	4385	10184404
Bromochloromethane	FL	4390	10184404
Bromodichloromethane	FL	4395	10184404
Bromoform	FL	4400	10184404
Carbon disulfide	FL	4450	10184404
Carbon tetrachloride	FL	4455	10184404
Chlorobenzene	FL	4475	10184404

Texas Commission on Environmental Quality

NELAP - Recognized Laboratory Fields of Accreditation

Microbac Laboratories, Inc., Ohio Valley Division
158 Starlite Drive
Marietta, OH 45750-5279

Certificate: T104704254-13-6
Expiration Date: 3/31/2014
Issue Date: 4/1/2013

These fields of accreditation supercede all previous fields. The Texas Commission on Environmental Quality urges customers to verify the laboratory's current accreditation status for particular methods and analyses.

Matrix: ***Non-Potable Water***

Chlorodibromomethane	FL	4575	10184404
Chloroethane (Ethyl chloride)	FL	4485	10184404
Chloroform	FL	4505	10184404
Chloroprene (2-Chloro-1,3-butadiene)	FL	4525	10184404
cis-1,2-Dichloroethylene	FL	4645	10184404
cis-1,3-Dichloropropene	FL	4680	10184404
Dibromofluoromethane	FL	4590	10184404
Dibromomethane (Methylene bromide)	FL	4595	10184404
Dichlorodifluoromethane (Freon-12)	FL	4625	10184404
Diethyl ether	FL	4725	10184404
Ethyl acetate	FL	4755	10184404
Ethyl methacrylate	FL	4810	10184404
Ethylbenzene	FL	4765	10184404
Ethyl-t-butylether (ETBE) (2-Ethoxy-2-methylpropane)	FL	4770	10184404
Hexachlorobutadiene	FL	4835	10184404
Iodomethane (Methyl iodide)	FL	4870	10184404
Isobutyl alcohol (2-Methyl-1-propanol)	FL	4875	10184404
Isopropyl ether	FL	4905	10184404
Isopropylbenzene (Cumene)	FL	4900	10184404
m+p-xylene	FL	5240	10184404
Methacrylonitrile	FL	4925	10184404
Methyl acetate	FL	4940	10184404
Methyl bromide (Bromomethane)	FL	4950	10184404
Methyl chloride (Chloromethane)	FL	4960	10184404
Methyl methacrylate	FL	4990	10184404
Methyl tert-butyl ether (MTBE)	FL	5000	10184404
Methylcyclohexane	FL	4965	10184404
Methylene chloride (Dichloromethane)	FL	4975	10184404
Naphthalene	FL	5005	10184404
n-Butyl alcohol (1-Butanol, n-Butanol)	FL	4425	10184404

Texas Commission on Environmental Quality

NELAP - Recognized Laboratory Fields of Accreditation

Microbac Laboratories, Inc., Ohio Valley Division	Certificate:	T104704254-13-6
	Expiration Date:	3/31/2014
158 Starlite Drive Marietta, OH 45750-5279	Issue Date:	4/1/2013

These fields of accreditation supercede all previous fields. The Texas Commission on Environmental Quality urges customers to verify the laboratory's current accreditation status for particular methods and analyses.

Matrix: ***Non-Potable Water***

n-Butylbenzene	FL	4435	10184404
n-Propylbenzene	FL	5090	10184404
o-Xylene	FL	5250	10184404
Propionitrile (Ethyl cyanide)	FL	5080	10184404
sec-Butylbenzene	FL	4440	10184404
Styrene	FL	5100	10184404
T-amylmethylether (TAME)	FL	4370	10184404
tert-Butyl alcohol	FL	4420	10184404
tert-Butylbenzene	FL	4445	10184404
Tetrachloroethylene (Perchloroethylene)	FL	5115	10184404
Toluene	FL	5140	10184404
trans-1,2-Dichloroethylene	FL	4700	10184404
trans-1,3-Dichloropropylene	FL	4685	10184404
trans-1,4-Dichloro-2-butene	FL	4605	10184404
Trichloroethene (Trichloroethylene)	FL	5170	10184404
Trichlorofluoromethane (Fluorotrichloromethane, Freon 11)	FL	5175	10184404
Vinyl acetate	FL	5225	10184404
Vinyl chloride	FL	5235	10184404
Xylene (total)	FL	5260	10184404

Method EPA 8270

Analyte	AB	Analyte ID	Method ID
1,2,4,5-Tetrachlorobenzene	FL	6715	10185203
1,2,4-Trichlorobenzene	FL	5155	10185203
1,2-Diphenylhydrazine	FL	6220	10185203
1,3-Dichlorobenzene	FL	4615	10185203
1,4-Dichlorobenzene	FL	4620	10185203
1,4-Naphthoquinone	FL	6420	10185203
1,4-Phenylenediamine	FL	6630	10185203
1-Naphthylamine	FL	6425	10185203
2,3,4,6-Tetrachlorophenol	FL	6735	10185203

Texas Commission on Environmental Quality

NELAP - Recognized Laboratory Fields of Accreditation

	Certificate:	T104704254-13-6
Microbac Laboratories, Inc., Ohio Valley Division	Expiration Date:	3/31/2014
158 Starlite Drive Marietta, OH 45750-5279	Issue Date:	4/1/2013

These fields of accreditation supercede all previous fields. The Texas Commission on Environmental Quality urges customers to verify the laboratory's current accreditation status for particular methods and analyses.

Matrix: ***Non-Potable Water***

2,4,5-Trichlorophenol	FL	6835	10185203
2,4,6-Trichlorophenol	FL	6840	10185203
2,4-Dichlorophenol	FL	6000	10185203
2,4-Dimethylphenol	FL	6130	10185203
2,4-Dinitrophenol	FL	6175	10185203
2,4-Dinitrotoluene (2,4-DNT)	FL	6185	10185203
2,6-Dichlorophenol	FL	6005	10185203
2,6-Dinitrotoluene (2,6-DNT)	FL	6190	10185203
2-Acetylaminofluorene	FL	5515	10185203
2-Chloronaphthalene	FL	5795	10185203
2-Chlorophenol	FL	5800	10185203
2-Methyl-4,6-dinitrophenol (4,6-Dinitro-2-methylphenol)	FL	6360	10185203
2-Methylaniline (o-Toluidine)	FL	5145	10185203
2-Methylnaphthalene	FL	6385	10185203
2-Methylphenol (o-Cresol)	FL	6400	10185203
2-Naphthylamine	FL	6430	10185203
2-Nitroaniline	FL	6460	10185203
2-Nitrophenol	FL	6490	10185203
2-Picoline (2-Methylpyridine)	FL	5050	10185203
3,3'-Dichlorobenzidine	FL	5945	10185203
3,3'-Dimethylbenzidine	FL	6120	10185203
3-Methylcholanthrene	FL	6355	10185203
3-Methylphenol (m-Cresol)	FL	6405	10185203
3-Nitroaniline	FL	6465	10185203
4-Aminobiphenyl	FL	5540	10185203
4-Bromophenyl phenyl ether (BDE-3)	FL	5660	10185203
4-Chloro-3-methylphenol	FL	5700	10185203
4-Chloroaniline	FL	5745	10185203
4-Chlorophenyl phenylether	FL	5825	10185203
4-Dimethyl aminoazobenzene	FL	6105	10185203

Texas Commission on Environmental Quality

NELAP - Recognized Laboratory Fields of Accreditation

Microbac Laboratories, Inc., Ohio Valley Division	Certificate:	T104704254-13-6
	Expiration Date:	3/31/2014
158 Starlite Drive Marietta, OH 45750-5279	Issue Date:	4/1/2013

These fields of accreditation supercede all previous fields. The Texas Commission on Environmental Quality urges customers to verify the laboratory's current accreditation status for particular methods and analyses.

Matrix: ***Non-Potable Water***

4-Methylphenol (p-Cresol)	FL	6410	10185203
4-Nitroaniline	FL	6470	10185203
4-Nitrophenol	FL	6500	10185203
5-Nitro-o-toluidine	FL	6570	10185203
7,12-Dimethylbenz(a) anthracene	FL	6115	10185203
a-a-Dimethylphenethylamine	FL	6125	10185203
Acenaphthene	FL	5500	10185203
Acenaphthylene	FL	5505	10185203
Acetophenone	FL	5510	10185203
Aniline	FL	5545	10185203
Anthracene	FL	5555	10185203
Aramite	FL	5560	10185203
Atrazine	FL	7065	10185203
Benzidine	FL	5595	10185203
Benzo(a)anthracene	FL	5575	10185203
Benzo(a)pyrene	FL	5580	10185203
Benzo(b)fluoranthene	FL	5585	10185203
Benzo(g,h,i)perylene	FL	5590	10185203
Benzo(k)fluoranthene	FL	5600	10185203
Benzoic acid	FL	5610	10185203
Benzyl alcohol	FL	5630	10185203
Biphenyl	FL	5640	10185203
bis(2-Chloroethoxy)methane	FL	5760	10185203
bis(2-Chloroethyl) ether	FL	5765	10185203
bis(2-Chloroisopropyl) ether	FL	5780	10185203
bis(2-Ethylhexyl) phthalate (DEHP)	FL	6255	10185203
Butyl benzyl phthalate	FL	5670	10185203
Caprolactam	FL	7180	10185203
Carbazole	FL	5680	10185203
Chlorobenzilate	FL	7260	10185203

Texas Commission on Environmental Quality

NELAP - Recognized Laboratory Fields of Accreditation

Microbac Laboratories, Inc., Ohio Valley Division
158 Starlite Drive
Marietta, OH 45750-5279

Certificate: T104704254-13-6
Expiration Date: 3/31/2014
Issue Date: 4/1/2013

These fields of accreditation supercede all previous fields. The Texas Commission on Environmental Quality urges customers to verify the laboratory's current accreditation status for particular methods and analyses.

Matrix: ***Non-Potable Water***

Chrysene	FL	5855	10185203
Dibenz(a,h) anthracene	FL	5895	10185203
Dibenzofuran	FL	5905	10185203
Diethyl phthalate	FL	6070	10185203
Dimethoate	FL	7475	10185203
Dimethyl phthalate	FL	6135	10185203
Di-n-butyl phthalate	FL	5925	10185203
Di-n-octyl phthalate	FL	6200	10185203
Diphenylamine	FL	6205	10185203
Ethyl methanesulfonate	FL	6260	10185203
Famphur	FL	7580	10185203
Fluoranthene	FL	6265	10185203
Fluorene	FL	6270	10185203
Hexachlorobenzene	FL	6275	10185203
Hexachlorobutadiene	FL	4835	10185203
Hexachlorocyclopentadiene	FL	6285	10185203
Hexachloroethane	FL	4840	10185203
Hexachlorophene	FL	6290	10185203
Hexachloropropene	FL	6295	10185203
Hexamethylphosphoramide (HMPA)	FL	7700	10185203
Indeno(1,2,3-cd) pyrene	FL	6315	10185203
Isodrin	FL	7725	10185203
Isophorone	FL	6320	10185203
Isosafrole	FL	6325	10185203
Kepone	FL	7740	10185203
Malathion	FL	7770	10185203
Methapyrilene	FL	6345	10185203
Methyl methanesulfonate	FL	6375	10185203
Methyl parathion (Parathion, methyl)	FL	7825	10185203
Naphthalene	FL	5005	10185203

Texas Commission on Environmental Quality

NELAP - Recognized Laboratory Fields of Accreditation

Microbac Laboratories, Inc., Ohio Valley Division
158 Starlite Drive
Marietta, OH 45750-5279

Certificate: T104704254-13-6
Expiration Date: 3/31/2014
Issue Date: 4/1/2013

These fields of accreditation supercede all previous fields. The Texas Commission on Environmental Quality urges customers to verify the laboratory's current accreditation status for particular methods and analyses.

Matrix: ***Non-Potable Water***

Nitrobenzene	FL	5015	10185203
Nitroquinoline-1-oxide	FL	6515	10185203
n-Nitrosodiethylamine	FL	6525	10185203
n-Nitrosodimethylamine	FL	6530	10185203
n-Nitrosodi-n-butylamine	FL	5025	10185203
n-Nitrosodi-n-propylamine	FL	6545	10185203
n-Nitrosodiphenylamine	FL	6535	10185203
n-Nitrosomorpholine	FL	6555	10185203
n-Nitrosopiperidine	FL	6560	10185203
n-Nitrosopyrrolidine	FL	6565	10185203
o,o,o-Triethyl phosphorothioate	FL	8290	10185203
Parathion, ethyl	FL	7955	10185203
Pentachlorobenzene	FL	6590	10185203
Pentachloronitrobenzene (PCNB)	FL	6600	10185203
Pentachlorophenol	FL	6605	10185203
Phenacetin	FL	6610	10185203
Phenanthrene	FL	6615	10185203
Phenol	FL	6625	10185203
Phorate	FL	7985	10185203
Pronamide (Kerb)	FL	6650	10185203
Pyrene	FL	6665	10185203
Pyridine	FL	5095	10185203
Safrole	FL	6685	10185203
Sulfotepp	FL	8155	10185203
Tetrachlorvinphos (Stirophos, Gardona)	FL	8197	10185203
Tetraethyl pyrophosphate (TEPP)	FL	8210	10185203
Thionazin (Zinophos)	FL	8235	10185203

Method EPA 8315

Analyte	**AB**	**Analyte ID**	**Method ID**
Formaldehyde	FL	4815	10187801

Texas Commission on Environmental Quality

NELAP - Recognized Laboratory Fields of Accreditation

Certificate: T104704254-13-6

Microbac Laboratories, Inc., Ohio Valley Division

158 Starlite Drive
Marietta, OH 45750-5279

Expiration Date: 3/31/2014

Issue Date: 4/1/2013

These fields of accreditation supercede all previous fields. The Texas Commission on Environmental Quality urges customers to verify the laboratory's current accreditation status for particular methods and analyses.

Matrix: ***Non-Potable Water***

Method EPA 8330

Analyte	AB	Analyte ID	Method ID
1,3,5-Trinitrobenzene (1,3,5-TNB)	FL	6885	10189807
1,3-Dinitrobenzene (1,3-DNB)	FL	6160	10189807
2,4,6-Trinitrotoluene (2,4,6-TNT)	FL	9651	10189807
2,4-Dinitrotoluene (2,4-DNT)	FL	6185	10189807
2,6-Dinitrotoluene (2,6-DNT)	FL	6190	10189807
2-Amino-4,6-dinitrotoluene (2-am-dnt)	FL	9303	10189807
2-Nitrotoluene	FL	9507	10189807
3-Nitrotoluene	FL	9510	10189807
4-Amino-2,6-dinitrotoluene (4-am-dnt)	FL	9306	10189807
4-Nitrotoluene	FL	9513	10189807
Methyl-2,4,6-trinitrophenylnitramine (tetryl)	FL	6415	10189807
Nitrobenzene	FL	5015	10189807
Nitroglycerin	FL	6485	10189807
Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine (HMX)	FL	9522	10189807
Pentaerythritoltetranitrate (PETN)	FL	9558	10189807
RDX (hexahydro-1,3,5-trinitro-1,3,5-triazine)	FL	9432	10189807

Method EPA 9014

Analyte	AB	Analyte ID	Method ID
Amenable cyanide	FL	1510	10193803
Total Cyanide	FL	1635	10193803

Method EPA 9056

Analyte	AB	Analyte ID	Method ID
Bromide	FL	1540	10199209
Chloride	FL	1575	10199209
Fluoride	FL	1730	10199209
Nitrate as N	FL	1810	10199209
Nitrite as N	FL	1840	10199209
Sulfate	FL	2000	10199209

Texas Commission on Environmental Quality

NELAP - Recognized Laboratory Fields of Accreditation

Microbac Laboratories, Inc., Ohio Valley Division
158 Starlite Drive
Marietta, OH 45750-5279

Certificate: T104704254-13-6
Expiration Date: 3/31/2014
Issue Date: 4/1/2013

These fields of accreditation supercede all previous fields. The Texas Commission on Environmental Quality urges customers to verify the laboratory's current accreditation status for particular methods and analyses.

Matrix: ***Non-Potable Water***

Method EPA 9060

Analyte	AB	Analyte ID	Method ID
Total Organic Carbon (TOC)	FL	2040	10200201

Method EPA RSK 175

Analyte	AB	Analyte ID	Method ID
2-methylpropane (Isobutane)	FL	4942	10212905
Carbon dioxide	FL	3755	10212905
Ethane	FL	4747	10212905
Ethene	FL	4752	10212905
Methane	FL	4926	10212905
n-Butane	FL	5007	10212905
n-Propane	FL	5029	10212905

Method HACH 8000

Analyte	AB	Analyte ID	Method ID
Chemical oxygen demand (COD)	FL	1565	60003001

Method SM 2120 B

Analyte	AB	Analyte ID	Method ID
Color	FL	1605	20001803

Method SM 2310 B (4a)

Analyte	AB	Analyte ID	Method ID
Acidity, as CaCO3	FL	1500	20002806

Method SM 2320 B

Analyte	AB	Analyte ID	Method ID
Alkalinity as CaCO3	FL	1505	20003003

Method SM 2340 B

Analyte	AB	Analyte ID	Method ID
Total hardness as CaCO3	FL	1755	20003401

Method SM 2340 C

Analyte	AB	Analyte ID	Method ID
Total hardness as CaCO3	FL	1755	20003605

Texas Commission on Environmental Quality

NELAP - Recognized Laboratory Fields of Accreditation

Certificate:	T104704254-13-6
Expiration Date:	3/31/2014
Issue Date:	4/1/2013

Microbac Laboratories, Inc., Ohio Valley Division

158 Starlite Drive
Marietta, OH 45750-5279

These fields of accreditation supercede all previous fields. The Texas Commission on Environmental Quality urges customers to verify the laboratory's current accreditation status for particular methods and analyses.

Matrix: ***Non-Potable Water***

Method SM 2540 B

Analyte	AB	Analyte ID	Method ID
Residue-total (total solids)	FL	1950	20004608

Method SM 2540 C

Analyte	AB	Analyte ID	Method ID
Residue-filterable (TDS)	FL	1955	20004404

Method SM 2540 D

Analyte	AB	Analyte ID	Method ID
Residue-nonfilterable (TSS)	FL	1960	20004802

Method SM 2540 F

Analyte	AB	Analyte ID	Method ID
Residue-settleable	FL	1965	20005009

Method SM 3500-Cr D

Analyte	AB	Analyte ID	Method ID
Chromium (VI)	FL	1045	20009001

Method SM 4500-CN^- E

Analyte	AB	Analyte ID	Method ID
Total Cyanide	FL	1635	20021209

Method SM 4500-F^- C

Analyte	AB	Analyte ID	Method ID
Fluoride	FL	1730	20012800

Method SM 4500-H+ B

Analyte	AB	Analyte ID	Method ID
pH	FL	1900	20016404

Method SM 4500-$NO2^-$ B

Analyte	AB	Analyte ID	Method ID
Nitrite as N	FL	1840	20024004

Method SM 4500-P E

Analyte	AB	Analyte ID	Method ID
Orthophosphate as P	FL	1870	20025803

Method SM 4500-$S2^-$ F

Analyte	AB	Analyte ID	Method ID

Texas Commission on Environmental Quality

NELAP - Recognized Laboratory Fields of Accreditation

	Certificate:	T104704254-13-6
Microbac Laboratories, Inc., Ohio Valley Division	Expiration Date:	3/31/2014
158 Starlite Drive Marietta, OH 45750-5279	Issue Date:	4/1/2013

These fields of accreditation supercede all previous fields. The Texas Commission on Environmental Quality urges customers to verify the laboratory's current accreditation status for particular methods and analyses.

Matrix: ***Non-Potable Water***

Analyte	AB	Analyte ID	Method ID
Sulfide	FL	2005	20126209

Method SM 5210 B

Analyte	AB	Analyte ID	Method ID
Biochemical oxygen demand (BOD)	FL	1530	20027401
Carbonaceous BOD, CBOD	FL	1555	20027401

Method SM 5310 C

Analyte	AB	Analyte ID	Method ID
Total Organic Carbon (TOC)	FL	2040	20028200

Method TCEQ 1005

Analyte	AB	Analyte ID	Method ID
Total Petroleum Hydrocarbons (TPH)	FL	2050	90019208

Texas Commission on Environmental Quality

NELAP - Recognized Laboratory Fields of Accreditation

Certificate:	T104704254-13-6
Expiration Date:	3/31/2014
Issue Date:	4/1/2013

Microbac Laboratories, Inc., Ohio Valley Division
158 Starlite Drive
Marietta, OH 45750-5279

These fields of accreditation supercede all previous fields. The Texas Commission on Environmental Quality urges customers to verify the laboratory's current accreditation status for particular methods and analyses.

Matrix: ***Solid & Chemical Materials***

Method EPA 1010

Analyte	AB	Analyte ID	Method ID
Ignitability	FL	1780	10116606

Method EPA 1311

Analyte	AB	Analyte ID	Method ID
TCLP	FL	849	10118806

Method EPA 1312

Analyte	AB	Analyte ID	Method ID
SPLP	FL	850	10119003

Method EPA 6010

Analyte	AB	Analyte ID	Method ID
Aluminum	FL	1000	10155201
Antimony	FL	1005	10155201
Arsenic	FL	1010	10155201
Barium	FL	1015	10155201
Beryllium	FL	1020	10155201
Boron	FL	1025	10155201
Cadmium	FL	1030	10155201
Calcium	FL	1035	10155201
Chromium	FL	1040	10155201
Cobalt	FL	1050	10155201
Copper	FL	1055	10155201
Iron	FL	1070	10155201
Lead	FL	1075	10155201
Lithium	FL	1080	10155201
Magnesium	FL	1085	10155201
Manganese	FL	1090	10155201
Molybdenum	FL	1100	10155201
Nickel	FL	1105	10155201
Potassium	FL	1125	10155201
Selenium	FL	1140	10155201

Texas Commission on Environmental Quality

NELAP - Recognized Laboratory Fields of Accreditation

Microbac Laboratories, Inc., Ohio Valley Division
158 Starlite Drive
Marietta, OH 45750-5279

Certificate: T104704254-13-6
Expiration Date: 3/31/2014
Issue Date: 4/1/2013

These fields of accreditation supercede all previous fields. The Texas Commission on Environmental Quality urges customers to verify the laboratory's current accreditation status for particular methods and analyses.

Matrix: ***Solid & Chemical Materials***

Sodium	FL	1155	10155201
Strontium	FL	1160	10155201
Thallium	FL	1165	10155201
Tin	FL	1175	10155201
Titanium	FL	1180	10155201
Vanadium	FL	1185	10155201
Zinc	FL	1190	10155201

Method EPA 6020

Analyte	AB	Analyte ID	Method ID
Antimony	FL	1005	10156204
Arsenic	FL	1010	10156204
Barium	FL	1015	10156204
Cadmium	FL	1030	10156204
Chromium	FL	1040	10156204
Cobalt	FL	1050	10156204
Copper	FL	1055	10156204
Lead	FL	1075	10156204
Manganese	FL	1090	10156204
Nickel	FL	1105	10156204
Selenium	FL	1140	10156204
Silver	FL	1150	10156204
Thallium	FL	1165	10156204
Vanadium	FL	1185	10156204
Zinc	FL	1190	10156204

Method EPA 7196

Analyte	AB	Analyte ID	Method ID
Chromium (VI)	FL	1045	10162206

Method EPA 7471

Analyte	AB	Analyte ID	Method ID
Mercury	FL	1095	10166004

Texas Commission on Environmental Quality

NELAP - Recognized Laboratory Fields of Accreditation

Microbac Laboratories, Inc., Ohio Valley Division
158 Starlite Drive
Marietta, OH 45750-5279

Certificate: T104704254-13-6
Expiration Date: 3/31/2014
Issue Date: 4/1/2013

These fields of accreditation supercede all previous fields. The Texas Commission on Environmental Quality urges customers to verify the laboratory's current accreditation status for particular methods and analyses.

Matrix: ***Solid & Chemical Materials***

Method EPA 8015

Analyte	AB	Analyte ID	Method ID
Diesel range organics (DRO)	FL	9369	10173203
Ethanol	FL	4750	10173203
Ethylene glycol	FL	4785	10173203
Gasoline range organics (GRO)	FL	9408	10173203
Isopropyl alcohol (2-Propanol, Isopropanol)	FL	4895	10173203
Methanol	FL	4930	10173203
Propylene Glycol	FL	6657	10173203

Method EPA 8081

Analyte	AB	Analyte ID	Method ID
4,4'-DDD	FL	7355	10178402
4,4'-DDE	FL	7360	10178402
4,4'-DDT	FL	7365	10178402
Aldrin	FL	7025	10178402
alpha-BHC (alpha-Hexachlorocyclohexane)	FL	7110	10178402
alpha-Chlordane	FL	7240	10178402
beta-BHC (beta-Hexachlorocyclohexane)	FL	7115	10178402
Chlordane (tech.)	FL	7250	10178402
delta-BHC (delta-Hexachlorocyclohexane)	FL	7105	10178402
Dieldrin	FL	7470	10178402
Endosulfan I	FL	7510	10178402
Endosulfan II	FL	7515	10178402
Endosulfan sulfate	FL	7520	10178402
Endrin	FL	7540	10178402
Endrin aldehyde	FL	7530	10178402
Endrin ketone	FL	7535	10178402
gamma-BHC (Lindane, gamma-Hexachlorocyclohexane)	FL	7120	10178402
gamma-Chlordane	FL	7245	10178402
Heptachlor	FL	7685	10178402
Heptachlor epoxide	FL	7690	10178402

Texas Commission on Environmental Quality

NELAP - Recognized Laboratory Fields of Accreditation

Certificate:	T104704254-13-6
Expiration Date:	3/31/2014
Issue Date:	4/1/2013

Microbac Laboratories, Inc., Ohio Valley Division

158 Starlite Drive
Marietta, OH 45750-5279

These fields of accreditation supercede all previous fields. The Texas Commission on Environmental Quality urges customers to verify the laboratory's current accreditation status for particular methods and analyses.

Matrix: ***Solid & Chemical Materials***

Methoxychlor	FL	7810	10178402
Toxaphene (Chlorinated camphene)	FL	8250	10178402

Method EPA 8082

Analyte	AB	Analyte ID	Method ID
Aroclor-1016 (PCB-1016)	FL	8880	10179007
Aroclor-1221 (PCB-1221)	FL	8885	10179007
Aroclor-1232 (PCB-1232)	FL	8890	10179007
Aroclor-1242 (PCB-1242)	FL	8895	10179007
Aroclor-1248 (PCB-1248)	FL	8900	10179007
Aroclor-1254 (PCB-1254)	FL	8905	10179007
Aroclor-1260 (PCB-1260)	FL	8910	10179007

Method EPA 8151

Analyte	AB	Analyte ID	Method ID
2,4,5-T	FL	8655	10183003
2,4-D	FL	8545	10183003
2,4-DB	FL	8560	10183003
Dalapon	FL	8555	10183003
Dicamba	FL	8595	10183003
Dichloroprop (Dichlorprop, Weedone)	FL	8605	10183003
Dinoseb (2-sec-butyl-4,6-dinitrophenol, DNBP)	FL	8620	10183003
Dinoseb (2-sec-butyl-4,6-dinitrophenol, DNBP)	FL	8620	10183003
MCPA	FL	7775	10183003
MCPP	FL	7780	10183003
Pentachlorophenol	FL	6605	10183003
Silvex (2,4,5-TP)	FL	8650	10183003

Method EPA 8260

Analyte	AB	Analyte ID	Method ID
1,1,1,2-Tetrachloroethane	FL	5105	10184404
1,1,1-Trichloroethane	FL	5160	10184404
1,1,2,2-Tetrachloroethane	FL	5110	10184404
1,1,2-Trichloroethane	FL	5165	10184404

Texas Commission on Environmental Quality

NELAP - Recognized Laboratory Fields of Accreditation

Microbac Laboratories, Inc., Ohio Valley Division

158 Starlite Drive
Marietta, OH 45750-5279

Certificate: T104704254-13-6
Expiration Date: 3/31/2014
Issue Date: 4/1/2013

These fields of accreditation supercede all previous fields. The Texas Commission on Environmental Quality urges customers to verify the laboratory's current accreditation status for particular methods and analyses.

Matrix: ***Solid & Chemical Materials***

1,1-Dichloroethane	FL	4630	10184404
1,1-Dichloroethylene	FL	4640	10184404
1,1-Dichloropropene	FL	4670	10184404
1,2,3-Trichlorobenzene	FL	5150	10184404
1,2,3-Trichloropropane	FL	5180	10184404
1,2,4-Trichlorobenzene	FL	5155	10184404
1,2,4-Trimethylbenzene	FL	5210	10184404
1,2-Dibromo-3-chloropropane (DBCP)	FL	4570	10184404
1,2-Dibromoethane (EDB, Ethylene dibromide)	FL	4585	10184404
1,2-Dichlorobenzene	FL	4610	10184404
1,2-Dichloroethane (Ethylene dichloride)	FL	4635	10184404
1,2-Dichloropropane	FL	4655	10184404
1,3,5-Trimethylbenzene	FL	5215	10184404
1,3-Dichlorobenzene	FL	4615	10184404
1,3-Dichloropropane	FL	4660	10184404
1,4-Dichlorobenzene	FL	4620	10184404
1,4-Dioxane (1,4-Diethyleneoxide)	FL	4735	10184404
1-Chlorohexane	FL	4510	10184404
2,2-Dichloropropane	FL	4665	10184404
2-Butanone (Methyl ethyl ketone, MEK)	FL	4410	10184404
2-Chloroethyl vinyl ether	FL	4500	10184404
2-Chlorotoluene	FL	4535	10184404
2-Hexanone (MBK)	FL	4860	10184404
2-Nitropropane	FL	5020	10184404
4-Chlorotoluene	FL	4540	10184404
4-Isopropyltoluene (p-Cymene)	FL	4915	10184404
4-Methyl-2-pentanone (MIBK)	FL	4995	10184404
Acetone (2-Propanone)	FL	4315	10184404
Acetonitrile	FL	4320	10184404
Acrolein (Propenal)	FL	4325	10184404

Texas Commission on Environmental Quality

NELAP - Recognized Laboratory Fields of Accreditation

Microbac Laboratories, Inc., Ohio Valley Division

158 Starlite Drive
Marietta, OH 45750-5279

Certificate: T104704254-13-6
Expiration Date: 3/31/2014
Issue Date: 4/1/2013

These fields of accreditation supercede all previous fields. The Texas Commission on Environmental Quality urges customers to verify the laboratory's current accreditation status for particular methods and analyses.

Matrix: ***Solid & Chemical Materials***

Acrylonitrile	FL	4340	10184404
Allyl chloride (3-Chloropropene)	FL	4355	10184404
Benzene	FL	4375	10184404
Bromobenzene	FL	4385	10184404
Bromochloromethane	FL	4390	10184404
Bromodichloromethane	FL	4395	10184404
Bromoform	FL	4400	10184404
Carbon disulfide	FL	4450	10184404
Carbon tetrachloride	FL	4455	10184404
Chlorobenzene	FL	4475	10184404
Chlorodibromomethane	FL	4575	10184404
Chloroethane (Ethyl chloride)	FL	4485	10184404
Chloroform	FL	4505	10184404
Chloroprene (2-Chloro-1,3-butadiene)	FL	4525	10184404
cis-1,2-Dichloroethylene	FL	4645	10184404
cis-1,3-Dichloropropene	FL	4680	10184404
Dibromofluoromethane	FL	4590	10184404
Dibromomethane (Methylene bromide)	FL	4595	10184404
Dichlorodifluoromethane (Freon-12)	FL	4625	10184404
Diethyl ether	FL	4725	10184404
Ethyl acetate	FL	4755	10184404
Ethyl methacrylate	FL	4810	10184404
Ethylbenzene	FL	4765	10184404
Hexachlorobutadiene	FL	4835	10184404
Iodomethane (Methyl iodide)	FL	4870	10184404
Isobutyl alcohol (2-Methyl-1-propanol)	FL	4875	10184404
Isopropylbenzene (Cumene)	FL	4900	10184404
Methacrylonitrile	FL	4925	10184404
Methyl acetate	FL	4940	10184404
Methyl bromide (Bromomethane)	FL	4950	10184404

Texas Commission on Environmental Quality

NELAP - Recognized Laboratory Fields of Accreditation

		Certificate:	T104704254-13-6
Microbac Laboratories, Inc., Ohio Valley Division		Expiration Date:	3/31/2014
158 Starlite Drive Marietta, OH 45750-5279		Issue Date:	4/1/2013

These fields of accreditation supercede all previous fields. The Texas Commission on Environmental Quality urges customers to verify the laboratory's current accreditation status for particular methods and analyses.

Matrix: ***Solid & Chemical Materials***

Methyl chloride (Chloromethane)	FL	4960	10184404
Methyl methacrylate	FL	4990	10184404
Methyl tert-butyl ether (MTBE)	FL	5000	10184404
Methylene chloride (Dichloromethane)	FL	4975	10184404
Naphthalene	FL	5005	10184404
n-Butyl alcohol (1-Butanol, n-Butanol)	FL	4425	10184404
n-Butylbenzene	FL	4435	10184404
n-Propylbenzene	FL	5090	10184404
Propionitrile (Ethyl cyanide)	FL	5080	10184404
sec-Butylbenzene	FL	4440	10184404
Styrene	FL	5100	10184404
tert-Butyl alcohol	FL	4420	10184404
tert-Butylbenzene	FL	4445	10184404
Tetrachloroethylene (Perchloroethylene)	FL	5115	10184404
Toluene	FL	5140	10184404
trans-1,2-Dichloroethylene	FL	4700	10184404
trans-1,3-Dichloropropylene	FL	4685	10184404
trans-1,4-Dichloro-2-butene	FL	4605	10184404
Trichloroethene (Trichloroethylene)	FL	5170	10184404
Trichlorofluoromethane (Fluorotrichloromethane, Freon 11)	FL	5175	10184404
Vinyl acetate	FL	5225	10184404
Vinyl chloride	FL	5235	10184404
Xylene (total)	FL	5260	10184404

Method EPA 8270

Analyte	AB	Analyte ID	Method ID
1,2,4,5-Tetrachlorobenzene	FL	6715	10185203
1,2,4-Trichlorobenzene	FL	5155	10185203
1,2-Dichlorobenzene	FL	4610	10185203
1,2-Diphenylhydrazine	FL	6220	10185203
1,3-Dichlorobenzene	FL	4615	10185203

Texas Commission on Environmental Quality

NELAP - Recognized Laboratory Fields of Accreditation

	Certificate:	T104704254-13-6	
Microbac Laboratories, Inc., Ohio Valley Division	Expiration Date:	3/31/2014	
158 Starlite Drive Marietta, OH 45750-5279	Issue Date:	4/1/2013	

These fields of accreditation supercede all previous fields. The Texas Commission on Environmental Quality urges customers to verify the laboratory's current accreditation status for particular methods and analyses.

Matrix: ***Solid & Chemical Materials***

1,4-Dichlorobenzene	FL	4620	10185203
1,4-Naphthoquinone	FL	6420	10185203
1,4-Phenylenediamine	FL	6630	10185203
1-Naphthylamine	FL	6425	10185203
2,3,4,6-Tetrachlorophenol	FL	6735	10185203
2,4,5-Trichlorophenol	FL	6835	10185203
2,4,6-Trichlorophenol	FL	6840	10185203
2,4-Dichlorophenol	FL	6000	10185203
2,4-Dimethylphenol	FL	6130	10185203
2,4-Dinitrophenol	FL	6175	10185203
2,4-Dinitrotoluene (2,4-DNT)	FL	6185	10185203
2,6-Dichlorophenol	FL	6005	10185203
2,6-Dinitrotoluene (2,6-DNT)	FL	6190	10185203
2-Acetylaminofluorene	FL	5515	10185203
2-Chloronaphthalene	FL	5795	10185203
2-Chlorophenol	FL	5800	10185203
2-Methyl-4,6-dinitrophenol (4,6-Dinitro-2-methylphenol)	FL	6360	10185203
2-Methylaniline (o-Toluidine)	FL	5145	10185203
2-Methylnaphthalene	FL	6385	10185203
2-Methylphenol (o-Cresol)	FL	6400	10185203
2-Naphthylamine	FL	6430	10185203
2-Nitroaniline	FL	6460	10185203
2-Nitrophenol	FL	6490	10185203
2-Picoline (2-Methylpyridine)	FL	5050	10185203
3,3'-Dichlorobenzidine	FL	5945	10185203
3,3'-Dimethylbenzidine	FL	6120	10185203
3-Methylcholanthrene	FL	6355	10185203
3-Methylphenol (m-Cresol)	FL	6405	10185203
3-Nitroaniline	FL	6465	10185203
4-Aminobiphenyl	FL	5540	10185203

Texas Commission on Environmental Quality

NELAP - Recognized Laboratory Fields of Accreditation

Microbac Laboratories, Inc., Ohio Valley Division	Certificate:	T104704254-13-6
	Expiration Date:	3/31/2014
158 Starlite Drive Marietta, OH 45750-5279	Issue Date:	4/1/2013

These fields of accreditation supercede all previous fields. The Texas Commission on Environmental Quality urges customers to verify the laboratory's current accreditation status for particular methods and analyses.

Matrix: ***Solid & Chemical Materials***

4-Bromophenyl phenyl ether (BDE-3)	FL	5660	10185203
4-Chloro-3-methylphenol	FL	5700	10185203
4-Chloroaniline	FL	5745	10185203
4-Chlorophenyl phenylether	FL	5825	10185203
4-Dimethyl aminoazobenzene	FL	6105	10185203
4-Methylphenol (p-Cresol)	FL	6410	10185203
4-Nitroaniline	FL	6470	10185203
4-Nitrophenol	FL	6500	10185203
5-Nitro-o-toluidine	FL	6570	10185203
7,12-Dimethylbenz(a) anthracene	FL	6115	10185203
a-a-Dimethylphenethylamine	FL	6125	10185203
Acenaphthene	FL	5500	10185203
Acenaphthylene	FL	5505	10185203
Acetophenone	FL	5510	10185203
Aniline	FL	5545	10185203
Anthracene	FL	5555	10185203
Aramite	FL	5560	10185203
Atrazine	FL	7065	10185203
Benzidine	FL	5595	10185203
Benzo(a)anthracene	FL	5575	10185203
Benzo(a)pyrene	FL	5580	10185203
Benzo(b)fluoranthene	FL	5585	10185203
Benzo(g,h,i)perylene	FL	5590	10185203
Benzo(k)fluoranthene	FL	5600	10185203
Benzoic acid	FL	5610	10185203
Benzyl alcohol	FL	5630	10185203
Biphenyl	FL	5640	10185203
bis(2-Chloroethoxy)methane	FL	5760	10185203
bis(2-Chloroethyl) ether	FL	5765	10185203
bis(2-Chloroisopropyl) ether	FL	5780	10185203

Texas Commission on Environmental Quality

NELAP - Recognized Laboratory Fields of Accreditation

	Certificate:	T104704254-13-6
Microbac Laboratories, Inc., Ohio Valley Division	Expiration Date:	3/31/2014
158 Starlite Drive Marietta, OH 45750-5279	Issue Date:	4/1/2013

These fields of accreditation supercede all previous fields. The Texas Commission on Environmental Quality urges customers to verify the laboratory's current accreditation status for particular methods and analyses.

Matrix: ***Solid & Chemical Materials***

bis(2-Ethylhexyl) phthalate (DEHP)	FL	6255	10185203
Butyl benzyl phthalate	FL	5670	10185203
Caprolactam	FL	7180	10185203
Carbazole	FL	5680	10185203
Chlorobenzilate	FL	7260	10185203
Chrysene	FL	5855	10185203
Diallate	FL	7405	10185203
Dibenz(a,h) anthracene	FL	5895	10185203
Dibenzofuran	FL	5905	10185203
Diethyl phthalate	FL	6070	10185203
Dimethoate	FL	7475	10185203
Dimethyl phthalate	FL	6135	10185203
Di-n-butyl phthalate	FL	5925	10185203
Di-n-octyl phthalate	FL	6200	10185203
Diphenylamine	FL	6205	10185203
Ethyl methanesulfonate	FL	6260	10185203
Famphur	FL	7580	10185203
Fluoranthene	FL	6265	10185203
Fluorene	FL	6270	10185203
Hexachlorobenzene	FL	6275	10185203
Hexachlorobutadiene	FL	4835	10185203
Hexachlorocyclopentadiene	FL	6285	10185203
Hexachloroethane	FL	4840	10185203
Hexachlorophene	FL	6290	10185203
Hexachloropropene	FL	6295	10185203
Hexamethylphosphoramide (HMPA)	FL	7700	10185203
Indeno(1,2,3-cd) pyrene	FL	6315	10185203
Isodrin	FL	7725	10185203
Isophorone	FL	6320	10185203
Isosafrole	FL	6325	10185203

Texas Commission on Environmental Quality

NELAP - Recognized Laboratory Fields of Accreditation

Certificate:	T104704254-13-6
Expiration Date:	3/31/2014
Issue Date:	4/1/2013

Microbac Laboratories, Inc., Ohio Valley Division

158 Starlite Drive
Marietta, OH 45750-5279

These fields of accreditation supercede all previous fields. The Texas Commission on Environmental Quality urges customers to verify the laboratory's current accreditation status for particular methods and analyses.

Matrix: ***Solid & Chemical Materials***

Kepone	FL	7740	10185203
Malathion	FL	7770	10185203
Methapyrilene	FL	6345	10185203
Methyl methanesulfonate	FL	6375	10185203
Naphthalene	FL	5005	10185203
Nitrobenzene	FL	5015	10185203
Nitroquinoline-1-oxide	FL	6515	10185203
n-Nitrosodiethylamine	FL	6525	10185203
n-Nitrosodimethylamine	FL	6530	10185203
n-Nitrosodi-n-butylamine	FL	5025	10185203
n-Nitrosodi-n-propylamine	FL	6545	10185203
n-Nitrosodiphenylamine	FL	6535	10185203
n-Nitrosomethylethylamine	FL	6550	10185203
n-Nitrosomorpholine	FL	6555	10185203
n-Nitrosopiperidine	FL	6560	10185203
n-Nitrosopyrrolidine	FL	6565	10185203
o,o,o-Triethyl phosphorothioate	FL	8290	10185203
Pentachlorobenzene	FL	6590	10185203
Pentachloronitrobenzene (PCNB)	FL	6600	10185203
Pentachlorophenol	FL	6605	10185203
Phenacetin	FL	6610	10185203
Phenanthrene	FL	6615	10185203
Phenol	FL	6625	10185203
Pronamide (Kerb)	FL	6650	10185203
Pyrene	FL	6665	10185203
Pyridine	FL	5095	10185203
Safrole	FL	6685	10185203
Sulfotepp	FL	8155	10185203
Tetrachlorvinphos (Stirophos, Gardona)	FL	8197	10185203
Tetraethyl pyrophosphate (TEPP)	FL	8210	10185203

Texas Commission on Environmental Quality

NELAP - Recognized Laboratory Fields of Accreditation

Certificate: T104704254-13-6
Expiration Date: 3/31/2014
Issue Date: 4/1/2013

Microbac Laboratories, Inc., Ohio Valley Division

158 Starlite Drive
Marietta, OH 45750-5279

These fields of accreditation supercede all previous fields. The Texas Commission on Environmental Quality urges customers to verify the laboratory's current accreditation status for particular methods and analyses.

Matrix: ***Solid & Chemical Materials***

Thionazin (Zinophos)	FL	8235	10185203

Method EPA 8315

Analyte	AB	Analyte ID	Method ID
Formaldehyde	FL	4815	10187801

Method EPA 8330

Analyte	AB	Analyte ID	Method ID
1,3,5-Trinitrobenzene (1,3,5-TNB)	FL	6885	10189807
1,3-Dinitrobenzene (1,3-DNB)	FL	6160	10189807
2,4,6-Trinitrotoluene (2,4,6-TNT)	FL	9651	10189807
2,4-Dinitrotoluene (2,4-DNT)	FL	6185	10189807
2,6-Dinitrotoluene (2,6-DNT)	FL	6190	10189807
2-Amino-4,6-dinitrotoluene (2-am-dnt)	FL	9303	10189807
2-Nitrotoluene	FL	9507	10189807
3-Nitrotoluene	FL	9510	10189807
4-Amino-2,6-dinitrotoluene (4-am-dnt)	FL	9306	10189807
4-Nitrotoluene	FL	9513	10189807
Methyl-2,4,6-trinitrophenylnitramine (tetryl)	FL	6415	10189807
Nitrobenzene	FL	5015	10189807
Nitroglycerin	FL	6485	10189807
Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine (HMX)	FL	9522	10189807
Pentaerythritoltetranitrate (PETN)	FL	9558	10189807
RDX (hexahydro-1,3,5-trinitro-1,3,5-triazine)	FL	9432	10189807

Method EPA 9014

Analyte	AB	Analyte ID	Method ID
Total Cyanide	FL	1635	10193803

Method EPA 9034

Analyte	AB	Analyte ID	Method ID
Sulfide	FL	2005	10196006

Method EPA 9040

Analyte	AB	Analyte ID	Method ID
Corrosivity	FL	1615	10196802

Texas Commission on Environmental Quality

NELAP - Recognized Laboratory Fields of Accreditation

Certificate:	T104704254-13-6
Expiration Date:	3/31/2014
Issue Date:	4/1/2013

Microbac Laboratories, Inc., Ohio Valley Division

158 Starlite Drive
Marietta, OH 45750-5279

These fields of accreditation supercede all previous fields. The Texas Commission on Environmental Quality urges customers to verify the laboratory's current accreditation status for particular methods and analyses.

Matrix: ***Solid & Chemical Materials***

pH	FL	1900	10196802

Method EPA 9045

Analyte	AB	Analyte ID	Method ID
pH	FL	1900	10197805

Method EPA 9056

Analyte	AB	Analyte ID	Method ID
Bromide	FL	1540	10199209
Chloride	FL	1575	10199209
Fluoride	FL	1730	10199209
Nitrate as N	FL	1810	10199209
Nitrite as N	FL	1840	10199209
Sulfate	FL	2000	10199209

Method EPA 9071

Analyte	AB	Analyte ID	Method ID
n-Hexane Extractable Material (HEM) (O&G)	FL	1803	10201408

Method EPA 9095

Analyte	AB	Analyte ID	Method ID
Paint Filter Liquids Test	FL	10312	10204009

Method TCEQ 1005

Analyte	AB	Analyte ID	Method ID
Total Petroleum Hydrocarbons (TPH)	FL	2050	90019208