ENTERED

RECEIVED

SEP 1 1 2014

NMED
Hazardous Waste Bureau

RECEIVED

1 2014

NMED
Hazardous Waste Bureau

RECEIVED

1 1 2014

NMED
Hazardous Waste Bureau

DEPARTMENT OF THE AIR FORCE
HEADQUARTERS 49TH WING (ACC)
HOLLOMAN AIR FORCE BASE, NEW MEXICO

5 September 2014

DeAnna Rothhaupt
Chief, Holloman AFB Environmental
550 Tabosa Avenue
Holloman AFB NM 88330-8458

Mr. John E. Kieling
Chief, Hazardous Waste Bureau
New Mexico Environment Department
2905 Rodeo Park Drive East Bldg. 1
Santa Fe NM 87505-6063

SUBJECT: Transmittal of Final Interim Measures Work Plan, Group 2 Former Underground Storage Tank Site: AOC-UST-889 (TU515)

Dear Mr. Kieling,

Attached is the Final Interim Measures Work Plan for your review and comment. Included with the hardcopy of the report is a CD that contains native and PDF files of the subject document.

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision according to a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

If you have any questions regarding this submittal, please contact me at (575) 572-3931.

Sincerely,

DEANNA ROTHHAUPT, GS-12, DAFC

Attachment(s): Final Interim Measures Work Plan, Group 2 Former Underground Storage Tank Site: AOC-UST-889 (TU515). Hard copy and CD.

cc: Mr. Brian Salem, NMED HWB (Hard copy and CD)
Mr. Will Moats, NMED HWB (letter only)
C. Hendrickson, EPA, Region 6 (letter and CD)

FINAL
INTERIM MEASURES WORK PLAN

Group 2 Former Underground Storage Tank Site:

AOC-UST-889 (TU515)

Holloman Air Force Base, New Mexico

Prepared for
Air Force Civil Engineer Center
2261 Hughes Ave, Suite 155
Joint Base San Antonio Lackland, Texas 78236-9853

Contract No.: FA8903-13-C-0008

URS Group, Inc.
Denver, Colorado

September 2014

TABLE OF CONTENTS

1.0 INTRODUCTION 1-1
1.1 Interim Measures Purpose 1-1
1.2 Interim Measures Objectives 1-2
1.3 Regulatory Setting 1-2
1.4 Interim Measures Work Plan Organization 1-3

2.0 PREVIOUS INVESTIGATIONS AND BACKGROUND INFORMATION 2-1
2.1 Previous Investigations 2-1
2.1.1 TU515 2-1
2.2 General Background Information 2-2
2.2.1 Physical Setting 2-2
2.2.2 Holloman AFB History 2-2
2.2.3 Physiography and Topography 2-2
2.2.4 Climate 2-3
2.2.5 Regional Geology and Soils 2-3

3.0 PROCEDURES FOR IMPLEMENTATION 3-1
3.1 Applicable Regulations and Standards 3-2
3.2 Pre-mobilization Activities 3-3
3.3 Mobilization Setup 3-3
3.4 Exploratory Soil and Groundwater Sampling 3-3
3.5 Excavation/Soil Removal 3-4
3.6 Confirmation Soil Sampling 3-5
3.7 Subsurface Injection 3-6
3.8 Monitoring Well Installation and Development 3-6
3.8.1 Monitoring Well Installation 3-6
3.8.2 Monitoring Well Development 3-8
3.9 Confirmation Groundwater Monitoring 3-9
3.10 Waste Management 3-10
3.11 Site Restoration 3-10
3.12 Surveying 3-11
3.13 Reporting 3-11

4.0 INTERIM MEASURES REPORT 4-1

5.0 PROJECT SCHEDULE 5-1

6.0 REFERENCES 6-1

LIST OF FIGURES

Figure 1-1 Location Map, Holloman Air Force Base
Figure 2-1 Building 889, TU515 Site Map
Figure 2-2 Regional Soils
Figure 2-3 Regional Hydrogeology
Figure 5-1 Preliminary Project Schedule

LIST OF APPENDICES

Appendix A Meeting Minutes: Interim Measures at TU-Sites. 19 June 2014

LIST OF ACRONYMS AND ABBREVIATIONS

°F	degree Fahrenheit
AFB	Air Force Base
AFCEC	Air Force Civil Engineer Center
AOC	Area of Concern
bgs	below ground surface
CAC	Corrective Action Complete
CFR	Code of Federal Regulations
COC	Contaminant of Concern
CY	cubic yard
DERA	Defense Environmental Restoration Account
DOT	Department of Transportation
DPT	direct-push technology
DRO	diesel range organics
FPM	FPM Remediations, LLC
ft	foot/feet
GIS	geographic information system
GRO	gasoline range organics
HSA	hollow stem auger
HASP	Health and Safety Plan
HWA	Hazardous Waste Act
HWB	Hazardous Waste Bureau
IDW	investigation derived waste
IM	Interim Measure
IRP	Installation Restoration Program
MCL	maximum contaminant level
mg/kg	milligrams per kilogram
mg/L	milligrams per liter
NM	New Mexico
NMAC	New Mexico Administrative Code
NMED	New Mexico Environment Department
NMWQCC	New Mexico Water Quality Control Commission
NRCS	Natural Resources Conservation Service
NTU	nephelometric turbidity unit
ORO	oil range organics
PAH	polynuclear aromatic hydrocarbon
PBR	Performance Based Remediation
PID	photoionization detector
PPE	personal protective equipment
ppm	parts per million
PVC	polyvinyl chloride
QA	quality assurance
QAPP	Quality Assurance Project Plan
QC	Quality Control
RCRA	Resource Conservation and Recovery Act

RFI	RCRA Facility Investigation
RSL	Regional Screening Level
Shaw	Shaw Environmental & Infrastructure, Inc.
SOP	Standard Operating Procedure
sq ft	square foot/feet
SSL	soil screening levels
SVOC	Semi-volatile organic compound
TAL	Target Analyte List
TAT	turn-around time
TCLP	Toxicity Characterization Leachate Procedure
TDS	total dissolved solids
TPH	total petroleum hydrocarbons
URS	URS Group, Inc.
USAF	United States Air Force
U.S. Census	United States Census Bureau
USEPA	United States Environmental Protection Agency
USGS	United States Geological Survey
UST	underground storage tank
VCM	Voluntary Corrective Measures
VOC	volatile organic compound
WMSR	White Sands Missile Range

1.0 INTRODUCTION

This Interim Measures (IM) Work Plan addresses one Group 2 Underground Storage Tank (UST) Area of Concern (AOC) located at Holloman Air Force Base (AFB) near Alamogordo, New Mexico (NM) (**Figure 1-1**). The AOC consists of a former UST site, where the UST has been removed, but elevated concentrations of petroleum hydrocarbons (e.g., diesel fuel) have been documented in soil. The former UST site discussed in this IM Work Plan is identified as:

- AOC-UST-889 (TU515, formerly TU/US-C515).

This IM Work Plan has been prepared by FPM Remediations, LLC (FPM)/URS Group, Inc. (URS) on behalf of the United States Air Force Civil Engineer Center (AFCEC), under Contract Number FA8903-12-R-0050, in accordance with Holloman AFB's Resource Conservation and Recovery Act (RCRA) Permit (Permit Number - NM6572124422) (NMED 2004) and Notice to Approve a Class 3 Permit Modifications (NMED 2012a), which added the site to the RCRA Permit.

As part of a Defense Environmental Restoration Account (DERA) study for AFCEC, this site was evaluated to determine eligibility for cleanup funding under DERA. The DERA Evaluation Report evaluated historical site information and recommended that this site be further investigated (URS 2009).

The site was partially investigated and some petroleum-impacted soil was removed by Shaw Environmental & Infrastructure, Inc. (Shaw, now a part of CB&I) under the Voluntary Corrective Measures (VCM) program. The VCM Request (Shaw 2011) was prepared by Shaw, on behalf of AFCEC under the Midwest Performance Based Remediation (PBR) Contract (Contract Number FA8903-09-D-8580) and submitted to the New Mexico Environment Department (NMED) for review by the United States Air Force (USAF) on 15 February 2012. In a letter dated 21 January 2014, NMED approved this VCM Request (NMED 2014). The technical approach utilized by Shaw mirrored that used for several "Group 3" UST sites at Holloman AFB; however, the Group 3 VCM Request (Shaw 2012) was not reviewed by NMED.

Based on URS' review of the preliminary data collected under the VCM, additional investigative and remedial work are necessary at this site to achieve Corrective Action Complete (CAC). This work can most effectively be accomplished through the use of IM because the site is relatively small, the nature of the petroleum hydrocarbons is well understood, and the technologies to remove and/or destroy the hydrocarbons are well-proven.

1.1 Interim Measures Purpose

The purpose of these IM is to facilitate a timely corrective measure which will minimize or prevent the further migration of contaminants and limit actual or potential human and environmental exposure to contaminants. The ultimate goal of this project is to bring this site to CAC status, with no requirement for further land use controls. The IM approach for this TU site was discussed with NMED during a meeting on 16 December 2013 between NMED, Holloman AFB, and URS (URS 2013), and in more specific detail during a second meeting on 19 June 2014 (URS 2014b). Minutes for the 19 June 2014 meeting with NMED are provided as **Appendix A**.

1.2 Interim Measures Objectives

The primary objectives of the IM are to:

- Clearly delineate the nature and extent of petroleum hydrocarbons in subsurface soil and groundwater;
- Remove and/or destroy petroleum hydrocarbons present in the soil and/or groundwater at concentrations above applicable screening values;
- Provide confirmatory sampling data to demonstrate that each site has achieved regulatory cleanup levels; and
- Provide the necessary data to support a CAC proposal to NMED to delist the site from the RCRA Permit.

These IM objectives will be achieved in part through the following field activities, which are described in this Work Plan:

- utility clearance;
- soil and groundwater reconnaissance sampling for contaminants of concern (COCs);
- excavation and disposal of contaminated soil;
- temporary well point and/or monitoring well installation;
- subsurface injection of bioremediation augmentation substrates (if necessary);
- confirmation sampling of soil and/or groundwater;
- surveying; and
- site restoration.

1.3 Regulatory Setting

Pursuant to the RCRA Permit, IM activities conducted at Holloman AFB are performed under the New Mexico Hazardous Waste Act (HWA), the New Mexico Hazardous Waste Management Regulations, and RCRA. The NMED Hazardous Waste Bureau (HWB) has regulatory enforcement authority for the State of New Mexico.

The media of concern for the UST sites referenced in this document include subsurface soil and groundwater. Pursuant to the RCRA Permit, and with guidance provided by NMED, cleanup levels for impacted soil under these IM will be to the latest revision of NMED and EPA documents at the time of work plan approval and/or execution of the fieldwork. Currently, these levels include the residential soil screening levels (SSLs) presented in the *Risk Assessment Guidance for Site Investigations and Remediation* (NMED 2012b), or the United States Environmental Protection Agency's (USEPA) *Regional Screening Levels (RSLs)* for residential soil (USEPA 2013), if no SSL has been identified for a specific compound. Additionally, the RCRA Permit requires groundwater cleanup levels (latest revision as of work plan approval) to be set at the more conservative of those specified by either the New Mexico Water Quality Control Commission (NMWQCC) as protective of human health (20.6.2.3103 New Mexico

Annotated Code [NMAC]), or by USEPA's Maximum Contaminant Levels (MCLs) (USEPA 2013).

The risk associated with vapor intrusion of subsurface contaminants into installation buildings will also be assessed. Preliminary analytical data collected during the VCM (Shaw 2013) indicate no significant risk due to vapor intrusion; however, these data were not satisfactorily reviewed and validated prior to publication.

In addition to the prescribed regulatory guidance, the *Final Background Study Report; Holloman AFB, New Mexico, Revision 3* (NationView 2011) provides reference data for comparison to metals concentrations in soils and groundwater under these IM. The background levels of metals in soil and groundwater published in that report have been accepted by NMED (NMED 2011) and will be used as secondary screening data to determine whether soil or groundwater have been impacted by metals at the former UST site. In the event that there are detected metals in excess of established background concentrations, it may be appropriate to further evaluate the data and propose a weight-of-evidence argument for selected values if it appears as though they may be naturally occurring.

1.4 Interim Measures Work Plan Organization

This IM Work Plan is divided into six sections and includes one appendix. The sections of this Work Plan include:

- Section 1 - Introduction, Purpose, Objectives, and Regulatory Setting;
- Section 2 - Previous Investigations and Background Information;
- Section 3 - The technical approach for implementing IM at the site, including general procedures and typical methods and materials that may be used;
- Section 4 - A brief discussion of the IM Report structure and contents;
- Section 5 - An estimated project schedule for IM implementation and reporting; and
- Section 6 - A list of documents referenced in this Work Plan.

This page intentionally left blank

2.0 PREVIOUS INVESTIGATIONS AND BACKGROUND INFORMATION

2.1 Previous Investigations

As stated in Section 1.0, initial investigative work was performed and documented in the DERA Evaluation Report (URS 2009). This work mostly involved a review of historical records with a resulting recommendation for further investigation based on the potential presence of contaminants. Subsequent environmental investigation and remediation was conducted under both the USAF's Installation Restoration Program (IRP) and the RCRA Corrective Action Program.

The following sections provide brief descriptions of work performed under the previously approved VCM Request (Shaw 2011). Shaw performed the VCM along with investigative work with the intention of concurrently conducting a RCRA Facility Investigation (RFI). However, the corresponding RFI Work Plan and Report were not reviewed by NMED. Data obtained from these activities were compiled in a Sample Completion Report, Group 2 – Five Former UST Sites (Shaw 2013), which has also not been reviewed or commented on by NMED as of the time of preparation of this IM Work Plan (April 2014). There is no indication that the results of the work previously performed will be submitted for review by NMED as a standalone document. The analytical data reported in the Sample Completion Report (Shaw 2013) will be re-evaluated within the context of the data generated under these IM, and a determination on its appropriateness as either a screening or compliance/confirmation tool will be made at that time. The 2012 investigation data will be submitted for review within the IM Report prepared in accordance with this Work Plan regardless of whether it is used for screening or confirmation purposes. References to the sample locations and results are discussed below, but will be formally presented in the IM Report.

2.1.1 TU515

Records for former UST site TU515 at Building 889 (**Figure 2-1**) indicate that the associated UST was closed in 1992 (URS 2009). Closure records report the UST was a bare steel tank with a capacity of 550 gallons. The tank had been in service for 9 years and was used for diesel fuel storage prior to closure. There was no known internal or external tank protection, and the associated piping was also bare steel. A visual inspection for leakage was performed following tank removal, and none was reported. There are no records to show that soil remediation or removal was performed at that time.

During the 2012 VCM, approximately forty cubic yards (cy) of soil were excavated from the site down to between 7 and 8 feet below ground surface (bgs). Nineteen soil samples were collected from both direct-push boreholes and excavated test pits at varying depths down to the water table at locations surrounding the former UST pit (Appendix A soil figure). The only parameters exceeding the soil screening criteria were TPH-GRO (in one floor sample) and TPH-DRO (in two floor and three wall samples). The limits of soil TPH contamination have been delineated to the north, west, and south of the former UST location, and to the foundation of Building 889 on the east. It is unknown if contamination extends under Building 889.

Three monitoring wells were installed as part of the VCM (**Figure 2-1**), with water table depth observed at approximately 8 ft bgs. Groundwater samples were collected from all three site monitoring wells and compared to the NMWQCC water quality standards. The only parameter

detected above the groundwater screening criteria was manganese in downgradient/cross-gradient well MW-02 (347 µg/L, which is above the 200 µg/L criteria). This detection is presumed to be a naturally-occurring concentration.

2.2 General Background Information

2.2.1 Physical Setting

Holloman AFB is situated in south central New Mexico, in the northwest central part of Otero County, approximately 75 miles north–northeast of El Paso, Texas (USAF 2013). Holloman AFB has a population of 3,054 (U.S. Census 2010) and occupies 59,639 acres in the northeast quarter of Section 1, Township 17 South, Range 8 East. The White Sands Missile Range (WSMR) testing facilities occupy additional land extending northward from the Base. Privately and publicly owned lands border the remainder of Holloman AFB. The major highway servicing Holloman AFB is Highway 70, which runs southwest from the town of Alamogordo, New Mexico, and separates Holloman AFB from publicly owned lands to the south. Alamogordo, which has a population of 30,401 according to (U.S. Census 2010), is located approximately 7 miles east of the Base.

2.2.2 Holloman AFB History

Holloman AFB was first established in 1942 as Alamogordo Army Air Field. From 1942 through 1945, Alamogordo Army Air Field served as the training grounds for over 20 different flight groups, flying primarily B-17s, B-24s, and B-29s. After World War II, most operations had ceased at the Base. In 1947, Air Material Command announced that the air field would be its primary site for the testing and development of unmanned aircraft, guided missiles, and other research programs (USAF 2013). On 13 January 1948, the Alamogordo installation was renamed in honor of the late Colonel George V. Holloman, a pioneer in guided missile research. In 1968, the 49th Tactical Fighter Wing arrived at Holloman AFB and has remained since. Today, Holloman AFB also serves as the training center for the German Air Force's Tactical Training Center.

2.2.3 Physiography and Topography

Holloman AFB is located within the Basin and Range Province physiographic province in the Sacramento Section on the western edge of the Sacramento Mountains at a mean elevation of 4,093 ft above mean sea level (USGS 2003). The region is characterized by high tablelands with rolling summit plains, cuesta-formed mountains dipping eastward, and west-facing escarpments with the wide bracketed basin forming the basin and range complex. Holloman AFB is within the Tularosa Basin, which is part of the Central Closed Basins (NMED 2004). The bordering mountains rise abruptly to altitudes of 7,000 to 12,000 ft above mean sea level. The San Andres Mountains approximately 30 miles to the west bound the basin to the west, with the Sacramento Mountains approximately 10 miles to the east (**Figure 1-1**). At its widest, the basin is approximately 60 miles east to west and stretches approximately 150 miles north to south.

2.2.4 Climate

As a whole, New Mexico has a mild, arid to semiarid continental climate characterized by light precipitation totals, abundant sunshine, relatively low humidity, and relatively large annual and diurnal temperature ranges (Western Regional Climate Center 2013). The climate of the Central Closed Basins varies with elevation. The Base is located in the lower elevation areas, characterized by warm temperatures and dry air. Daytime temperatures often exceed 100 degrees Fahrenheit (°F) in the summer months and are in the middle 50-degree range in the winter. A preponderance of clear skies and relatively low humidity permits rapid cooling resulting in average diurnal temperature ranges of 25° to 35°F. Potential evapotranspiration, at 73 inches per year, significantly exceeds annual precipitation, usually less than 10 inches. Arid conditions resulting from very low rainfall amounts, coupled with topographically induced wind patterns and combined with sparse vegetation, tend to cause localized "dust devils." The annual rainfall for Alamogordo is 12 inches per year. Much of the precipitation falls during the mid-summer monsoonal period (July and August) from brief, yet frequent, intense thunderstorms culminating in 30 to 40 percent of the total annual rainfall.

2.2.5 Regional Geology and Soils

2.2.5.1 Regional Geology

The sedimentary rocks, which make up the adjacent mountain ranges, are between 500 and 250 million years old (Weir, Jr. 1965). During the period when the area was submerged beneath the shallow intracontinental sea, the layers of limestone, shale, gypsum, and sandstone were deposited. In time, these layers were pushed upward through various tectonic forces, forming a large bulge on the surface. Approximately 10 million years ago, the center began to subside, resulting in a vertical drop of thousands of feet leaving the edges still standing (the present-day Sacramento and San Andres mountain ranges). In the millions of years following, rainfall, snowmelt, and wind eroded the mountain sediments, depositing them in the valley (i.e., Tularosa Basin). Water carrying eroded limestone, dolomite, gravel, and other materials continued to flow into the basin.

As the Tularosa Basin is a bolson-type basin, which is a basin with no surface drainage outlet, sediments carried by surface water into a closed basin are bolson deposits. The overlying alluvium generally consists of unconsolidated gravels, sands, and clays. Soils in the basin are derived from the adjacent ranges as erosional deposits of limestone, dolomite, and gypsum. A fining sequence from the ranges towards the basin's center characterizes the area with the near surface soils being alluvial, eolian, and lacustrine deposits. The alluvial fan deposits are laterally discontinuous units of interbedded sand, silt, and clay, while the eolian deposits consist primarily of gypsum sands. The eolian and alluvial deposits are usually indistinguishable due to the reworking of the alluvial sediment by eolian processes. The playa, or lacustrine deposits, consist of clay containing gypsum and are contiguous with the alluvial fan and eolian deposits throughout the Base. Stiff caliche layers, varying in thickness, have been identified at different areas of the Base.

2.2.5.2 Soils

The United States Natural Resources Conservation Service (NRCS) (formerly Soil Conservation Service) has identified two soil associations in the vicinity of Holloman AFB—the Holloman-Gypsum Land-Yesum Complex and the Mead silty clay loam (Derr 1981)(**Figure 2-2**). The hydraulic conductivity of these horizons ranges from 4×10^{-4} to 1×10^{-3} centimeters per second.

The Holloman-Gypsum Land-Yesum Complex (0 to 5 percent slopes) consists of larger areas of shallow and deep, well-drained soils and areas of exposed gypsum. The Holloman soil makes up about 35 percent of the complex. Typically, the surface layer is light brown, very fine sandy loam approximately 3 inches thick. The upper 13 inches of the substratum is pink, very fine sandy loam that is very high in gypsum. Below that, the substratum is white gypsum to a depth of more than 60 inches. This soil is calcareous and mildly alkaline to moderately alkaline throughout. Permeability is moderate, and available water capacity is very low.

Gypsum Land makes up approximately 30 percent of the Holloman-Gypsum Land-Yesum Complex (0 to 5 percent slopes). Typically less than 1 inch of very fine sandy loam overlies soft to hard, white gypsum. The deeper Yesum horizon consists of very fine sandy loam that makes up approximately 20 percent of the complex. Typically, the surface layer is light brown, very fine sandy loam approximately 3 inches thick. The upper 9 inches of the substratum is light brown, fine sandy loam that is very high in gypsum. Below that, the substratum is pink, very fine sandy loam to a depth of more than 60 inches. The soil is calcareous throughout and is mildly alkaline. Permeability is moderate, and available water capacity is moderate. Many fine gypsum crystals are found throughout the profile.

The soil type found across the main drainage area for the Base is Mead silty clay loam (0 to 1 percent slopes). This deep, poorly drained, nearly level soil occurs on outer fringes of alluvial fans. This soil formed in fine-textured alluvium over lacustrine lake sediment. It is very high in salt content because of periodic flooding and poor drainage. Slopes are smooth and concave. Typically, the surface layer is reddish-brown, silty clay loam and clay loam approximately 5 inches thick. The substratum, to a depth of 48 inches, is light reddish-brown clay that has a high salt content. Below that, the substratum is lacustrine material of variable texture and color to a depth of more than 60 inches. Included within this soil are areas of Holloman soils and Gypsum Land along the margins of the unit of steep, short gully sides and knolls.

These inclusions make up approximately 15 percent of the map unit for this soil type. Individual areas are generally smaller than 10 acres. This soil is moderately calcareous throughout and is moderately to strongly alkaline. It has a layer of salt that is more soluble than gypsum. Permeability is very low, and available water capacity is low (URS 2009).

2.2.5.3 Regional Hydrogeology

Groundwater occurs as an unconfined aquifer in the unconsolidated deposits of the central basin, with the primary source of recharge as rainfall percolation and minor amounts of stream runoff along the western edge of the Sacramento Mountains (Basabilvazo, Myers, and Nickerson 1994). Surface water/rainfall migrates downward into the alluvial sediments at the edge of the shallow aquifer near the ranges and flows downgradient through progressively finer-grained sediments towards the central basin. Because the Tularosa Basin is a closed system, water that enters the area leaves either through evaporation or percolation. This elevated amount of percolation results

in a fairly high water table. Beneath Holloman AFB, groundwater ranges from 5 to 50 ft bgs. Flow for the Base is generally towards the southwest with localized influences from variations in topography (**Figure 2-3**). In the northern and western portions of the Base, groundwater flows more to the west towards the Ritas Draw, Malone Draw, and Lost River drainages. Groundwater flow is affected by local topography in areas immediately adjacent to arroyos, where groundwater flows directly toward the drainages regardless of the regional flow pattern.

Groundwater in the Tularosa Basin is of potable quality at the recharge areas in close proximity to the Sacramento Mountains and becomes increasingly mineralized toward the central portion of the basin and discharge areas. The majority (over 70 percent) of the Installation Restoration Program sites located across Holloman AFB have groundwater monitoring wells containing water with an average TDS concentration greater than 10,000 mg/L. These TDS data support the hypothesis that TDS concentrations below 10,000 mg/L at Holloman AFB are caused by dilution of natural groundwater quality from leaking water lines and surface irrigation from the domestic water supply. TDS concentrations greater than 10,000 mg/L exceed the NMWQCC limit for potable water, and therefore, the groundwater beneath Holloman AFB has been designated as unfit for human consumption. Likewise, the USEPA guidelines have identified the groundwater as a Class IIIB water source, characterized by TDS concentrations exceeding 10,000 mg/L and a low degree of interconnection with adjacent surface water or groundwater of a higher class. Groundwater at Holloman AFB does not discharge or connect to any adjacent aquifers because the Tularosa Basin is a closed basin. Adjacent surface waters include Lost River and Lake Holloman, which also have high concentrations of TDS and are not considered potential drinking water sources.

2.2.5.4 Surface Water Hydrology

The Tularosa Basin contains all of the surface flow in its boundaries (NMWQCC 2006). The nearest inflow of surface waters to the Base comes from the Lost River, located in the north central region of the Base. The upper reaches of the Three Rivers and Sacramento River are perennial in the basin. Holloman AFB is dissected by several southwest-trending arroyos that control surface drainage. Hay Draw arroyo is located in the far north. Malone and Ritas draws, which drain into the Lost River and Dillard Draw arroyos, are located along the eastern perimeter of the Base. Indications are that the climate was much wetter approximately 10,000 years ago. The present-day Lake Otero formerly encompassed a much larger area, possibly upwards of several hundred square miles. Its remains are the Alkali Flat and Lake Lucero. Lake Lucero is a temporary feature merely a few inches deep during the rainy season. Ancient lakes and streams deposited water-bearing deposits over older bedrock basement materials. Fractures, cracks, and fissures in the Permian and Pennsylvanian bedrock yield small quantities of relatively good quality water in the deeper periphery. Potable water is only found in wells near the edges of the basin with more saline water found towards the center. Two of the principal sources of potable water are a long narrow area on the upslope sides of Tularosa and Alamogordo and another area in the far southwestern part of the basin. A portion of the city of Alamogordo's water, as well as the Holloman AFB's water, was formerly supplied from Bonito Lake (which is in the Pecos River Basin) prior to the Little Bear Fire, in 2012.

2.2.5.5 Current and Future Land Use

The land surrounding Holloman AFB consists of residential areas to the east and northeast (city of Alamogordo), rangeland to the south, White Sands National Monument to the west, and areas where military activities are conducted to the north. The desert terrain immediately surrounding Holloman AFB has limited development, Mesa Verde Ranch operates along the eastern border, and there are no residential communities, or large industrial operations located adjacent to the Base. Holloman AFB is an active military installation and is expected to remain active for the foreseeable future. No transfer of military property to the public is anticipated, and public access to the Base is restricted (Foster Wheeler 2002). Future land use is not expected to differ significantly from current land use practices (Foster Wheeler 2002).

Building 889 is located within the Holloman AFB airfield, and has presently and historically been used for industrial purposes. There is no indication that the USAF will modify land use at the TU515 site.

2.2.5.6 Current and Future Water Use

Currently, there are no potable supplies of groundwater or surface water located on the Base (Foster Wheeler 2002). Holloman AFB obtains its water supply from the city of Alamogordo and Holloman AFB wells in the Boles, San Andres, and Douglas well fields at the Base of the Sacramento Mountains. No water supply wells are located on or near the Base because of poor groundwater quality with TDS concentrations greater than 10,000 mg/L. There are no potable or irrigation wells near or immediately downgradient of the Base.

3.0 PROCEDURES FOR IMPLEMENTATION

This section includes general procedures for implementing the delineation and remedial action activities to be undertaken. Several supporting project-related plans have also been prepared as a Technical Memorandum to supplement this IM Work Plan and provide a more thorough framework for URS to conduct these IM (URS 2014c):

- A site-specific Quality Assurance Project Plan (QAPP)establishes the overarching analytical and data collection protocols and documentation requirements so that data are generated, reviewed, and analyzed in a consistent manner, for the investigation and remediation activities performed in the scope of work presented in this Work Plan.
- A site-specific Health and Safety Plan (HASP) defines the health and safety guidelines developed to protect URS personnel, subcontractors, and government personnel involved in the IM.
- URS Standard Operating Procedures (SOPs) outline the general procedures used to conduct various activities associated with IM implementation.

The following specific tasks will be applied to the former UST site subject to IM under this Work Plan:

- Pre-mobilization activities;
- Mobilization/site setup;
- Exploratory soil and groundwater sampling;
- Excavation/soil removal;
- Confirmation soil sampling;
- Subsurface injection (if necessary);
- Monitoring well installation and development;
- Confirmation groundwater sampling;
- Waste management;
- Site restoration;
- Site surveying; and
- Reporting.

URS has evaluated the VCM approach proposed by Shaw for the TU515 site (Shaw 2011) as approved by NMED (NMED 2014), and prepared this IM Work Plan with recognition of the existing VCM Request, but with proposed changes to more effectively achieve the goals of IM. The primary changes between the previously approved VCM Request (Shaw 2011) and this IM Work Plan are:

- Removal of the 40 CY excavation limit contained within the VCM Request, which was a contractual limitation for that work. Impacted soil with COC concentrations above the applicable cleanup levels will be removed (or otherwise remediated), whenever feasible, with no fixed limit on the volume of excavation at a given site.

- Modification of the previous monitoring well installation plan which stipulated only three wells per site. Instead, additional monitoring wells and/or temporary well points will be installed as necessary to achieve objectives of the IM including delineation of the nature and extent of contamination. At the site, at least three properly constructed monitoring wells will be used to perform site delineation, remediation performance monitoring, and/or compliance monitoring.
- Pursuant to Part 4, Section F of the Holloman AFB RCRA Permit, planned IM activities at the former UST site are not limited to remediation of impacted soil. IM will be implemented to "mitigate any current or potential threat(s) to human health or the environment and [are] consistent with and integrated into any long-term solution at the facility" (NMED 2004), including the remediation of impacted groundwater and soil vapor intrusion. Following identification of the nature and extent of contamination at the site, soil removal and bioremediation will be utilized to remediate contaminated soil and groundwater, if necessary.

3.1 Applicable Regulations and Standards

Federal and state regulations and standards that may be applicable to these IM include the following:

- Holloman AFB RCRA Permit No. NM6572124422, February 2004 (NMED 2004).
- RCRA Permit No. NM6572124422 Modification, October 2009 (NMED 2009).
- NMED residential SSLs (NMED 2012).
- USEPA residential RSLs (USEPA 2013).
- NMWQCC groundwater cleanup levels protective of human health (20.6.2.3103 NMAC).
- USEPA MCLs (USEPA 2013).
- New Mexico HWA (NMSA 1978, §74-4-1).
- New Mexico Hazardous Waste Management Regulations, (20.4.1.100 NMAC).
- RCRA, 40 Code of Federal Regulations (CFR) 260-268, Management of Hazardous Waste. In the event that investigation derived waste (IDW) sampling and analysis indicate the presence of constituents of potential concern at concentrations rendering them hazardous, storage and disposal protocols will be followed in accordance with RCRA hazardous waste regulations, as adopted by NMED.
- United States Department of Transportation (DOT) 49 CFR 172, 173, and 178: Applies to packaging IDW for removal off site and addresses hazard-class diamond labeling.

The latest revision of NMED and EPA documents at the time of work plan approval and/or execution of the fieldwork will be used.

3.2 Pre-mobilization Activities

Prior to mobilization of equipment, subcontractors (e.g., drilling subcontractor, New Mexico-licensed surveyor, and approved analytical laboratory) will be procured. All necessary permits (e.g., digging permits) will be initiated. All site activities will be coordinated with appropriate Holloman AFB personnel.

Prior to initiating intrusive activities, a completed and approved Air Force Form 332 will be obtained for authorization of construction work at Holloman AFB. A request for locating underground utilities in the area will be submitted to the local one-call utility notification center, as applicable. Additionally, Air Force Form 103 will be submitted to request that the location of underground utilities be marked at the specific sites. Drilling and excavation locations will be identified with paint, flags, or stakes, as appropriate to the surface material. Utility clearance approvals will be completed by the appropriate Holloman AFB utility office (e.g., telephone, sewer, water, natural gas, etc.).

3.3 Mobilization Setup

Personnel, equipment, and resources necessary to implement this IM Work Plan will be mobilized to the site. Site setup will occur at the former UST site. Warning signs and safety fencing may be used, where necessary, to indicate the danger of entering a work zone and to keep the work area clear of obstructions such as facility-worker vehicles. Setup will also include establishing a location for material storage and other equipment staging areas.

Site work at TU515 is anticipated to be performed in conjunction with other IM to be implemented at Holloman AFB Group 3 UST sites discussed in a separate IM Work Plan (URS 2014a).

3.4 Exploratory Soil and Groundwater Sampling

Exploratory (pre-remediation) soil and groundwater sampling are intended to be utilized as a screening tool; therefore, the protocols for exploratory delineation sampling may differ from the more stringent requirements of confirmatory and compliance sampling that will be conducted following remedial activities. The sample collection and preparation procedures utilized during delineation will be implemented to provide guidance for excavation and subsurface injection, if needed, and will not provide analytical data to be relied upon as a boundary condition or to achieve site closure directly. The results of exploratory sampling may also be used to determine placement of more formal confirmation and compliance sample locations. As opposed to confirmatory sampling, exploratory samples may be analyzed in the field by a screening test or in a setting other than a fully-accredited laboratory and will not be required to adhere to criteria specified in the QAPP or SOPs.

The main types of sampling that will be conducted during implementation of this IM Work Plan include:

- Pre-remediation delineation soil and groundwater sampling for chemical contamination;
- Performance monitoring sampling, as warranted, during any ongoing remedial actions; and

- Post-remediation confirmation sampling for contaminated soil and groundwater.

The more formal confirmatory sampling activities are described in greater detail in **Section 3.6** (Confirmation Soil Sampling) and **Section 3.9** (Confirmation Groundwater Sampling). Exploratory samples will be clearly identified as exploratory, delineation, or with similar wording to avoid confusion with confirmation samples.

To differentiate exploratory from confirmatory samples, an exploratory sample is defined as a field-screening tool to be used for determining more precise application of the IM, whereas a confirmation sample is defined as a representative sample that has been collected, analyzed, and validated in accordance with the QAPP and applicable SOPs, and is subsequently used to document that the concentrations of COCs in soil or groundwater are below the applicable cleanup levels. Pre-excavation exploratory sample data will not be validated; however, the data will be included in the IM Report for reference.

At the former UST site, exploratory sampling will be conducted using DPT, trenching, or other appropriate methods. In addition to standard vertical DPT drilling methods, angled and/or horizontal soil borings may be utilized to access otherwise obstructed areas such as beneath building foundations. Subsurface investigation will be conducted to determine the horizontal and vertical extent of soil and groundwater contamination, as required. During trenching or DPT drilling, soil screening will be conducted using a photoionization detector (PID), visual and olfactory observations, and collection of screening samples (as described above) to guide the exploration and identify the extent of soil contamination.

The maximum extent of accessible soil contamination will be determined based on field observation, site conditions, and physical restrictions. Visual observation of stained soil; field and/or laboratory soil screening; and proximity of existing underground utilities, surface structures, and building foundations may also define the limits of accessible contamination.

Exploratory samples will be analyzed for TPH-GRO, -DRO, and -oil range organics (ORO) using Modified USEPA Method 8015. Target Analyte List (TAL) metals, polynuclear aromatic hydrocarbons (PAHs), and VOCs will also be analyzed. The QAPP (URS 2014c) indicates the sampling and analytical method requirements for confirmation soil and groundwater samples; however, not all elements of the QAPP are applicable to exploratory sample collection and analysis. The SOPs (URS 2014c) describe the general methods and equipment to be used in the collection and handling of environmental samples; exploratory sampling for soil and groundwater will be in general accordance with the applicable SOPs.

Proposed delineation sample locations were discussed between URS, Holloman AFB, and NMED during a meeting on 19 June 2014 (URS 2014b). The meeting minutes presented in **Appendix A** include an excerpted summary table of estimated monitoring well installations, soil, and groundwater samples, as well as planning figures showing approximate proposed sample locations and historical analytical data.

3.5 Excavation/Soil Removal

Once contamination in site soil has been delineated, removal of contaminated soil may be performed using a backhoe or hydraulic excavator. Should the soil removal require access to areas completed in concrete or asphalt, the surface covering will be removed prior to excavation and replaced following backfill and compaction.

If contaminated soil appears to extend past the expected excavation limits, excavation will continue until soil is no longer considered to be potentially contaminated, based on visual evidence, field- or laboratory-screening, or other appropriate screening methods. However, excavation may be limited by the presence of buildings and/or utilities. Once the screening inspection indicates that soil is not potentially contaminated, confirmation samples will be collected in accordance with the QAPP and SOPs (URS 2014c). Confirmation samples will be collected at a frequency of one from each side wall of the excavation per 20 linear feet along the area of contamination within the excavation. This applies to excavations with less than 50,000 CYs of soil. For excavations greater than 50,000 CYs, the frequency of sampling will be every 50 linear feet. A minimum of one excavation floor sample will be collected and for larger excavations floor samples will be collected at intervals of approximately 500 square feet (sq ft). Excavation activities and subsequent sampling and analysis will continue until confirmation sampling and analysis indicate that concentrations of COCs do not exceed the applicable NMED residential SSLs (NMED 2012b).

Following removal of contaminated soil and confirmation sampling, the excavations will be backfilled with clean fill material (verified clean by analytical results, or other appropriate certification) and compacted by methods appropriate to fulfill Holloman AFB requirements. There is no pre-defined limit to the volume, depth, or horizontal extent of excavation.

The excavated soil will be placed in appropriate roll-off containers (lined and covered, if necessary) for off-site disposal, or on 20-mil plastic sheeting for temporary stockpiling. Waste characterization samples may be collected to facilitate off-site transport and disposal of IDW at an appropriate permitted disposal facility or on-Base land farm. Management of IDW is further described in **Section 3.10**.

Open trenches will be lined with plastic sheeting to prevent contact between rainwater and contaminated soil. When necessary, soil berms or other appropriate methods may be used to control storm water. Rainwater may be pumped out of open trenches to the ground surface or to the storm water drainage system. Groundwater encountered in an excavation will be pumped from the excavation and contained as IDW for treatment/disposal prior to backfilling.

3.6 Confirmation Soil Sampling

Following discussion with NMED, confirmation soil samples will be analyzed for TPH-GRO, -DRO, and -ORO using Modified USEPA Method 8015. TAL metals, PAHs, and VOCs will also be analyzed. The QAPP (URS 2014c) indicates the sampling and analytical method requirements for confirmation soil samples.

Pursuant to the Holloman AFB RCRA Permit, soil analytical results will be compared with the corresponding NMED residential SSLs (NMED 2012b), or USEPA RSLs (USEPA 2013) if no SSL has been designated. Excavation activities and subsequent sampling and analysis will continue until confirmation sampling and analysis indicate that COC concentrations do not exceed the applicable cleanup levels.

If a confirmation soil sample result exceeds the applicable screening levels, then an additional amount of wall or floor material will be excavated, and one additional confirmation soil sample (wall or floor) will be collected. This process will continue until the confirmation soil samples indicate concentrations are below applicable cleanup levels.

All samples will be collected and delivered to the laboratory under chain-of-custody protocol with request for expedited turn-around time (TAT) for analytical results. These samples will be collected, handled, and analyzed according to the QAPP and SOPs (URS 2014c).

Quality Assurance (QA)/Quality Control (QC) samples will be collected for the appropriate COCs so that sample results can be properly validated and eventually used as confirmation samples. The QA/QC samples will be collected at the following frequencies, per matrix, as detailed in the QAPP (URS 2014c):

- Trip Blanks: one for every 20 field samples analyzed for GRO and/or VOCs;
- Field Duplicates: one for every 20 field samples;
- Matrix Spike, Matrix Spike Duplicate pairs: one for every 20 field samples; and
- Rinsate (Equipment) Blanks: one for every 20 field samples collected with non-disposable/non-dedicated equipment.

3.7 Subsurface Injection

Due to the relatively small size of the site, the generally straightforward nature of hydrocarbon remediation, and the established effectiveness of bioremediation for petroleum hydrocarbons, selected bioremediation augmentation substrates will be injected into the subsurface where COC concentrations in the vadose zone or groundwater exceed the applicable screening levels following any remedial excavation. The appropriateness of remedial injections under IM was confirmed in the 19 July 2014 meeting between NMED, Holloman AFB, and URS (URS 2014b). The injection locations will be spaced at appropriate horizontal and vertical intervals, and are anticipated to be set on approximate 10- to 20-ft centers, with injection depths ranging from approximately 5 to 20 ft bgs, with specific injection details to be determined in the field.

The optimum method to deliver bioremediation augmentation substrates into the subsurface is to inject the material through direct push rods using hydraulic mixing and pumping equipment. This approach increases the spreading and mixing of substrates into the aquifer. Upon completion of injection, each direct-push hole will be properly sealed to the surface.

The quantity of substrate dosing required at the site will be based on the results of exploratory soil and groundwater sample analysis, and consultation with the selected substrate manufacturer, among other pertinent factors.

Bioremediation augmentation substrates under consideration for these IM (i.e., BOS 200® and ORC Advanced®) are non-toxic and proven remediation technologies that have been used successfully by both URS and the USAF at multiple sites. These bioremediation augmentation substrates are also suitable for use in groundwater with elevated TDS concentrations.

3.8 Monitoring Well Installation and Development

3.8.1 Monitoring Well Installation

Additional monitoring wells may be installed in the vicinity of the former UST location to determine the impact to groundwater. As discussed in Section 1.0, the site already has three monitoring wells in place. Additional monitoring wells will be installed as necessary to fulfill

the objectives of the IM. At least three properly constructed monitoring wells will be utilized at the site to perform compliance monitoring.

Well-drilling activities will be performed by an individual with a current and valid well driller license issued by the State of New Mexico. Monitoring wells will be installed using the hollow-stem auger (HSA) drilling technique in accordance with NMED Ground Water Quality Bureau Monitoring Well Construction and Abandonment Guidelines (NMED 2011b). The boreholes will be advanced into the water table using HSAs such that the borehole diameter will be at least 4 inches larger than the outside diameter of the well casing to allow for proper placement of the filter pack and sealant. Care will be taken so that the completed monitoring wells are sufficiently straight and plumb to allow passage of measuring and sampling devices.

During drilling, a URS Geologist will document the following information for each boring:

- Boring or well identification (this identification will be unique, and ensure it has not been used previously at the Base);
- Purpose of the boring (e.g., soil sampling, monitoring well);
- Location in relation to an easily identifiable landmark;
- Names of drilling subcontractor and logger;
- Start and finish dates and times;
- Drilling method;
- Diameters of surface casing, casing type, and methods of installation;
- Depth at which saturated conditions were first encountered;
- Lithologic descriptions and depths of lithologic boundaries;
- Sampling-interval depths; and
- Other pertinent field observations.

Field forms including soil boring logs for documentation of field activities are provided in in SOPs. Well installation equipment will be decontaminated according to the specifications of the Decontamination SOP (URS 2014c).

Approximately two to three soil samples will be collected from split-spoons during the advancement of each well boring at the 0 to 2 ft interval and the interval with the highest PID field screen result, or the interval immediately above groundwater if no elevated PID readings are observed. Soil samples collected from the well borings will be analyzed for the same parameters as the exploratory soil samples described in **Section 3.4**; however, well boring soil samples will be treated as confirmatory/compliance samples, and will be subject to the protocols established in the QAPP and SOPs (URS 2014c).

Well borings will be advanced approximately 8 ft into the water table and completed such that the well screen intersects the water table. The wells will be constructed of 2-inch diameter Schedule 40 polyvinyl chloride (PVC) riser and screen. The screened section of the wells will consist of 10 ft of 0.010-inch slotted screen (or other field determined slot size). A silica sand filter pack will be placed around the screen to approximately 2 ft above the top of the screen. A

2-ft thick bentonite seal will be placed above the filter pack. The remaining annular space will be grouted with neat cement.

For wells that will be finished aboveground ("stick-up"), the casing will extend from the top of the screen to approximately 2 to 3 ft above ground surface. The top of the casing will be fitted with a removable cap, and the exposed casing will be protected by a locking steel protective casing. The protective casing will be large enough in diameter to allow easy access for removal of the cap. A concrete pad (2-ft minimum radius, 4-inch minimum thickness) will be installed around the protective casing and wellhead. The concrete and surrounding soil will be sloped to direct rainfall and runoff away from the wellhead. Protective steel posts (bollards) will be installed around the wells, where needed, to protect the wellhead from damage by vehicles or equipment.

Monitoring wells that are completed as "flush-mounted" will be constructed with water-tight well vaults that are rated to withstand traffic loads and fitted with locking, expandable well plugs. Concrete pads (2-ft minimum radius, 4-inch minimum thickness) will be poured around the well vaults. Vault covers will be secured with bolts. Additionally, the vault cover will indicate that the wellhead of a monitoring well is contained within the vault. The concrete and surrounding soil must be sloped to direct rainfall and runoff away from the well vault.

To document specific details of the monitoring well installations, the URS Geologist will prepare drilling logs and as-built well construction diagrams in the field as the activity is taking place. Specific procedures and example forms for installing monitoring wells are provided in SOPs (URS 2014c). The monitoring wells will be constructed in accordance with NMED guidance (NMED 2011b).

3.8.2 Monitoring Well Development

The newly installed monitoring wells will be developed to create an effective filter pack around the well screen, remove fine particles from the formation near the borehole, and assist in restoring the natural water quality of the aquifer in the vicinity of the well. All newly installed monitoring wells will be developed no sooner than 48 hours after installation to allow for grout curing.

Monitoring wells will be developed using surge blocks, bailers, or pumps to achieve effective well development.

During well development, documentation of the activity will take place in accordance with SOPs (URS 2014c) and will include recording of water level and depth-to-bottom measurements, water quality parameters, discharge water color, water volume, and time period.

Well development will continue until the following criteria are met:

- Water that has been removed from the well is visually clear, and the turbidity measures less than or equal to 10 nephelometric turbidity units (NTUs); and
- The pH, temperature, and specific conductance parameters have stabilized (less than 10 percent variation for three successive readings).

In the event that fine-grained deposits are present in the subsurface, it may be difficult to achieve a turbidity of 10 NTUs during well development. This is primarily a concern when a well has been screened in a formation that contains a high level of fine material (silt and clay). Silt and

clay can occasionally travel through filter packs on properly constructed wells, resulting in turbid water. While selection of proper filter pack and screen materials minimizes turbidity, fine-grained particles may still flow through. Proper well construction and development procedures will be followed to reduce measured turbidity in monitoring wells. If turbidity remains greater than 10 NTUs after 4 hours of continuous well development, well development will cease. If the well is pumped dry, it will be allowed to recharge and be re-pumped as much as practical within the 4-hour time limit.

3.9 Confirmation Groundwater Monitoring

Following remedial actions taken at the site, confirmation groundwater samples will be collected based on recommendations in the IM Report. It is estimated that quarterly sampling for a period of 1 year will be required.

Following discussion with NMED, confirmation groundwater samples will be analyzed for TPH-GRO, -DRO, and -ORO using Modified USEPA Method 8015. TAL metals, PAHs, and VOCs will also be analyzed. The QAPP (URS 2014c) indicates the sampling and analytical method requirements for confirmation soil samples.

Groundwater samples will be collected from site monitoring wells in accordance with the procedures provided in QAPP and SOPs (URS 2014c). If groundwater at the site exceeds NMED water quality standards, the TDS levels from nearby monitoring wells will be used to develop a TDS survey to determine if the present-day groundwater in the immediate vicinity of the site is above the NMED 10,000-mg/L TDS potable water threshold. The Groundwater Bureau does not regulate groundwater that has a TDS over this threshold. However, if contaminant concentrations exceed regulatory thresholds, it may be necessary to assess potential risks associated with vapor intrusion and/or ecological receptors.

Groundwater sampling will occur no sooner than 2 days following monitoring well development at any monitoring well. Groundwater monitoring wells will be purged and samples will be collected using low-flow sampling techniques in accordance with the QAPP and SOPs (URS 2014c). Field parameters (e.g., temperature, conductivity, pH, and turbidity) will be measured during well purging. Groundwater samples will be collected when the field parameters stabilize with minor fluctuation between consecutive readings. Groundwater samples collected from monitoring wells will be analyzed for the same parameters as the exploratory groundwater samples described in **Section 3.4**; however, monitoring well groundwater samples will be treated as confirmatory/compliance samples, and will be subject to the protocols established in the QAPP and SOPs (URS 2014c). Groundwater samples for metals analysis will be submitted to the analytical laboratory for both total and dissolved metals analyses; samples for dissolved metals analysis will be field filtered prior to submittal.

Quality Assurance (QA)/Quality Control (QC) samples will be collected for the appropriate COCs so that sample results can be properly validated and eventually used as confirmation samples. The QA/QC samples will be collected at the following frequencies, per matrix, as detailed in the QAPP (URS 2014c):

- Trip Blanks: one for every 20 field samples analyzed for GRO and/or VOCs;
- Field Duplicates: one for every 20 field samples;

- Matrix Spike, Matrix Spike Duplicate pairs: one for every 20 field samples; and
- Rinsate (Equipment) Blanks: one for every 20 field samples collected with non-disposable/non-dedicated equipment. Dedicated/disposable equipment is anticipated to be used for groundwater sampling.

3.10 Waste Management

Waste management options in order of preference are reuse, recycling, treatment, and disposal. Waste may be classified as non-investigative waste or investigative waste:

- Non-investigative waste, such as trash and office garbage, will be collected on an as-needed basis to maintain the site in a clean and orderly manner. This waste will be accumulated in plastic garbage bags and transported to a designated sanitary landfill or collection bin.
- IDW generated during these IM will be segregated into the following categories:
    - Suspected contaminated soil
    - Concrete or asphalt rubble
    - Decontamination, well development, seepage water in excavations, and purge water
    - Personnel protective equipment (PPE), sampling debris, and plastic sheeting

The IDW will be properly containerized and temporarily stored at a location specified by Holloman AFB prior to disposal. Depending on the COCs, fencing or other special marking may be required. Acceptable waste containers include sealed, DOT-approved, steel 55-gallon drums; small dumping bins with lids; or roll-off boxes with liners and covers. The containers will be transported in such a manner as to prevent spillage or particulate loss to the atmosphere. When required, sampling of drums or roll-off boxes will be done in accordance with SOPs URS 2014c).

The IDW will be segregated at the site according to the specified categories. Each waste container will be properly labeled with site identification, matrix, date of generation, and other pertinent information for handling.

3.11 Site Restoration

Following delineation and remedial action activities at the former UST site, site conditions will be restored to similar states as initial conditions. Direct-push boreholes will be filled with appropriate materials, and the surfaces will be finished to match the surrounding area (e.g., soil, asphalt cold patch, concrete, etc.). Excavations will be backfilled with clean fill and compacted with a vibratory compactor, backhoe, or other appropriate methods. The area will be graded to maintain positive drainage to conform to site conditions. The ground covering will then be restored to surrounding site conditions or other covering as directed by Holloman AFB.

3.12 Surveying

Surveying of the locations (northing, easting, and elevation coordinates) of excavations, confirmation soil sampling locations, new and existing monitoring well locations, and other pertinent site features will be conducted by a State of New Mexico-licensed surveyor. Elevation data for monitoring wells will include the top of the PVC riser and ground surface elevation at the well locations. Surveying data will be provided in a spreadsheet format for import into the geographic information system (GIS), and the data will also be incorporated into the report figures.

Horizontal coordinates will be referenced to the New Mexico Central State Plane Coordinate System, and surveyed to an accuracy of ±1.0 ft. Vertical elevations will be referenced to North American Datum 1983 coordinate system to an accuracy of ±0.01 ft.

Geospatial information will also be submitted as a separate deliverable to the USAF. All applicable federal, U.S. Department of Defense, and USAF geospatial data standards will be followed. Spatial data will be compliant with the Spatial Data Standards for Facilities, Infrastructure, and Environment v2.6.

Each geospatial data set will be accompanied by metadata that conforms to the Spatial Data Facilities, Infrastructure, and Environment standards. The horizontal accuracy of any geospatial data created will be tested and reported in accordance with the National Standard for Spatial Data Accuracy, and the results will be recorded in the metadata.

3.13 Reporting

The details of reporting related to this IM Work Plan are discussed in **Section 4.0** (Interim Measures Report).

This page intentionally left blank

4.0 INTERIM MEASURES REPORT

Documentation of the project will be maintained, including field notes/forms, photographs, analytical, and survey data. An IM Report detailing the delineation and remedial action activities will be prepared and submitted to NMED for review. The IM Report will include the following elements:

- A description of IM implemented, including:
  - Purpose of the IM;
  - A summary of the delineation and remedial action activities conducted at the site as part of the overall IM;
  - Descriptions of field operations, including quantity of soil removed, quantity of soil backfilled, number of soil borings or monitoring wells installed, quantities of materials injected into the subsurface, and quantity of wastes generated;
  - Documentation of disposal volumes, manifests, and bills of lading;
  - Maps with surveyed excavation footprints and locations of surveyed confirmation samples, including monitoring wells; and
  - Photographs showing site conditions and/or typical operations.
- Summaries of results, including:
  - A discussion of the chemical sampling efforts, including the results of all delineation sampling, and associated maps and tables; and
  - Explanation of data validation efforts.
- Summaries of problems encountered, including:
  - Explanation and description of any modifications to the IM Work Plan, and why the modification was necessary.
- Summaries of accomplishments and/or effectiveness of IMs, including:
  - A discussion of the confirmation/compliance sample analytical results; and
  - Recommendations, as appropriate, for disposition of the site(s) under the Holloman AFB RCRA Part B Permit.
- Copies of relevant laboratory/monitoring data, etc., including:
  - Pertinent field data, sampling sheets, and laboratory results in appendices.

This page intentionally left blank

5.0 PROJECT SCHEDULE

A preliminary project schedule for the overall anticipated sequence of IM activities is presented in **Figure 5-1**. The schedule is dependent on many independent factors including, but not limited to, USAF and NMED review and comment, subcontractor availability, weather, and site conditions.

USAF and NMED will be notified 30 days prior to the start of IM field activities. Additionally, during IM implementation, brief daily status reports may be submitted to Environmental representatives at Holloman AFB by electronic mail. These reports will summarize the previous day's activities, the planned activities for the following day, and other pertinent information.

As a general rule, IM will proceed quickly from site delineation to remediation within the same mobilization, if feasible. The IM implementation schedule will allow for evaluation of screening-level data collected during delineation to formulate a more detailed remedial approach specific to the site. Following implementation of the site-specific IM remedy, compliance and confirmation sample collection will begin. Post-remedy groundwater sample collection (e.g., monthly or quarterly) may be conducted to monitor IM effectiveness at the site and augment the implemented remedial actions with additional remediation if deemed necessary to achieve the IM objectives.

Upon successful completion of the IM, the IM Report will be submitted for review and approval of CAC without controls status.

This page intentionally left blank

6.0 REFERENCES

Basabilvazo, G.T., Myers, R.G., and Nickerson, E.L. 1994. Geohydrology of the High Energy Laser System Test Facility Site, White Sands Missile Range, Tularosa Basin, south- central New Mexico: U.S. Geological Survey Water-Resources Investigations Report 93-4192, 59 p.

Derr, Phillip S. *Soil Survey of Otero Area, New Mexico, Parts of Otero, Eddy, and Chaves Counties.* Soil Conservation and Forest Service incooperation with the New Mexico State University Agricultural Experiment Station, 1981.

Foster Wheeler Environmental Corporation (Foster Wheeler). 2002. Draft Report for the Remedial Investigation of DP-63—Disposal Pit 63, Holloman Air Force Base, New Mexico. December.

NationView/Bhate JV III, LLC (NationView). 2011. Basewide Background Study Report, Holloman Air Force Base, New Mexico. Contract No. W9128F-07-D-0022. Task Order No. 0003. July.

New Mexico Administrative Code (NMAC). 2013a. Title 20 Environmental Protection. Chapter 6. Water Quality. Part 2. Ground and Surface Water Protection. 20.6.2. Standards for Ground Water of 10,000 mg/l TDS Concentration or Less.

NMAC. 2013b. Title 20 Environmental Protection. Chapter 4. Hazardous Waste. Part 1. Hazardous Waste Management Regulations. 20.4.1. Adoption of 40 CFR Part 260.

New Mexico Environment Department (NMED). 2001. Use of Low-Flow and Other Non-Traditional Sampling Techniques for RCRA Compliant Groundwater Monitoring. Hazardous Waste Bureau. Santa Fe, New Mexico. October.

NMED. 2004. Holloman Air Force Base RCRA Permit No. NM6572124422. February.

NMED. 2011a. "Partial Approval, Basewide Background Study Report, January 2009, Holloman Air Force Base, USEPA ID# NM6572124422, HWB-HAFB-09-004," letter to D. Scruggs, Chief, Environmental Restoration Program, Holloman Air Force Base from J.E. Kieling, Acting Chief, Hazardous Waste Bureau, New Mexico Environment Department, August 12.

NMED. 2011b. Monitoring Well Construction and Abandonment Guidelines. Ground Water Quality Bureau. Santa Fe, New Mexico. March.

NMED. 2012a. Notice of Public Comment Period and Intent to Approve a Class 3 Permit Modification to the Holloman Air Force Base hazardous Waste Facility Permit, October 29, 2012.

NMED. 2012b. Risk Assessment Guidance for Site Investigations and Remediation, Volume 1, Tier 1: Soil Screening Guidance Technical Background Document. Hazardous Waste Bureau and Ground Water Quality Bureau Voluntary Remediation Program. Santa Fe, New Mexico. February.

NMED. 2014. "Approval, Voluntary Corrective Measure Request Group 2, Five Former Underground Storage Tank Sites, Holloman Air Force Base, EPA ID# NM6572124422, HWB-HAFB-12-004," letter to D. Rothhaupt, Chief, Compliance and Restoration,

Holloman Air Force Base from J.E. Kieling, Chief, Hazardous Waste Bureau, New Mexico Environment Department, January 21.

New Mexico Statutes Unannotated (NMSA).1983. Chapter 74 Environmental Improvement. Article 4. Hazardous Wastes. 74-4-1. Hazardous Waste Act.

New Mexico Water Quality Control Commission (NMWQCC). 2006. 2004-2006 State of New Mexico Integrated Clean Water Act §303(D)/§305(B) Report.

Shaw Environmental & Infrastructure, Inc. (Shaw). 2011. Working Copy Voluntary Corrective Measures Request, Group 2 - Five Former Underground Storage Tank Sites, Holloman Air Force Base, Contract No. FA8903-09-D-8580, Task Order No. 0013, Project No. 144106, Rev. 0, December 2011.

Shaw. 2012. Final Voluntary Corrective Measures Request, Group 3 - Nine Former Underground Storage Tank Sites, Holloman Air Force Base, Contract No. FA8903-09-D-8580, Task Order No. 0013, Project No. 144106, Rev. 0, February 2012.

Shaw. 2013. *Sample Completion Report, Group 23 – Five Former UST Sites, Holloman Air Force Base, New Mexico*, Contract No. FA8903-09-D-8580, Task Order No. 0013, Project No. 144106, Rev. 0. March.

United States Air Force (USAF). 2013. Holloman Air Force Base official website. http://www.holloman.af.mil/. Accessed 12/3/2013.

United States Census Bureau (U.S. Census). 2010. Census 2010 using American FactFinder. http://factfinder2.census.gov. Accessed 12/3/2013.

U.S. Environmental Protection Agency (USEPA). 2013. USEPA Regional Screening Level (RSL) Chemical-specific Parameters Supporting Table. November. Accessed online at: http://www.epa.gov/region9/superfund/prg/.

USEPA. 2010. Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, SW-846. 3rd ed. Including all promulgated updates and new methods. July 2010.

USEPA. 1992. Resource Conservation and Recovery Act Ground-Water Monitoring. Technical Enforcement Guidance Document. November.

United States Geological Survey (USGS). 2003. Geologic map of New Mexico.

URS Group, Inc. (URS). 2009. Volume II, Final Evaluation Report, Holloman Air Force Base, Identification and Evaluation of Defense Environmental Restoration Account Eligibility. Contract No. W912QR-04-D-0025, Task Order DS03. September.

URS, 2013. Meeting Minutes: Project Kickoff with NMED. 16 December.

URS. 2014a. Draft Final Interim Measures Work Plan - Group 3 Former Underground Storage Tank Sites: AOC-UST-221 (TU503), AOC-UST-298 (TU508), AOC-UST-901 (TU506), and AOC-UST-7003 (TU518), Holloman Air Force Base, New Mexico. Contract No.: FA8903-13-C-0008. March 2014.

URS. 2014b. Meeting Minutes: Interim Measures at TU-Sites. 19 June.

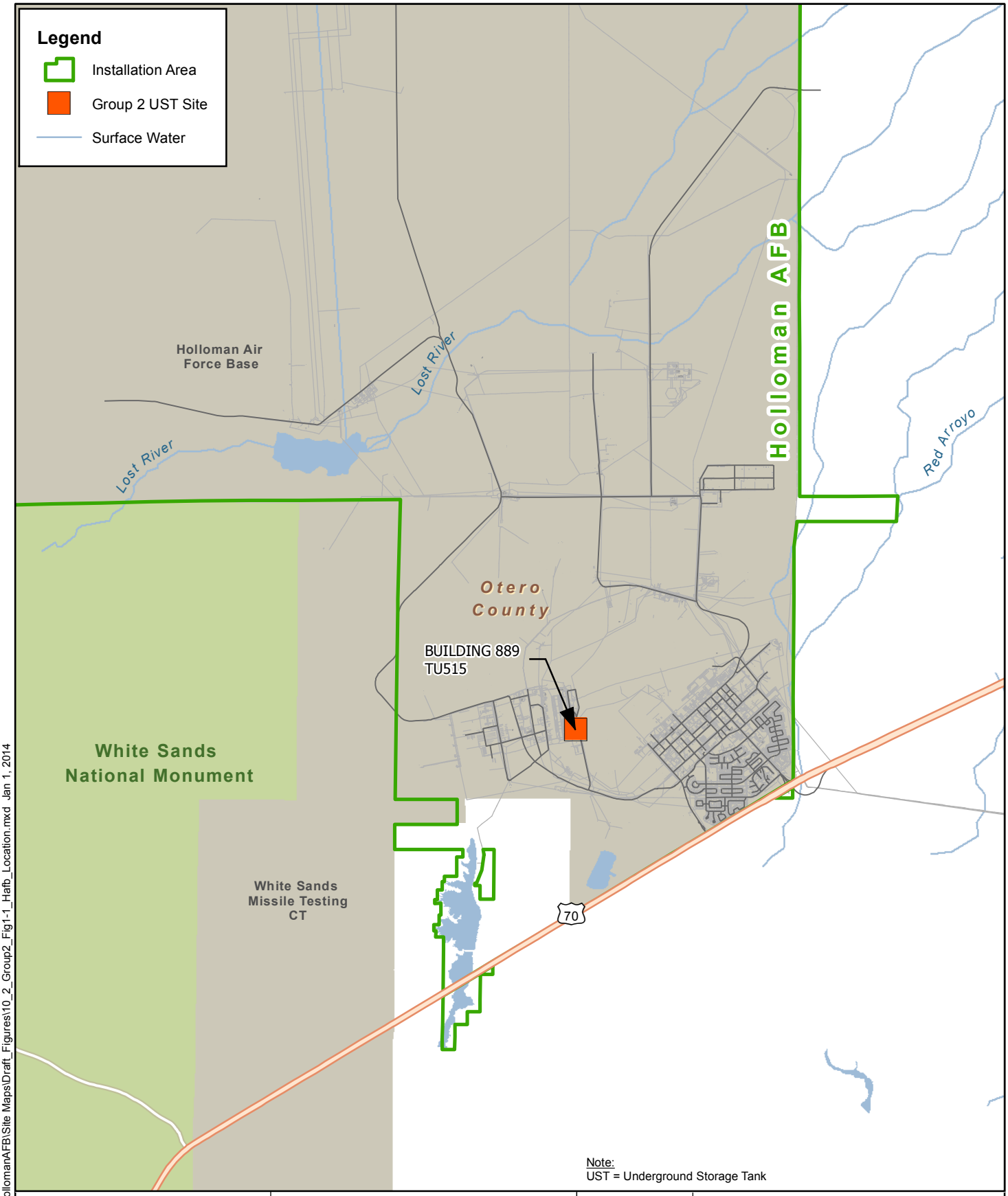
URS. 2014c. Technical Memorandum – Interim Measures Supplemental Plan Documents For TU-Sites. Holloman Air Force Base, New Mexico. Contract No.: FA8903-13-C-0008. *{In Progress}*

Weir, Jr., James E. *Geology and Availability of Ground Water in the Northern Part of the White Sands Missile Range and Vicinity New Mexico.* U.S Geological Survey and U.S. Department of interior, 1965.

Western Regional Climate Center. 2013. Desert Research Institute State Narrative Web Page, http://www.wsmr.army.mil/paopage/Pages/WU%2360.htm. Accessed 12/3/2013.

This page intentionally left blank

Figures



Note:
UST = Underground Storage Tank

N
W E
S

0 3,500 7,000 10,500
Scale in Feet
1 inch = 7,000 feet

URS

Coordinate System:
NAD 1983 State Plane, New Mexico Central Zone, Feet

Designed	JDM
Drawn	LED
Checked	DAE
Peer Review	DAE
Project Manager	BGP
Project Number	23446543

Figure 1-1

Location Map

Holloman Air Force Base
USAF

Jan 9, 2014

Y:\GIS\Projects\AZNM_PBR_HollomanAFB\Site Maps\Draft_Figures\10_2_Group2_Fig1-1_Hafb_Location.mxd Jan 1, 2014

Legend

- Monitoring Well
- Existing Structure
- Sewer
- Concrete
- Excavation
- Pot Hole
- Road Centerline
- Wall
- Storm Sewer Line
- Wastewater Line
- Water Line
- Electrical Cable Line
- Natural Gas Line
- Fuel Line

Coordinate System:
NAD 1983 State Plane, New Mexico
Central Zone, Feet

N W E S

0 12 24 48
Scale in Feet
1 inch = 24 feet

URS

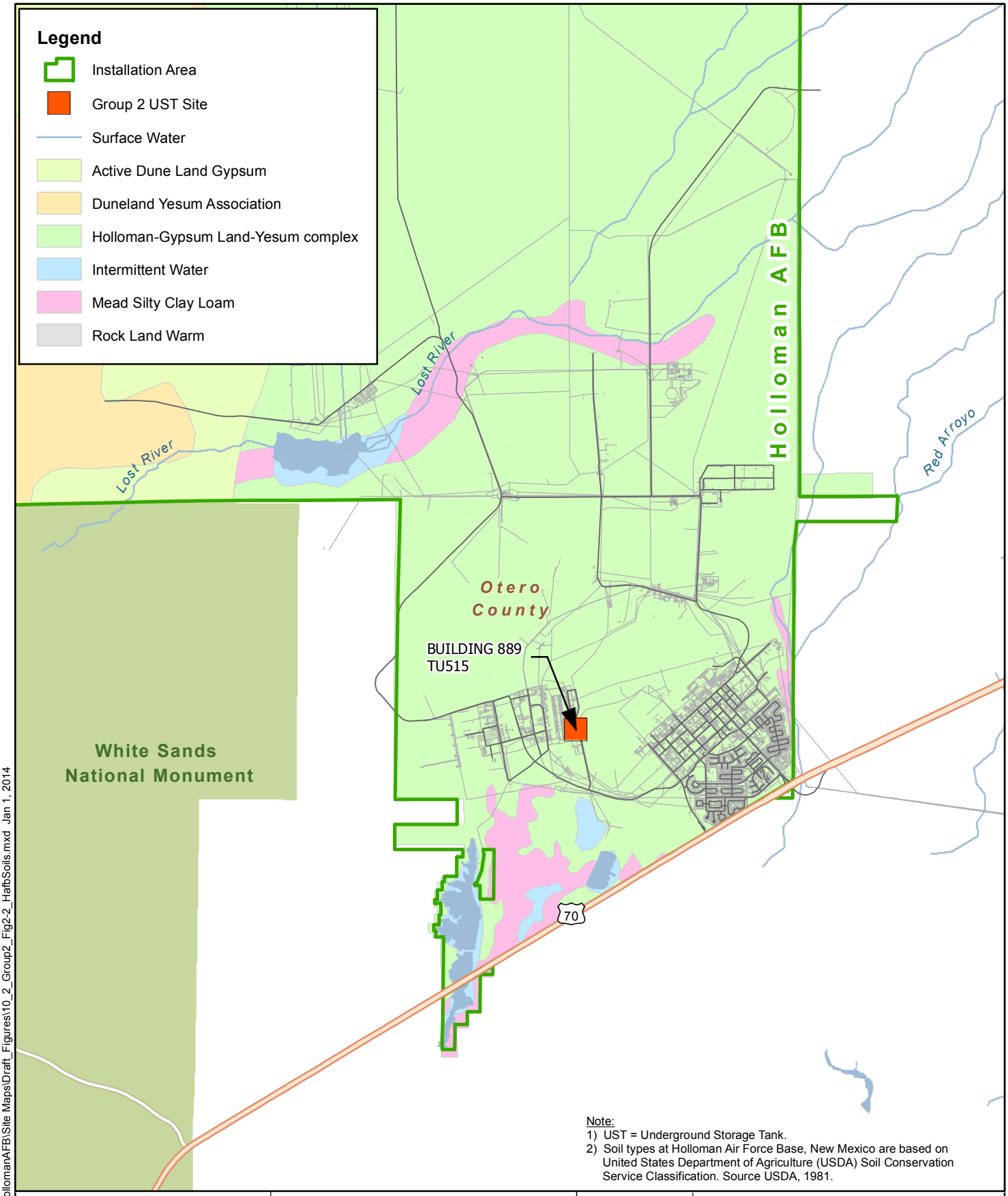
Designed	JDM
Drawn	LED
Checked	DAE
Peer Review	DAE
Project Manager	BGP
Project Number	23446543

Figure 2-1
Building 889
TU515
Site Map

Holloman Air Force Base
USAF

Apr 23, 2014

E:\GIS\Projects\AZNM_PBR_HollomanAFB\Site Maps\Draft_Figures\10_2_Group2_Fig2-1_TU515_SiteMap.mxd Apr 23, 2014



Note:
1) UST = Underground Storage Tank.
2) Soil types at Holloman Air Force Base, New Mexico are based on United States Department of Agriculture (USDA) Soil Conservation Service Classification. Source USDA, 1981.

N
W E
S

0 3,500 7,000 10,500
Scale in Feet
1 inch = 7,000 feet

URS

Coordinate System:
NAD 1983 State Plane, New Mexico Central Zone, Feet

Designed	JDM
Drawn	LED
Checked	DAE
Peer Review	DAE
Project Manager	BGP
Project Number	23446543

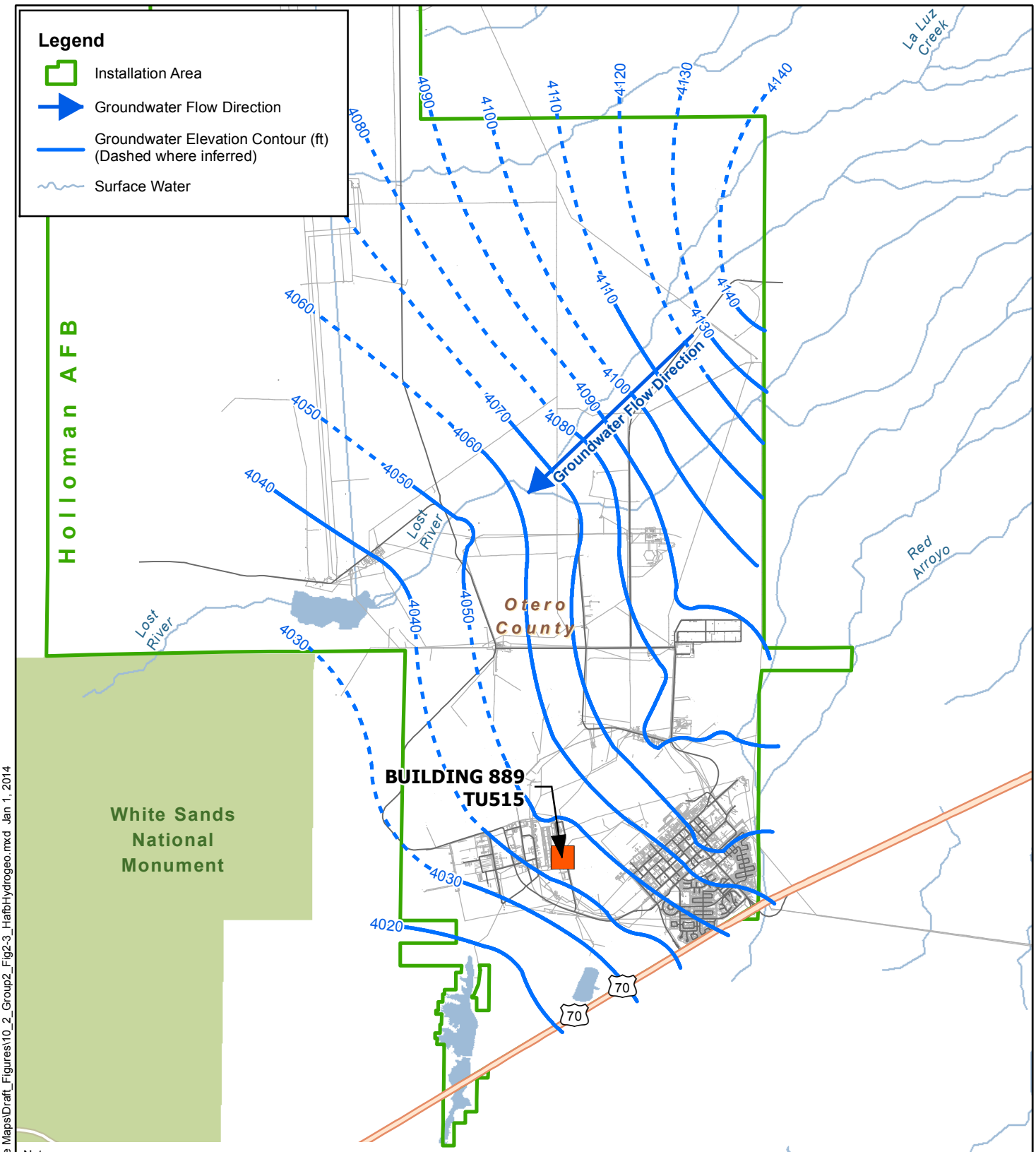
Figure 2-2

Regional Soils

Holloman Air Force Base
USAF

Jan 9, 2014

Y:\GIS\Projects\AZNM_PBR_HollomanAFB\Site Maps\Draft_Figures\10_2_Group2_Fig2-2_HafbSoils.mxd Jan 1, 2014



Note:
1) Groundwater contour map showing groundwater elevation contours across Holloman Air Force Base, New Mexico, are based on 2002 measurements taken from the shallow aquifer.
2) Source: Holloman AFB GIS, 2002 LTM.

N W E S

0 4,000 8,000 12,000

Scale in Feet
1 inch = 8,000 feet

URS

Coordinate System:
NAD 1983 State Plane, New Mexico Central Zone, Feet

Designed	JDM
Drawn	LED
Checked	DAE
Peer Review	DAE
Project Manager	BGP
Project Number	23446543

Figure 2-3

Regional Hydrogeology

Holloman Air Force Base
USAF

Jan 9, 2014

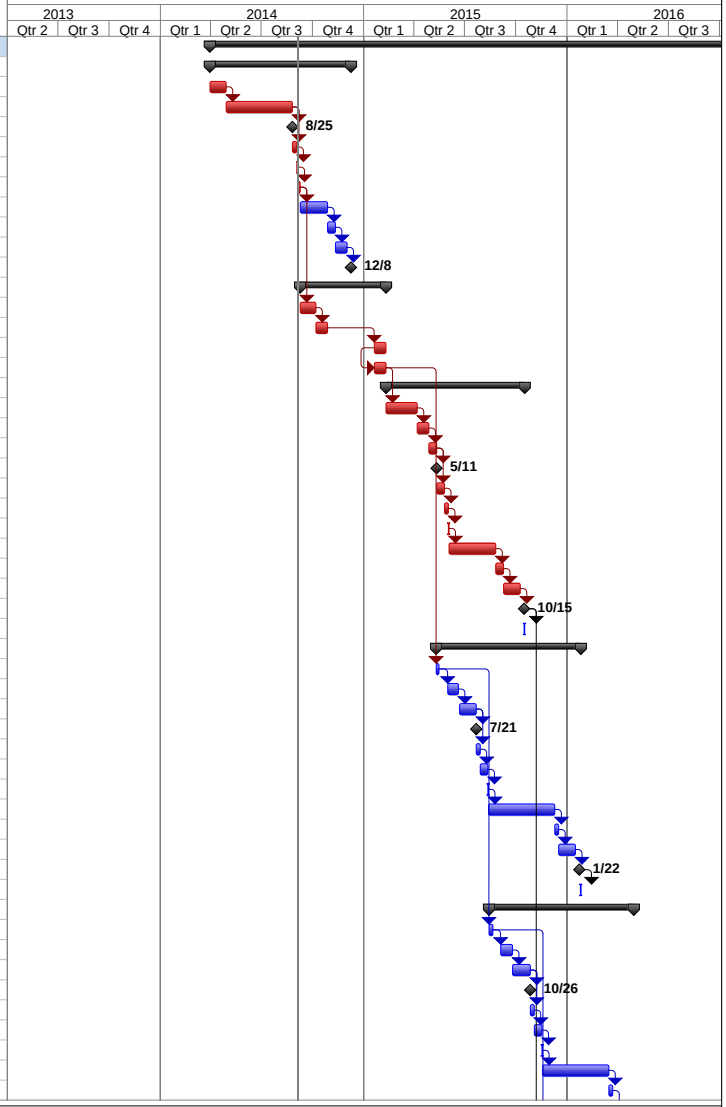
Y:\GIS\Projects\AZNM_PBR_HollomanAFB\Site Maps\Draft_Figures\10_2_Group2_Fig2-3_HafbHydrogeo.mxd Jan 1, 2014

FA8903-12-R-0050

Proposed Schedule for Interim Measures - Group 2 UST Site TU515
New Mexico-Arizona Group
Holloman AFB, New Mexico
Performance Based Remediation

URS

ID	Name	Duration	Start	Finish	Predecessors
1	**TU515**	**694 days**	**Mon 3/31/14**	**Thu 11/24/16**	
2	**IM Work Plan**	**181 days**	**Mon 3/31/14**	**Mon 12/8/14**	
3	Prepare & Submit Draft IM Work Plan to AF	21 days	Mon 3/31/14	Mon 4/28/14	
4	Air Force Review of Draft / Provide Comments	85 days	Tue 4/29/14	Mon 8/25/14	3
5	AF Approval of Draft IM Work Plan Milestone	0 days	Mon 8/25/14	Mon 8/25/14	4
6	Respond to Comments (AF) / Prepare & Submit Draft Final to AF	6 days	Tue 8/26/14	Tue 9/2/14	4
7	AF Review & Approval of Draft Final IM Work Plan	2 days	Wed 9/3/14	Thu 9/4/14	6
8	Submit Draft Final IM Work Plan for Regulator Review	2 days	Fri 9/5/14	Mon 9/8/14	7
9	Regulator Review of Draft Final / Provide Comments	35 days	Tue 9/9/14	Mon 10/27/14	8
10	Respond to Comments (Regulator) / Prepare & Submit Final	10 days	Tue 10/28/14	Mon 11/10/14	9
11	AF and Regulator Review of Final IM Work Plan	15 days	Tue 11/11/14	Mon 12/1/14	10
12	AF and Regulator Approval of Final IM Work Plan Milestone	0 days	Mon 12/8/14	Mon 12/8/14	11FS+5 days
13	**IM Field Work**	**110 days**	**Tue 9/9/14**	**Mon 2/9/15**	
14	Dig Permits & Utility Clearance	20 days	Tue 9/9/14	Mon 10/6/14	8
15	Supplemental Characterization Field Work	15 days	Tue 10/7/14	Mon 10/27/14	14
16	Excavation, Confirmatory Sampling, and Site Restoration	15 days	Tue 1/20/15	Mon 2/9/15	15FS+60 days
17	Groundwater Remediation (injection)	15 days	Tue 1/20/15	Mon 2/9/15	16SS
18	**IM Report**	**179 days**	**Tue 2/10/15**	**Fri 10/16/15**	
19	Prepare & Submit Draft IM Report	40 days	Tue 2/10/15	Mon 4/6/15	17
20	Air Force Review of Draft / Provide Comments	15 days	Tue 4/7/15	Mon 4/27/15	19
21	Respond to Comments	10 days	Tue 4/28/15	Mon 5/11/15	20
22	Air Force Approval of Draft IM Report Milestone	0 days	Mon 5/11/15	Mon 5/11/15	21
23	Prepare & Submit Draft Final to AF	10 days	Tue 5/12/15	Mon 5/25/15	21
24	AF Review & Approval of Draft Final / Revise as needed	5 days	Tue 5/26/15	Mon 6/1/15	23
25	Submit Draft Final IM Report for Regulatory Review	1 day	Tue 6/2/15	Tue 6/2/15	24
26	Regulator Review of Draft Final / Provide Comments	60 days	Wed 6/3/15	Tue 8/25/15	25
27	Respond to Regulator Comments on Draft Final and Prepare Final	10 days	Wed 8/26/15	Tue 9/8/15	26
28	AF and Regulator Review of Final / Revise as needed	22 days	Wed 9/9/15	Thu 10/8/15	27
29	Regulatory and AF Approval of Final IM Report Milestone	0 days	Thu 10/15/15	Thu 10/15/15	28FS+5 days
30	ERPIMS Submission	1 day	Fri 10/16/15	Fri 10/16/15	29
31	**1Q Groundwater Monitoring Report**	**186 days**	**Mon 5/11/15**	**Mon 1/25/16**	
32	Groundwater Monitoring Field Work	5 days	Mon 5/11/15	Fri 5/15/15	17FS+90 edays
33	Prepare & Submit Draft to AF 1Q 2015 Groundwater Monitoring Report	15 days	Mon 6/1/15	Fri 6/19/15	32FS+10 days
34	Air Force Review of Draft / Provide Comments	22 days	Mon 6/22/15	Tue 7/21/15	33
35	AF Approval of Draft 1Q 2015 Groundwater Monitoring Report Milestone	0 days	Tue 7/21/15	Tue 7/21/15	34
36	Respond to Comments (AF) / Prepare & Submit Draft Final to AF	5 days	Wed 7/22/15	Tue 7/28/15	34
37	AF Review & Approval of Draft Final 1Q 2015 Groundwater Monitoring Report	10 days	Wed 7/29/15	Tue 8/11/15	36
38	Submit Draft Final for Regulator Review	1 day	Wed 8/12/15	Wed 8/12/15	37
39	Regulator Review of Draft Final / Provide Comments	85 days	Thu 8/13/15	Wed 12/9/15	38
40	Respond to Comments (Regulator) / Prepare & Submit Final	5 days	Thu 12/10/15	Wed 12/16/15	39
41	AF and Regulator Review of Final 1Q 2015 Groundwater Monitoring Report	22 days	Thu 12/17/15	Fri 1/15/16	40
42	AF and Regulator Approval of Final 1Q 2015 Groundwater Monitoring Report Milestone	0 days	Fri 1/22/16	Fri 1/22/16	41FS+5 days
43	ERPIMS Submission	1 day	Mon 1/25/16	Mon 1/25/16	42
44	**2Q Groundwater Monitoring Report**	**186 days**	**Fri 8/14/15**	**Fri 4/29/16**	
45	Groundwater Monitoring Field Work	5 days	Fri 8/14/15	Thu 8/20/15	32FS+90 edays
46	Prepare & Submit Draft to AF 2Q 2015 Groundwater Monitoring Report	15 days	Fri 9/4/15	Thu 9/24/15	45FS+10 days
47	Air Force Review of Draft / Provide Comments	22 days	Fri 9/25/15	Mon 10/26/15	46
48	AF Approval of Draft 2Q 2015 Groundwater Monitoring Report Milestone	0 days	Mon 10/26/15	Mon 10/26/15	47
49	Respond to Comments (AF) / Prepare & Submit Draft Final to AF	5 days	Tue 10/27/15	Mon 11/2/15	47
50	AF Review & Approval of Draft Final 2Q 2015 Groundwater Monitoring Report	10 days	Tue 11/3/15	Mon 11/16/15	49
51	Submit Draft Final for Regulator Review	1 day	Tue 11/17/15	Tue 11/17/15	50
52	Regulator Review of Draft Final / Provide Comments	85 days	Wed 11/18/15	Tue 3/15/16	51
53	Respond to Comments (Regulator) / Prepare & Submit Final	5 days	Wed 3/16/16	Tue 3/22/16	52



Project: Group 2 UST Site IM
Date: Fri 9/5/14
File: zFigure_5-1 Preliminary Project S

Task		Project Summary		Inactive Milestone		Manual Summary Rollup		Critical	
Split		External Tasks		Inactive Summary		Manual Summary		Critical Split	
Milestone		External Milestone		Manual Task		Start-only		Progress	
Summary		Inactive Task		Duration-only		Finish-only		Deadline	

April 24, 2014

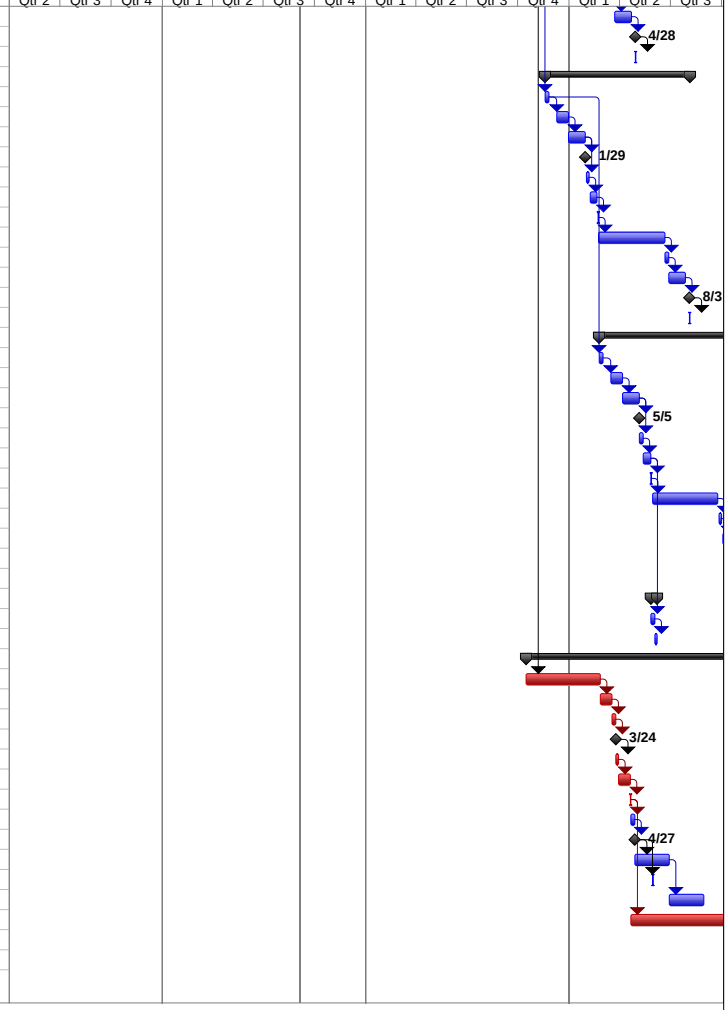
Figure 5-1. Preliminary Project Schedule

FA8903-12-R-0050

Proposed Schedule for Interim Measures - Group 2 UST Site TU515
New Mexico-Arizona Group
Holloman AFB, New Mexico
Performance Based Remediation

URS

ID	Name	Duration	Start	Finish	Predecessors
54	AF and Regulator Review of Final 2Q 2015 Groundwater Monitoring Report	22 days	Wed 3/23/16	Thu 4/21/16	53
55	AF and Regulator Approval of Final 2Q 2015 Groundwater Monitoring Report Milestone	0 days	Thu 4/28/16	Thu 4/28/16	54FS+5 days
56	ERPIMS Submission	1 day	Fri 4/29/16	Fri 4/29/16	55
57	**3Q Groundwater Monitoring Report**	**186 days**	**Thu 11/19/15**	**Thu 8/4/16**	
58	Groundwater Monitoring Field Work	5 days	Thu 11/19/15	Wed 11/25/15	45FS+90 edays
59	Prepare & Submit Draft to AF 3Q 2015 Groundwater Monitoring Report	15 days	Thu 12/10/15	Wed 12/30/15	58FS+10 days
60	Air Force Review of Draft / Provide Comments	22 days	Thu 12/31/15	Fri 1/29/16	59
61	AF Approval of Draft 3Q 2015 Groundwater Monitoring Report Milestone	0 days	Fri 1/29/16	Fri 1/29/16	60
62	Respond to Comments (AF) / Prepare & Submit Draft Final to AF	5 days	Mon 2/1/16	Fri 2/5/16	60
63	AF Review & Approval of Draft Final 3Q 2015 Groundwater Monitoring Report	10 days	Mon 2/8/16	Fri 2/19/16	62
64	Submit Draft Final for Regulator Review	1 day	Mon 2/22/16	Mon 2/22/16	63
65	Regulator Review of Draft Final / Provide Comments	85 days	Tue 2/23/16	Mon 6/20/16	64
66	Respond to Comments (Regulator) / Prepare & Submit Final	5 days	Tue 6/21/16	Mon 6/27/16	65
67	AF and Regulator Review of Final 3Q 2015 Groundwater Monitoring Report	22 days	Tue 6/28/16	Wed 7/27/16	66
68	AF and Regulator Approval of Final 3Q 2015 Groundwater Monitoring Report Milestone	0 days	Wed 8/3/16	Wed 8/3/16	67FS+5 days
69	ERPIMS Submission	1 day	Thu 8/4/16	Thu 8/4/16	68
70	**4Q Groundwater Monitoring Report**	**186 days**	**Wed 2/24/16**	**Wed 11/9/16**	
71	Groundwater Monitoring Field Work	5 days	Wed 2/24/16	Tue 3/1/16	58FS+90 edays
72	Prepare & Submit Draft to AF 4Q 2015 Groundwater Monitoring Report	15 days	Wed 3/16/16	Tue 4/5/16	71FS+10 days
73	Air Force Review of Draft / Provide Comments	22 days	Wed 4/6/16	Thu 5/5/16	72
74	AF Approval of Draft 4Q 2015 Groundwater Monitoring Report Milestone	0 days	Thu 5/5/16	Thu 5/5/16	73
75	Respond to Comments (AF) / Prepare & Submit Draft Final to AF	5 days	Fri 5/6/16	Thu 5/12/16	73
76	AF Review & Approval of Draft Final 4Q 2015 Groundwater Monitoring Report	10 days	Fri 5/13/16	Thu 5/26/16	75
77	Submit Draft Final for Regulator Review	1 day	Fri 5/27/16	Fri 5/27/16	76
78	Regulator Review of Draft Final / Provide Comments	85 days	Mon 5/30/16	Fri 9/23/16	77
79	Respond to Comments (Regulator) / Prepare & Submit Final	5 days	Mon 9/26/16	Fri 9/30/16	78
80	AF and Regulator Review of Final 4Q 2015 Groundwater Monitoring Report	22 days	Mon 10/3/16	Tue 11/1/16	79
81	AF and Regulator Approval of Final 4Q 2015 Groundwater Monitoring Report Milestone	0 days	Tue 11/8/16	Tue 11/8/16	80FS+5 days
82	ERPIMS Submission	1 day	Wed 11/9/16	Wed 11/9/16	81
83	**Well Abandonment Field Work**	**7 days**	**Fri 5/27/16**	**Mon 6/6/16**	
84	Dig Permits & Utility Clearance (if applicable)	5 days	Fri 5/27/16	Thu 6/2/16	76
85	Well Abandonment	2 days	Fri 6/3/16	Mon 6/6/16	84
86	**Corrective Action Complete (CAC) Proposal**	**290 days**	**Fri 10/16/15**	**Thu 11/24/16**	
87	Prepare and Submit Draft CAC Proposal	95 days	Fri 10/16/15	Thu 2/25/16	29
88	Air Force Review of Draft/Provide Comments	15 days	Fri 2/26/16	Thu 3/17/16	87
89	Respond to Comments	5 days	Fri 3/18/16	Thu 3/24/16	88
90	Air Force Approval Draft CAC Proposal	0 days	Thu 3/24/16	Thu 3/24/16	89
91	Prepare and Submit Draft Final CAC Proposal	3 days	Fri 3/25/16	Tue 3/29/16	90
92	Air Force and MSG Review of Draft Final/Revise as Needed	15 days	Wed 3/30/16	Tue 4/19/16	91
93	Submit Draft Final for Regulatory Review	1 day	Wed 4/20/16	Wed 4/20/16	92
94	Prepare Newspaper Notice	5 days	Thu 4/21/16	Wed 4/27/16	93
95	Publish Approved Newspaper Notice and Submit it to Stakeholders and NMED	0 days	Wed 4/27/16	Wed 4/27/16	94
96	Public Comment Period	44 days	Thu 4/28/16	Tue 6/28/16	95
97	Public Meeting	1 day	Mon 5/30/16	Mon 5/30/16	95FS+22 days
98	Assist with Responses to Public Comment (if any)	44 days	Wed 6/29/16	Mon 8/29/16	96
99	Regulator Review of Draft Final / Provide Comments	124 days	Thu 4/21/16	Tue 10/11/16	93
100	Respond to Regulator Comments on Draft Final (if necessary) and Prepare Final CAC Proposal	10 days	Wed 10/12/16	Tue 10/25/16	99
101	Air Force and Regulator Review of Final CAC Proposal/Revise as needed	22 days	Wed 10/26/16	Thu 11/24/16	100
102	Regulatory Approval of Final CAC Proposal (Administratively Completeness Letter) and Achieve SC (finished with all AF requirements to Permit Mod)	0 days	Thu 11/24/16	Thu 11/24/16	101



Project: Group 2 UST Site IM
Date: Fri 9/5/14
File: zFigure_5-1 Preliminary Project S

Task		Project Summary		Inactive Milestone		Manual Summary Rollup		Critical	
Split		External Tasks		Inactive Summary		Manual Summary		Critical Split	
Milestone		External Milestone		Manual Task		Start-only		Progress	
Summary		Inactive Task		Duration-only		Finish-only		Deadline	

April 24, 2014

Figure 5-1. Preliminary Project Schedule

Appendix A
Meeting Minutes
Interim Measures at TU-Sites. 19 June 2014

Holloman Air Force Base
Meeting Minutes
Interim Measures at TU-Sites

PURPOSE: Meeting with New Mexico Environment Department (NMED), Holloman Air Force Base (HAFB), and HAFB's Contractor, URS Group, Inc. (URS) to discuss Interim Measures (IM) at Group 3 UST Sites TU-503, TU-506, TU-508 and TU-518, Group 2 UST Site TU-515, and Group 1 Septic System Site TU-904.

LOCATION: New Mexico Environment Department (NMED), 5500 San Antonio Dr. NE, Albuquerque, NM

DATE: 19 June 2014

TIME: 1:00 p.m. Mountain Time

MEETING ATTENDEES:

Name	Organization	Phone Number	Email Address
Brian Salem	NMED	505-222-9576	Brian.Salem@state.nm.us
David Strasser	NMED	505-222-9526	David.Strasser@state.nm.us
David Rizzuto	HAFB	575-572-5395	David.Rizzuto.Ctr@holloman.af.mil
Brian Powers	URS	303-740-3924	Brian.Powers@urs.com
Jon Mallonee	URS	303-740-3967	Jon.Mallonee@urs.com
Steven Geiger	URS	505-672-2107	Steve.Geiger@urs.com

INTRODUCTIONS AND SITE OVERVIEW

Brian Powers (BP) and Dave Rizzuto (DR) provided an overview of meeting objectives and site histories.

General Items:

- The rationale for splitting up the reports (Group 3 – TU 503; TU-508; TU-506 and TU-518; Group 2 – TU-515; and separately, TU-904) was discussed. DR described these as the sites that prior contractor did not finish under a previous Performance-Based Remediation (PBR) contract.

- Brian Salem (BS) and Dave Strasser (DS) discussed Interim Measure vs. a full Corrective Measures Studies (CMS) approach. NMED stated that we can proceed with Interim Measures if we use presumptive and 'simple' remediation approaches (e.g., injections, soil vapor extraction (SVE), etc.); however, if the remediation is expected to take longer than 2 years without steadily improving conditions, then we would need to step back and go through a formal Resource Conservation and Recovery Act (RCRA) CMS process. The stated 2-year timeframe is not absolute, and positive results could allow extension of that timeline.
- NMED agreed that based on the limited nature and extent of contamination at the former UST sites, we can proceed with IM that are limited to such straightforward activities as investigation, excavation, injections of reagents or amendments, and SVE. NMED would prefer to remove as much contamination as possible via soil excavations; however, they recognize that other measures may be needed if the contamination extends underneath immovable structures (e.g., buildings and/or utilities).
- NMED said that using the prior contractor's data in the IM final reports is acceptable if the data quality is good. A preference was also stated that subsequent site investigation/remediation reports be consolidated into a single deliverable, as applicable.
- BS indicated that the IM Work Plan screening criteria (e.g., PID and confirmatory samples) are appropriate and acceptable.

TU-503

- Resampling the three existing groundwater (GW) monitoring wells before taking additional actions was discussed. Well MW-01 is downgradient of the former UST location and was not sampled previously due to "poor water yield". URS will determine if there is now sufficient water to collect a sample.
- NMED recommended adding another GW sampling location on the east-southeast side of Bldg. 221 (other side of building from excavation) to address potential data gaps in groundwater.
- NMED indicated peristaltic pumps are unacceptable for VOCs and bailers should be used.

TU-506

- The absence of soil contamination at TU-506 and the presence of limited GW contamination at one well located adjacent and slightly upgradient of the UST excavation was discussed. Contamination consists of diesel-range organics (DRO) and a low level of manganese (Mn). It was acknowledged that a downgradient well and an upgradient well are needed to confidently delineate the contamination. Existing wells will also be resampled. NMED concurred with the proposed approach.

- Regarding the slightly elevated Mn concentration in GW (0.205 milligrams/liter (mg/l) vs. a standard of 0.2 mg/l), NMED agreed that these levels of Mn are not unusual for HAFB, likely represent background, and shouldn't be an obstacle for closing the site.

TU-508

- Challenges regarding the colocation of TU-508 and SS-018, and commingling of contaminants were discussed. The general consensus is that TU-508 is not the source of the solvents plume and a relatively minor site compared to the larger impacts of the SS-018 site. NMED indicated that we could conceivably close TU-508 and roll the GW contamination into SS-018.
- BP described prior soil sample results for Arsenic and a single detection of Cobalt. NMED asked if the previous contractor had analyzed soils using 8260/8270 and Jon Mallonee (JM) confirmed and explained that the current figures only show analytes with values greater than screening levels.
- URS is proposing 4 soil samples, 4 new wells and/or GW samples, and 6 GW samples from existing wells adjacent to the TU-508 site.
- BS asked if URS could sample three additional unspecified SS-018 wells as part of the TU-508 action as part of a synoptic data collection effort to help with SS-018 planning, and to help determine if the edge of the SS-018 plume could be better defined with additional wells. These additional SS-018 delineation wells would presumably be part of the additional SS-018 investigation and response.
- NMED recommended that URS move the newly proposed downgradient MW location to within the yellow hatched anomaly area (presumed source area) as depicted on the figures. URS agreed this would be a more definitive area and will relocate the proposed well accordingly.
- NMED concurred with the proposed scope of work for TU-508.

TU-515

- The plan for additional soil samples, one new MW, and sampling of three existing GW wells was discussed. It is anticipated that soil excavation is all that is needed to achieve closure for this site.
- NMED concurred with the proposed scope of work for TU-515 and there was consensus that the site should be "closeable" with the current proposed plan.

TU-518

- DR indicated this was the RATSCAT site at White Sands Missile Range (WSMR) and the site will be transferring to the Army, but the Air Force retains responsibility for

closure. WSMR has moved operations from these buildings and there's uncertainty as to what the Army plans for the buildings.

- Evidence suggests that there was a surface spill (i.e., overflow) and likely not a tank leak. NationView, a prior contractor at the site, only excavated to remove the tank and a little soil around it. Another contractor (CB&I) conducted the environmental sampling. There is concern for potential contamination under the buildings. Bldg. 7003 housed a water treatment system and has a substantial below-grade foundation. The other building is likely a slab on grade. It is not possible to get any kind of rig inside the buildings.
- Currently, there is no GW data for the TU-518 site because the previous contractor used Direct Push Technology (DPT) and got refusal in caliche at 8 feet below ground surface. It appears no efforts were made at that time to use other drilling methods (e.g., hollow stem auger). Extremely high total dissolved solids (~ 60,000 parts per million) are present in the groundwater in this area.
- If contamination extends underneath the building, horizontal drilling and/or drilling from inside the buildings would be considered. NMED indicated that if one side of the building has high levels, then take another sample from the other side of the building in that location to be able to approximate the extent of contamination.
- NMED indicated that soil may not need to be removed if it is only impacted by Total Petroleum Hydrocarbons (TPH). If VOCs/SVOCs are clean (i.e., less than regulatory levels), NMED can close the site, but URS will need to establish that there is no risk due to TPH to satisfy USAF. NMED indicated that they could potentially close this site based on risk; however, BP said that we still need to achieve AF closure which includes unrestricted use/unlimited exposure.
- DR clarified that for the HAFB Part B permit, DRO is acceptable for screening but confirmation samples must include compound specific analyses for closure (e.g., 8260/70).

TU-904

- A site overview was provided and the issue at this site is primarily a trichloroethylene (TCE) groundwater plume. No impacted soil has been identified.
- URS plans to sample 4 newly proposed wells, existing wells with previous TCE detections, and those wells that are one step removed from problem area to properly delineate the plume.
- NMED concurred with the approach for TU-904.

General Comments and Discussion

- The proposed timing of the TU sites fieldwork was identified as the latter part of July. NMED stated that the scale of work to be done is appropriate and should generate enough data to close out the UST sites.
- BS said he's ready to approve the Group 3 Work Plan soon (Dave Cobrain is out for 2 more weeks), and reiterated the request to submit a single report for all TU sites in the future. He also indicated that future Work Plan submittals to NMED do not need to contain HASP, QAPP, or SOPs.
- BS stated a desire to visit HAFB during the upcoming field work this July, if possible.

Sidebar Topics:

- SS-018: There was considerable discussion of the solvent plume attributable to SS-018. NMED indicated they want to see plume maps for individual VOC constituents in GW. The source of VOCs needs to be determined and although it's likely from SS-018, it was speculated that there may be multiple sources and/or a definitive source may not be discernable. DR said that there used to be an AGE storage area nearby and they also did fuel storage at that site, so there is a potential for other types of releases exists. NMED indicated that the vapor intrusion pathway for solvent sites (i.e., SS-018 and TU-904) will need to be evaluated, and that indoor air canister sampling in nearby structures may be necessary. There was also awareness that due to the high TDS, it might be possible to leave it in place with regard to the VOC plume(s) at SS-018. DS will be the reviewer on SS-018 and he will retain the regulatory lead on that site.
- SS-059: Per DR, the hush house(s) at the T-38 Test Cell may be removed and new ones reconstructed. This could be of significant benefit to remediation at the SS-059 site. There's uncertainty on the timing but more information will be known in the coming weeks.
- SS-017: The Hospital across the street (1st St.) from SS-017 is slated to be moved into the area of the current parking lot (northeast of current hospital location). This could be in the near future. DR expects that they would keep the current hospital until the new one comes on line and then possibly decommission and demolish the current facility. The empty lot of SS-017 would likely be used for parking and equipment staging during construction activities.
- SD-027: BS said that he is approving the SD-027 Quarterly Sampling report (TetraTech). I believe that BS said that (paraphrase) "he is going to tell them to do dig/haul OR think about using amendments due to the runway issue", "maybe something more active". He said this letter is going out soon. He's also requesting more quarterly sampling on SD-027.

Table X. Estimated Interim Measures Implementation Summary, Holloman AFB, New Mexico {*Excerpted to show TU515 information only* }

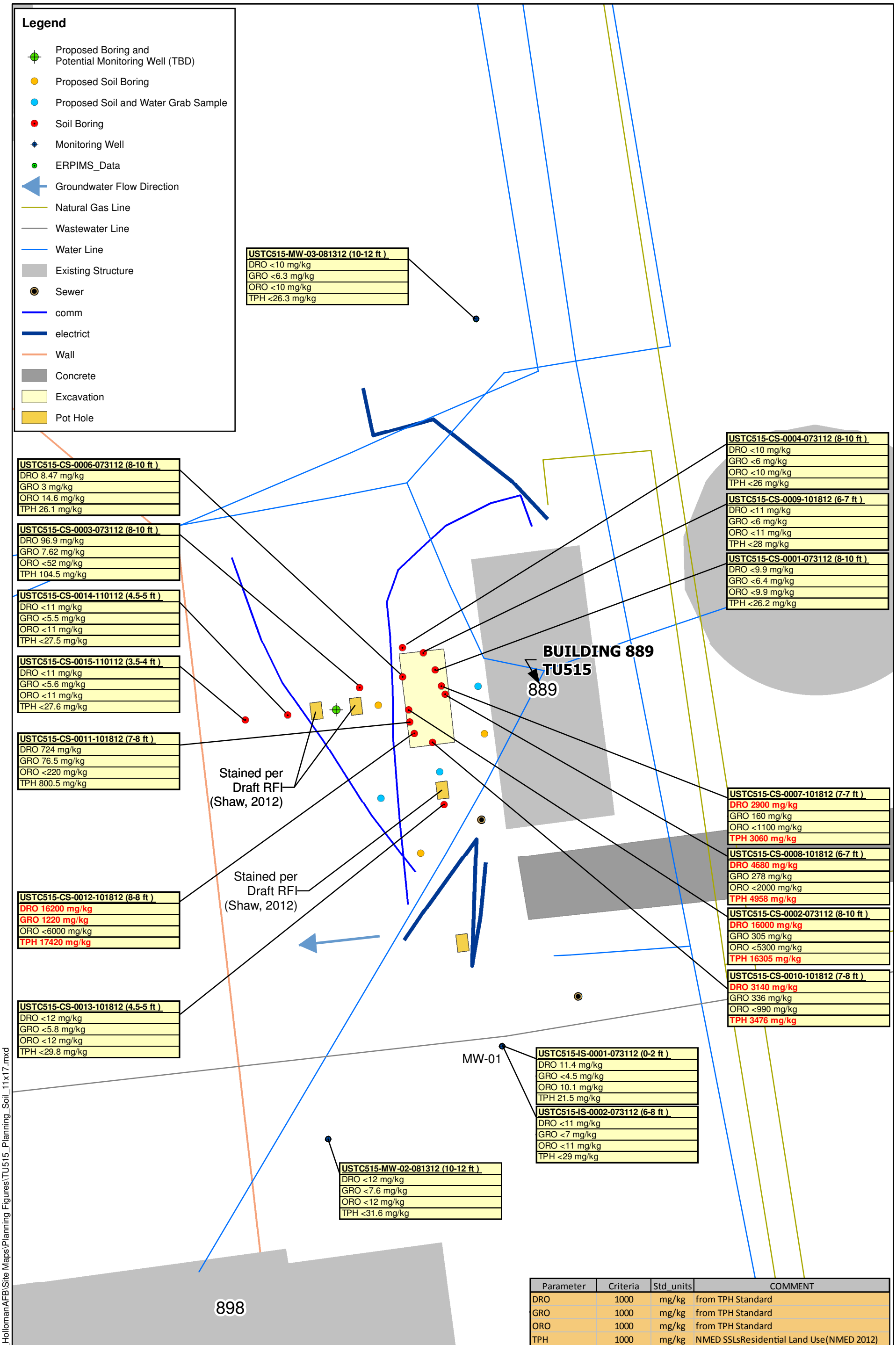
Site IDs :	TU515	Totals	
Site Name / Alias	Building 889 UST TU/US-C515		
AOC/SWMU	AOC-UST-889		
Soil COCs	DRO; GRO		
Groundwater COCs	*none*		
Soil Borings	7	7	*From Site Figure, includes soil samples collected from water sample / MW locations as well.*
Soil Samples (primary)	14	14	*2x per borehole*
Soil QC Samples (FD/MS/SD)	3	3	*1/20 QC * 3 (FD, MS, SD)*
Soil Samples (TOTAL)	**17**	**17**	
GW Sample Locations	4	4	*From Site Figure, includes grab sample at MW location prior to MW installation.*
GW Grab Samples (primary)	4	4	*1x per location*
GW QC Samples (FD/MS/SD)	3	3	*1/20 QC * 3 (FD, MS, SD)*
GW Grab Samples (TOTAL)	**7**	**7**	
Monitoring Well Installations	1	1	*From Site Figure; each MW will have been previously grab sampled for water*
MW Sample Locations *	4	4	** All sites aside from TU518 and TU904 have 3 existing MWs.*
MW QC Samples (FD/MS/SD)	3	3	*1/20 QC * 3 (FD, MS, SD)*
MW Samples (TOTAL)	**7**	**7**	
Excavation (cu. yd, approx.)	80	80	*TU506 will not be excavated.*
Confirmation Samples (Side Wall)	4	4	*1/20 ft*
Confirmation Samples (Floor)	1	1	*1/500 sq ft*
Confirmation QC Samples (FD/MS/SD)	3	3	*1/20 QC * 3 (FD, MS, SD)*
Confirmation Samples (TOTAL)	**8**	**8**	
Injection Locations (Approx.)	0	0	*TU503 and TU515 will not be injected. TU506 and TU518 pending further study.*

Grand Totals	
Soil Samples	**25**
Water Samples	**14**

Table Y. Estimated Interim Measures Implementation Tasks Holloman AFB, New Mexico {*Excerpted to show TU515 information only*}

Activity	Quantity	Units	Comments	
Direct-push Sampling (soil/gw)				
TU515 Direct-push (soil/gw)	7	boring	GW Grab Samples	4
Totals:	***7***			
Monitoring Well Installation				
TU515 Well installation	1	well	Well Depths (ft)	12-15
Totals:	***1***			
Monitoring Well Development				
TU515 MW development	1	well		
Totals:	***1***			
Monitoring Well Sampling				
TU515 MW sampling	4	well		
Totals:	***4***			
Remedial Excavations				
TU515 Excavation	80	cu. yd		
Totals:	***80***			
Site Restoration				
TU515 Restoration	270	sq. ft	Based on excavation volume & 8 ft depth.	
Totals:	***270***			
Remedial Injections				
TU515 Injection	0	points	TU515 will not be injected.	
Totals:	***0***			
Investigation / Remediation Demobe				
IDW Disposal - ALL SITES	1	event	Includes only IDW (soil/water) drums.	

Note: Grey shading indicates quantities referenced or calculated from Table X (IM Implementation Summary).



Parameter	Criteria	Std_units	COMMENT
DRO	1000	mg/kg	from TPH Standard
GRO	1000	mg/kg	from TPH Standard
ORO	1000	mg/kg	from TPH Standard
TPH	1000	mg/kg	NMED SSLsResidential Land Use(NMED 2012)

Note:
Sample results from CBI 2013.

Sources:
HAFB, CBI, ULS Services Corp.

Coordinate System:
NAD 1983 State Plane,
New Mexico Central Zone, Feet

N W E S

0 5 10 15 20 40
Scale in Feet
1 inch = 20 feet

URS

Designed	JDM
Drawn	LED
Checked	DAE
Peer Review	DAE
Project Manager	BGP
Project Number	23446543

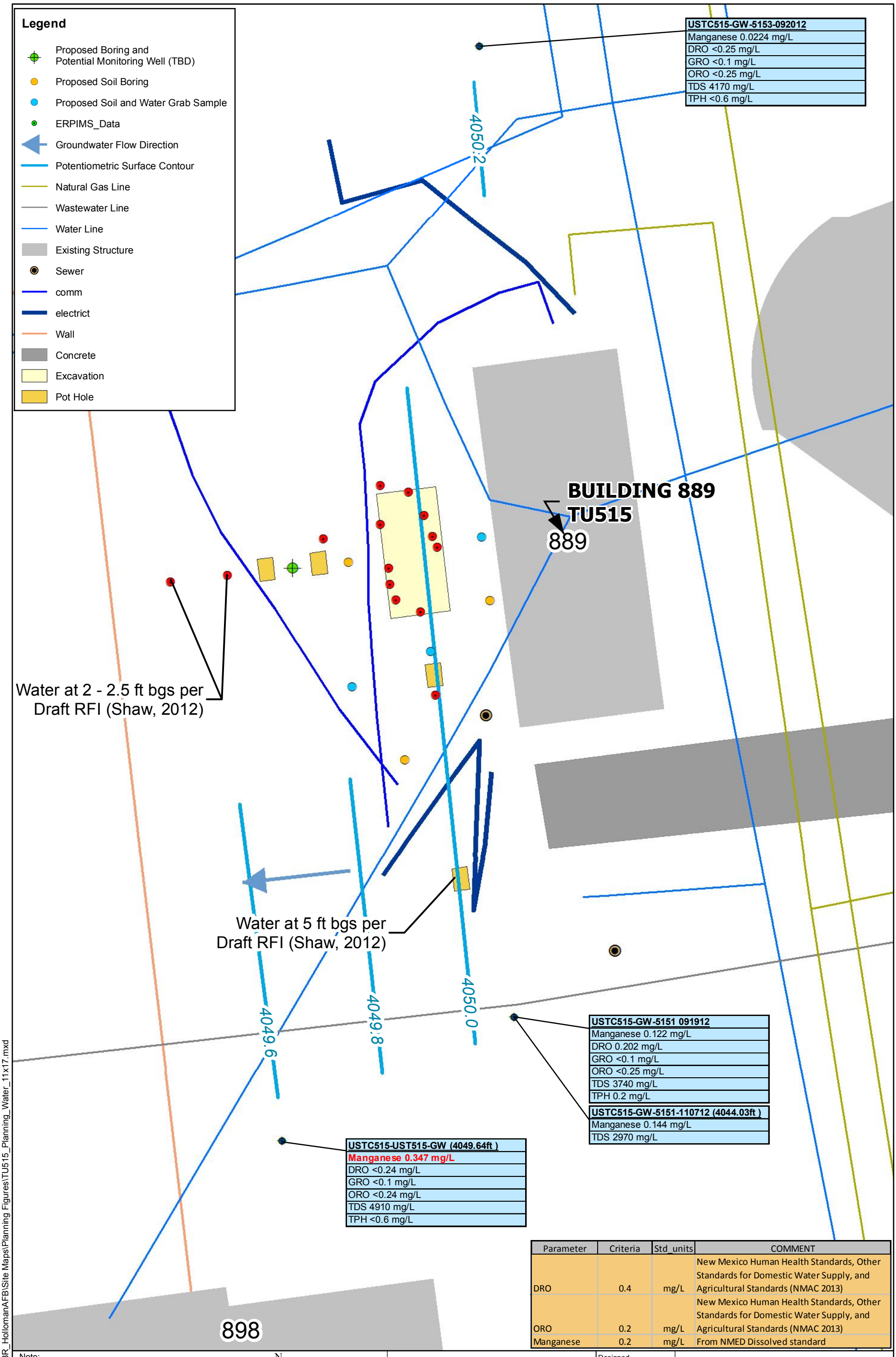
Figure
Building 889
TU515
Soil Results and
Proposed Sample Locations

Holloman Air Force Base

USAF

May 21, 2014

E:\GIS\Projects\AZNM_PBR_HollomanAFB\Site Maps\Planning Figures\TU515_Planning_Soil_11x17.mxd



Parameter	Criteria	Std_units	COMMENT
DRO	0.4	mg/L	New Mexico Human Health Standards, Other Standards for Domestic Water Supply, and Agricultural Standards (NMAC 2013)
ORO	0.2	mg/L	New Mexico Human Health Standards, Other Standards for Domestic Water Supply, and Agricultural Standards (NMAC 2013)
Manganese	0.2	mg/L	From NMED Dissolved standard

Note:
Sample results from CBI 2013.

Sources:
HAFB, CBI, ULS Services Corp.
Potentiometric map and sample results from CBI.
Coordinate System:
NAD 1983 State Plane,
New Mexico Central Zone, Feet

N W E S

0 5 10 15 30
Scale in Feet
1 inch = 15 feet

URS

Designed	JDM
Drawn	LED
Checked	DAE
Peer Review	DAE
Project Manager	BGP
Project Number	23446543

Figure

Building 889
TU515
Water Results and Proposed Sample Locations

Holloman Air Force Base

USAF May 21, 2014

E:\GIS\Projects\AZNM_PBR_HollomanAFB\Site Maps\Planning Figures\TU515_Planning_Water_11x17.mxd

DRAFT
INTERIM MEASURES WORKPLAN

Appendix A
Sampling and Analysis Plan/Quality Assurance Project Plan

Group 2 Former Underground Storage Tank Sites:

AOC-UST-889 (TU515)

Holloman Air Force Base, New Mexico

Prepared for
Air Force Civil Engineer Center
2261 Hughes Ave
Joint Base San Antonio Lackland, Texas 78236-9853

Contract No.: FA8903-13-C-00080
SubCLIN: 0054AA

URS Group, Inc.
Denver, Colorado

April 2014

TABLE OF CONTENTS

EXECUTIVE SUMMARY 1

QAPP Worksheet #1 – Title and Approval Page (UFP-QAPP Manual Section 2.1) 3
QAPP Worksheet #2 – QAPP Identifying Information 5
QAPP Worksheet #3 – Distribution List 10
QAPP Worksheet #4 – Project Personnel Sign Off 13
QAPP Worksheet #5 – Project Organizational Chart 14
QAPP Worksheet #6 – Project Points of Contact 15
QAPP Worksheet #7 – Personnel Responsibilities and Qualifications 16
QAPP Worksheet #8 – Special Personnel Training Requirements 17
QAPP Worksheet #9 – Project Scoping Session Participants Sheet 18
QAPP Worksheet #10 – Problem Definition 19
QAPP Worksheet #11 – Project Quality Objectives/Systematic Planning Process Statements 21
QAPP Worksheet #12 – Measurement Performance Criteria Table 22
QAPP Worksheet #13 – Secondary Data Criteria and Limitations Table 43
QAPP Worksheet #14 – Summary of Project Tasks 44
QAPP Worksheet #15 – Reference Limits and Evaluation Table ..... 48~~47~~
QAPP Worksheet #16 – Project Schedule & Milestones Chart ..... 61~~60~~
QAPP Worksheet #17 – Sampling Approach, Sampling Design, and Rationale ..... 62~~61~~
QAPP Worksheet #18 – Sampling Locations and Methods/SOP Requirements Table ..... 63~~62~~
QAPP Worksheet #19 – Analytical SOP Requirements Table ..... 65~~64~~
QAPP Worksheet #20 – Field Quality Control Sample Summary Table ..... 67~~66~~
QAPP Worksheet #21 – Project Specific Sampling SOP Reference Table ..... 69~~68~~
QAPP Worksheet #22 – Field Equipment Calibration, Maintenance, Testing, and Inspection Table ..... 71~~70~~
QAPP Worksheet #23 – Analytical SOP References Tables ..... 72~~71~~
QAPP Worksheet #24 – Analytical Instrument Calibration Table ..... 75~~74~~
QAPP Worksheet #25 – Analytical Instrument and Equipment Maintenance, Testing, and Inspection Table ..... 76~~75~~
QAPP Worksheet #26 – Sample Handling System ..... 77~~76~~
QAPP Worksheet #27 – Sample Custody Requirements ..... 78~~77~~
QAPP Worksheet #28-1 – QC Samples – GRO ..... 79~~78~~
QAPP Worksheet #28-2 – QC Samples – DRO ..... 80~~79~~
QAPP Worksheet #28-3 – QC Samples - VOCs ..... 81~~80~~
QAPP Worksheet #28-4 – QC Samples - SVOCs ..... 82~~81~~
QAPP Worksheet #28-5 – QC Samples - PAHs ..... 83~~82~~
QAPP Worksheet #28-6 – QC Samples - Metals ..... 84~~83~~
QAPP Worksheet #28-7 – QC Samples - TDS ..... 85~~84~~
QAPP Worksheet #29 – Project Documents and Records Table ..... 86~~85~~
QAPP Worksheet #30 – Analytical Services Table ..... 87~~86~~
QAPP Worksheet #31 – Planned Project Assessment Table ..... 89~~88~~

QAPP Worksheet #32 – Assessment Findings and Corrective Action Responses.....90~~89~~
QAPP Worksheet #33 – QA Management Reports Table.....91~~90~~
QAPP Worksheet #34 – Verification (Step I) Process Table .....92~~91~~
QAPP Worksheet #35 – Validation (Steps IIa and IIb) Process Table.....93~~92~~
QAPP Worksheet #36 – Validation (Steps IIa and IIb) Summary Table .....94~~93~~
QAPP Worksheet #37 – Usability Assessment .....95~~94~~

REFERENCES..... 99~~98~~

List of Tables

Table 12-1a Accuracy and Precision Criteria for Method 8015 – GRO/Water..... 30
Table 12-1b Accuracy and Precision Criteria for Method 8015 – GRO/Soil..... 30
Table 12-2a Accuracy and Precision Criteria for Method 8015 – DRO/ORO/Water 30
Table 12-2b Accuracy and Precision Criteria for Method 8015 – DRO/ORO/Soil 30
Table 12-3a Accuracy and Precision Criteria for Method 8260B – Water..... 31
Table 12-3b Accuracy and Precision Criteria for USEPA Method 8260B – Soil 33
Table 12-4a Accuracy and Precision Criteria for Method 8270C – Water..... 35
Table 12-4b Accuracy and Precision Criteria for Method 8270C – Soil..... 37
Table 12-5a Accuracy and Precision Criteria for Method 8270-SIM – Water..... 39
Table 12-5b Accuracy and Precision Criteria for Method 8270-SIM – Soil..... 40
Table 12-6a Accuracy and Precision Criteria for Methods 6010B/6020A/7470 – Water..... 41
Table 12-6b Accuracy and Precision Criteria for Methods 6010B/6020A/7471 – Soil 42
Table 12-7 Accuracy and Precision Criteria for Method 160.1 – Water 42
Table 15-1 Groundwater Screening Level Criteria..... 49~~48~~
Table 15-2 Soil Screening Level Criteria ..... 55~~54~~

LIST OF ACRONYMS

%	percent
%R	percent recovery
<	less than
>	greater than
±	plus or minus
≤	less than or equal to
≥	greater than or equal to
°C	degrees Celsius
µg/L	micrograms per liter
A	analytical
AFB	Air Force Base
AFCEC	United States Air Force Civil Engineer Center
AL	action limit
AOC	area of concern
B.A.	Bachelor of Arts
B.S.	Bachelor of Science
CA	corrective action
CD	compact disc (electronic copy)
CFR	Code of Federal Regulations
COC	chain-of-custody
COPC	chemicals of potential concern
COR	contracting officer representative
CVAA	cold vapor atomic absorption
DI	de-ionized
DL	detection limit
DO	dissolved oxygen
DoD	Department of Defense
DQI	data quality indicator
DRO	diesel range organics
EB	equipment blank
ELAP	environmental laboratory accreditation program
ESC	ESC Lab Sciences of Mount Juliet, Tennessee
FB	field blank
FPM	FPM Remediations, Inc.
g	gram
GC	gas chromatography
GC/MS	gas chromatography/mass spectrometer
GFAA	graphite furnace atomic absorption
GPS	global positioning system
GRO	gasoline range organics
HC	hard copy
HCl	hydrochloric acid
HNO_3	nitric acid

HWB	Hazardous Waste Bureau
ICP	inductively couple plasma
ICP-AES	inductively coupled plasma-atomic emission spectrometry
ID	identification
IDW	investigation-derived waste
IM	Interim Measure
L	liter
LCS	laboratory control sample
LCSD	laboratory control sample duplicate
LD	laboratory duplicate
LOD	limit of detection
LOQ	limit of quantitation
MDL	method detection limit
MEK	Methyl ethyl ketone
mg/Kg	milligrams per kilogram
mg/L	milligrams per liter
mL	milliliter
mS/cm	milliSiemens per centimeter
M.S.	Master of Science
MS	mass spectrometer
MS/MSD	matrix spike/matrix spike duplicate
MTBE	Methyl tert-butyl ether
NA	not applicable
NELAP	National Environmental Laboratory Accreditation Program
NM	New Mexico
NMED	New Mexico Environment Department
No.	number
ORO	oil range organics
ORP	oxygen reduction potential
oz	ounce
PAH	polynuclear aromatic hydrocarbons
PCE	Tetrachloroethylene
PDS	post-digestion spike
Ph.D	Doctorate
PID	photoionization detector
PQO	project quality objectives
QA	quality assurance
QAPP	quality assurance project plan
QC	quality control
QSM	Quality Systems Manual
RCRA	Resource Conservation and Recovery Act of 1976
RL	reporting limit
RPD	relative percent difference
RSL	regional screening level
S	sampling

SAP	sampling and analysis plan
SARA	Superfund Amendments and Reauthorization Act of 1986
SIM	selected ion monitoring
SM	Standard Methods
SOP	standard operating procedure
SSHP	site safety and health plan
SVOC	semivolatile organic compound
TB	trip blank
TBD	to be determined
TCE	Trichloroethylene
TCLP	Toxicity Characteristic Leaching Procedure
TDS	total dissolved solids
TPH	total petroleum hydrocarbons
U.S.	United States
UFP-QAPP	Uniform Federal Policy for Quality Assurance Project Plans
URS	URS Group, Inc.
USEPA	U.S. Environmental Protection Agency
UST	underground storage tank
VOC	volatile organic compound
YSI	YSI Incorporated

THIS PAGE INTENTIONALLY BLANK

UNIFORM FEDERAL POLICY FOR QUALITY ASSURANCE PROJECT PLANS
Holloman Air Force Base

EXECUTIVE SUMMARY

This Sampling and Analysis Plan (SAP)/Quality Assurance Project Plan (QAPP) for the Interim Measures (IM) Work Plan details the corrective measures planned for one former underground storage tank (UST) site at Holloman Air Force Base (AFB) near Alamogordo, New Mexico. This SAP/QAPP has been prepared by URS Group, Inc. (URS)), as a subcontractor to FPM Remediations, Inc. (FPM) and is addressed under the New Mexico-Arizona Group Performance-Based Remediation (PBR) Contract on behalf of the United States Air Force Civil Engineer Center (AFCEC).

The former Group 2 UST site is located at the following Holloman AFB Areas of Concern (AOC): AOC-UST-889 (TU515, formerly TU/US-C515). The proposed IM will minimize or prevent the further migration of contaminants and limit actual or potential human and environmental exposure to contaminants. The IM Work Plan and this SAP/QAPP have been prepared pursuant to the requirements of the Holloman AFB Hazardous Waste Facility Permit No. NM6572124422 (the Permit) issued and enforced by New Mexico Environment Department (NMED) (NMED, 2004).

In accordance with the Holloman AFB RCRA Permit, the primary objectives of this IM are to facilitate a timely corrective measure which will mitigate any current or potential threat(s) to human health or the environment and is consistent with, and integrated into, any long-term solution at the facility. The ultimate goal of this project is to bring this site to Corrective Action Complete (CAC) status, with no requirement for further land use controls.

This compilation of worksheets meets the requirements of the SAP and QAPP, and supplements the IM Work Plan. Each worksheet addresses specific requirements of the Uniform Federal Policy (UFP)-QAPP. The ultimate success of an environmental program or project depends on the quality of the environmental data collected and used in decision-making, and this depends significantly on the adequacy of the QAPP and its effective implementation.

The tasks described in this project technical plan will be performed in accordance with the Site Safety and Health Plan (SSHP) which describes the health and safety guidelines developed by URS to protect URS personnel, subcontractors, and government personnel involved in the project at Holloman AFB. The UFP– SAP/QAPP was prepared in accordance with the *Uniform Federal Policy (UFP) for Quality Assurance Project Plans (QAPPs): Evaluating, Assessing, and Documenting Environmental Collection and Use Programs Part 2A: UFP-QAPP Workbook* (Intergovernmental Data Quality Task Force, 2005) and will be utilized to establish the overarching analytical and data collection protocols and documentation requirements such that data are generated, reviewed, and analyzed in a consistent manner.

The IM Work Plan presents the technical rationale for the proposed IM approach and describes planned activities, including:

- Advancing and sampling soil borings to evaluate the nature and extent of contamination, if any, in soil.
- Installing and sampling temporary groundwater monitoring wells to evaluate the nature and extent of contamination, if any, in groundwater.
- Focused excavation and/or subsurface injection of bioremediation augmentation substrates to address areas where contaminants of concern exceed applicable screening levels.
- Confirmation sampling to demonstrate the efficacy of any focused excavation and or subsurface injection of bioremediation augmentation substrates.

More details associated with the site background, history, current and future land use and previous site investigations are presented in the IM Work Plan.

ESC Lab Sciences of Mount Juliet, Tennessee (ESC) was selected to provide the analytical support for this project and is a Department of Defense Environmental Laboratory Accreditation Program (DoD ELAP) and New Mexico National Environmental Laboratory Accreditation Program (NELAP) certified laboratory.

QAPP Worksheet #1 – Title and Approval Page
(UFP-QAPP Manual Section 2.1)

DRAFT
Site-Specific Sampling and Analysis Plan/Quality Assurance Project Plan

Interim Measures Work Plan

Group 2 Former Underground Storage Tank Site:

AOC-UST-889 (TU515)

Holloman Air Force Base, New Mexico

April 2014

Prepared for:
United States Air Force Civil Engineer Center
2261 Hughes Ave
Joint Base San Antonio-Lackland, Texas

Prepared by:
URS Group, Inc.
8181 East Tufts Avenue
Denver, CO 80237
(303) 740-2600

Prepared under:
Contract No. FA8903-13-C-0008

Review Signatures:

_____
Brian Powers/URS Project Manager/**Date**

_____
Larry Brook/URS Project Chemist/**Date**

Approval Signatures:

_____
Stephanie Ramon, Air Force Civil Engineer Center Contracting Officer's Representative/**Date**

_____
David Rizzuto, Holloman Environmental/**Date**

THIS PAGE INTENTIONALLY BLANK

QAPP Worksheet #2 – QAPP Identifying Information
(UFP-QAPP Manual Section 2.2.4)

Site Name/Project Name: Holloman AFB/Former UST Site

Title: Interim Measures

Site Location: Holloman AFB, Otero County, New Mexico

Revision Number: 0

Site Number/Code: One Group 2 UST

Revision Date: NA

Areas of Concern: AOC-UST-889 (TU515, formerly TU/US-C515)

Contractor Name: URS Group, Inc.

Contract Number: FA8903-13-C-0008

Contract Title: New Mexico-Arizona Group Performance-Based Remediation (PBR) Contract with the Air Force Civil Engineer Center (AFCEC)

Work Assignment Number: URS Project Number 23446543

1. Identify regulatory program: Following the Resource Conservation and Recovery Act (RCRA) process as administered by the New Mexico Environment Department (NMED). Tasks will be performed in accordance with the Holloman AFB, RCRA Permit NM6572124422-2, prepared and administered by the NMED, Hazardous Waste Bureau (HWB), Santa Fe, New Mexico (NM).

   This Site-Specific Sampling and Analysis Plan (SAP)/Quality Assurance Project Plan (QAPP) was prepared using guidance from the following documents:

   - *Uniform Federal Policy (UFP) for Quality Assurance Project Plans (QAPPs): Evaluating,*
   - *Assessing, and Documenting Environmental Collection and Use Programs Part 2A: UFP-QAPP Workbook* (Intergovernmental Data Quality Task Force, 2005)
   - *Guidance on Systematic Planning Using the Data Quality Objectives Process, U.S. Environmental Protection Agency (EPA) QA/G-4* (EPA, 2006)
   - *U.S. Department of Defense (DOD) Quality Systems Manual (QSM) for Environmental Laboratories, Version 4.2* (DOD, 2010)
   - *EPA Guidance for Quality Assurance Project Plans*, *EPA QA/G-5,* (EPA, 2002)
   - *EPA Requirements for Quality Assurance Project Plans,* EPA QA/R-5, (EPA, 2001)

2. Identify approval entity: Approvals will be provided by the Air Force Civil Engineer Center (AFCEC) and Holloman Air Force Base (AFB).

3. The QAPP is (select one): ☐Generic ☒Project Specific

4. List dates of scoping sessions that were held: A project kick-of meeting took place in Albuquerque, New Mexico on December 16, 2013.

5. List dates and titles of QAPP documents written for previous site work, if applicable:

Title	Approval Date
Working Copy Voluntary Corrective Measures Request, Group 2 - Five Former Underground Storage Tank Sites, Holloman Air Force Base, . (Shaw Environmental and Infrastructure [Shaw], December 2011).	January 21, 2014

6. List organizational partners (stakeholders) and connection with lead organization:
   AFCEC, Lead Organization; NMED HWB, regulator; FPM, prime contractor; URS, subcontractor; and Holloman AFB, property owners.

7. List data users:
   AFCEC, Holloman AFB, NMED HWB

QAPP Worksheet #2 – Identifying Information

Required QAPP Element(s) and Corresponding QAPP Section(s)	Required Information	Crosswalk to this UFP QAPP and Related Documents
Project Management and Objectives		
2.1 Title and Approval Page	- Title and Approval Page	Site-Specific SAP/QAPP Worksheet #1
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 - QAPP Identifying Information	Site-Specific SAP/QAPP Worksheet #2
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	Site-Specific SAP/QAPP Worksheets #3 and #4
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	Site-Specific SAP/QAPP Worksheets #5 through #8
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 - Site Maps (historical and present)	Site-Specific SAP/QAPP Worksheets #9 and #10 IM Work Plan Section 1
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 (PQOs) - Measurement Performance Criteria Table - Reference Limits and Evaluation Table	Site-Specific SAP/QAPP Worksheets #11, #12, and 15 IM Work Plan Sections 1 and 3
2.7 Secondary Data Evaluation	- Sources of Secondary Data and Information - Secondary Data Criteria and Limitations Table	Site-Specific SAP/QAPP Worksheet #13
2.8 Project Overview and Schedule 2.8.1 Project Overview 2.8.2 Project Schedule	- Summary of Project Tasks - Project Schedule/Timeline Table	Site-Specific SAP/QAPP Worksheets #14 and #16 IM Work Plan Sections 1 and 5

QAPP Worksheet #2 – Identifying Information

Required QAPP Element(s) and Corresponding QAPP Section(s)	Required Information	Crosswalk to this UFP QAPP and Related 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 - Sampling Locations and Methods/SOP Requirements Table - Sample Container Identification - Analytical Methods Requirements Table - Field Quality Control (QC) Sample Summary Table - Sampling SOPs - Project Sampling SOP References Table - Field Equipment Calibration, Maintenance, Testing, and Inspection Table	Site-Specific SAP/QAPP Worksheets #17 through #22 IM Work Plan Section 3
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	- ESC Analytical SOPs - ESC Analytical SOP References Table - Analytical Instrument Calibration Table - Analytical Instrument and Equipment Maintenance, Testing, and Inspection Table	Site-Specific SAP/QAPP Worksheets #23 through #25
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, Packaging, Shipment, Receipt, Archival and Disposal - Sample Chain-of-Custody and Sample Custody	Site-Specific SAP/QAPP Worksheets #26 and #27
3.4 Quality Control Samples 3.4.1 Sampling Quality Control Samples 3.4.2 Analytical Quality Control Samples	- Sampling and Analytical QC Samples Table	Site-Specific SAP/QAPP Worksheet #28
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 SOPs	Site-Specific SAP/QAPP Worksheets #29 and #30

QAPP Worksheet #2 – Identifying Information

Required QAPP Element(s) and Corresponding QAPP Section(s)	Required Information	Crosswalk to this UFP QAPP and Related Documents
Assessment/Oversight		
4.1 Assessments and Response Actions 4.1.1 Planned Assessments 4.1.2 Assessment Findings and Corrective Action Responses	- Planned Project Assessments Table - Assessment Findings and Corrective Action Responses Table	Site-Specific SAP/QAPP Worksheets #31 and #32
4.2 QA Management Reports	- QA Management Reports Table	Site-Specific SAP/QAPP Worksheet #33
4.3 Final Project Report	- Report Summarizing Activities, Results and Conclusions	IM Work Plan Section 4
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	Site-Specific SAP/QAPP Worksheets #34 through #37
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		Site-Specific SAP/QAPP Worksheets #31 and #32

QAPP Worksheet #3 – Distribution List
(UFP-QAPP Manual Section 2.3.1)

Document Distribution List for IM Work Plan and IM Report

Document Description	Agency/Contact					
	AFCEC Attn: Brian Renaghan [a]	AFCEC Attn: Layi Oyelowo	Holloman AFB Attn: DeAnna Rothhaupt	NMED HWB Attn: Brian Salem	ESC Lab Sciences Attn: Daphne Richards [b]	Holloman AFB Information Repository
Draft	0 HC 1 CD	0 HC 1 CD	0 HC 2 CD	0 HC 0 CD	0 HC 1 CD	0 HC 0 CD
Draft Final	0 HC 1 CD	0 HC 1 CD	4 HC 4 CD	2 HC 2 CD	1 HC 1 CD	0 HC 0 CD
Final	0 HC 1 CD	0 HC 1 CD	4 HC 4 CD	2 HC 2 CD	1 HC 1 CD	1 HC 1 CD

Notes:
[a] Brian Renaghan will be replacing Stephanie Ramon as the AFCEC Contracting Officer Representative in June 2014.
[b] ESC Lab Sciences will receive just the Sampling and Analysis Plan/Quality Assurance Project Plan, Appendix A of the Work Plan.
AFB – Air Force Base
AFCEC – Air Force Civil Engineer Center
CD – Compact disc (electronic copy)
HC – Hard copy
NMED HWB – New Mexico Environment Department, Hazardous Waste Bureau

QAPP Worksheet #3 – Distribution List (continued)
(UFP-QAPP Manual Section 2.3.1)

Organization: AFCEC

Project Personnel	Title	Telephone Number
Brian Renaghan [(a)]	Contracting Officer Representative	210.863.8633
Layi Oyelowo	Contracting Officer Representative Alternate	(210) 395-8567

Organization: Holloman AFB

Project Personnel	Title	Telephone Number
DeAnna Rothhaupt	Holloman Chief, Environmental	575.572.3931

Organization: NMED HWB

Project Personnel	Title	Telephone Number
Brian Salem	Environmental Specialist	505-222-9576

Organization: ESC Lab Sciences

Project Personnel	Title	Telephone Number
Daphne Richards	Project Manager	615.773.9662

QAPP Worksheet #3 Distribution List (continued)
(UFP-QAPP Manual Section 2.3.1)

Organization: FPM

Project Personnel	Title	Telephone Number
Maureen Whalen	Project Manager	315.336.7721 x216

Organization: URS Group

Project Personnel	Title	Telephone Number
Brian Powers	Project Manager	303.740.3924
Jon Mallonee	Field Team Leader	303.740.3967
Larry Brook	Project Chemist	303.740.2787

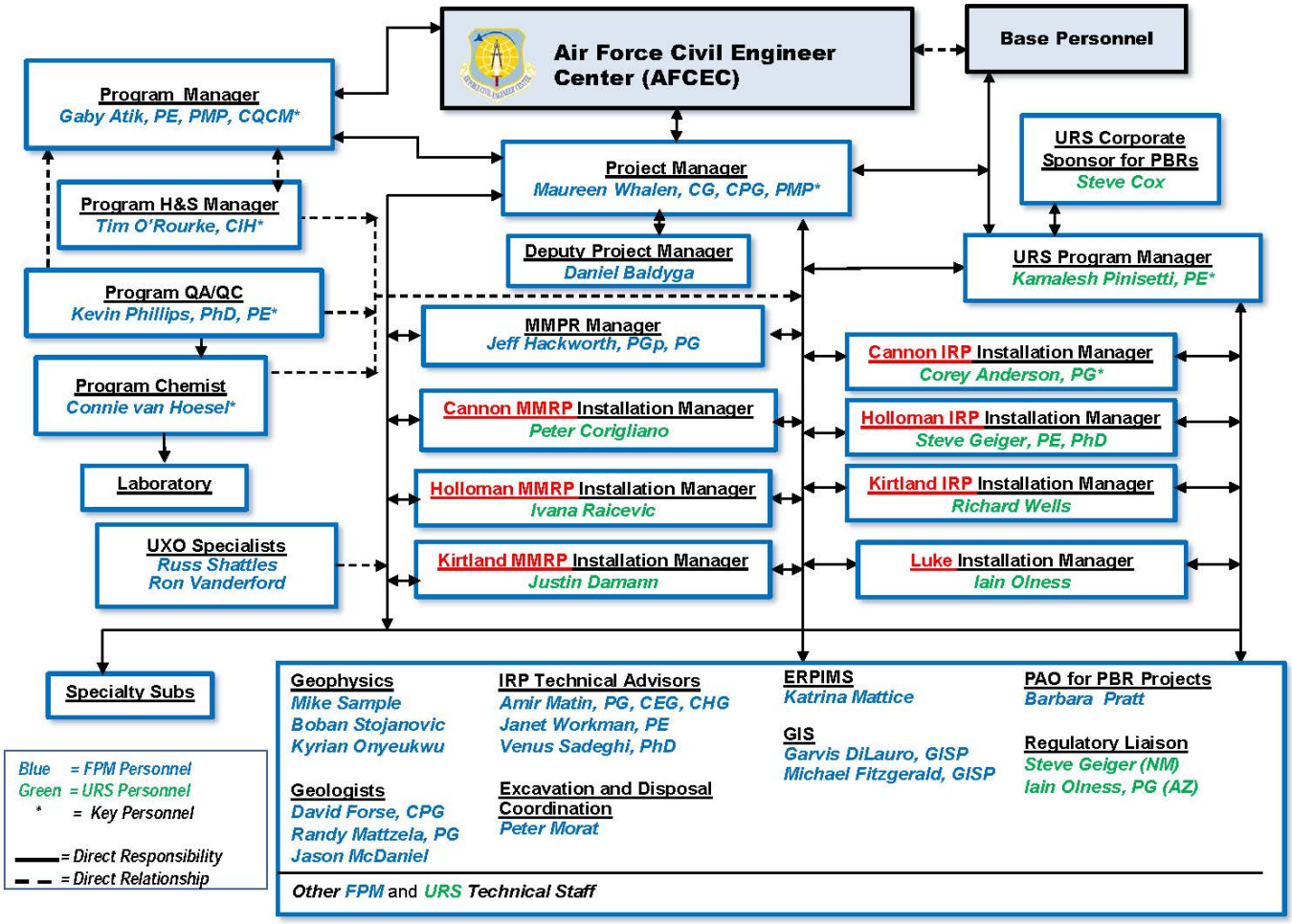
[(a)] Brian Renaghan will be replacing Stephanie Ramon as the AFCEC Contracting Officer Representative in June 2014.

QAPP Worksheet #4 – Project Personnel Sign Off
(UFP-QAPP Manual Section 2.3.2)

Project Personnel	Title	Telephone Number	Signature *	Date QAPP Read
David Rizzuto	Holloman Environmental	575.572.5395		
Daphne Richards	ESC Project Manager	615.773.9662		
Brian Powers	URS Project Manager	303.740.3924		
Jon Mallonee	URS Field Team Leader	303.740.3967		
Larry Brook	URS Project Chemist	303.740.2787		

* I have read and understand this site-specific SAP/QAPP and will perform project tasks as described within this plan.

QAPP Worksheet #5 – Project Organizational Chart
(UFP-QAPP Manual Section 2.4.1)



QAPP Worksheet #6 – Project Points of Contact
(UFP-QAPP Manual Section 2.4.2)

Name	Affiliation	Title	Phone	Email
Brian Renaghan [(a)]	AFCEC	Contracting Officer Representative	210.395.8633	brian.renaghan@us.af.mil
DeAnna Rothhaupt	Holloman AFB	Holloman Chief, Environmental	575.572.3931	deanna.rothhaupt@us.af.mil
David Rizzuto	Holloman AFB	Holloman, Environmental	575.572.5395	david.rizzuto.ctr@holloman.af.mil
Maureen Whalen	FPM	Project Manager	315.336.7721 x216	m.whalen@fpm-remediations.com
Brian Powers	URS	Technical Lead	303.740.3924	brian.powers@urs.com
Daphne Richards	ESC	Project Manager	615.773.9662	drichards@esclabsciences.com
Field/Sampling Points of Contact				
Jon Mallonee	URS	Project Scientist	303-740-3967	jon.mallonee@urs.com
Larry Brook	URS	Project Chemist	303-740-2787	larry.brook@urs.com

[(a)] Brian Renaghan will be replacing Stephanie Ramon as the AFCEC Contracting Officer Representative in June 2014.

QAPP Worksheet #7 – Personnel Responsibilities and Qualifications
(UFP-QAPP Manual Section 2.4.3)

Name	Title	Organizational Affiliation	Responsibilities	Education and Experience Qualifications
Brian Renaghan [(a)]	Contracting Officer Representative	AFCEC	Manages project for AFCEC and will participate in decision making for this project	NA
DeAnna Rothhaupt	Chief, Environmental	Holloman AFB	Manages project for Holloman AFB and will participate in decision making for this project	NA
David Rizzuto	Technical Lead	Holloman AFB	Provides technical review for Holloman AFB and participates in decision making for the project	NA
Maureen Whalen	Project Manager	FPM Remediations, Inc.	Manages project for FPM and will participate in decision making for the project	M.S. Quaternary Studies, B.S. Geology. CPG, PG, PMP; over 20 years of environmental experience
Brian Powers	Project Manager	URS Group, Inc.	Manages project for URS and is the point of contact with AFCEC and Holloman AFB; will participate in decision making for the project	M.S. Geology and Mineralogy, B.S. Geology. PG; over 20 years environmental experience
Bill Ruoff	Project Risk Assessor	URS Group, Inc.	Uses collected data to evaluate response complete or the need for human health risk screening	Ph.D Physiology. Over 20 years environmental experience.
Larry Brook	Project Chemist	URS Group, Inc.	Activities related to coordination, acquisition, and validation of analytical data and subcontracted services	B.S. Biochemistry. CHMM; over 20 years environmental experience.
Jon Mallonee	Field Sampling Team Leader	URS Group, Inc.	Oversees implementation of the SAP/QAPP, including management of the field team and schedule.	B.S. Geology, 10 years of environmental experience.

Notes:
[(a)] Brian Renaghan will be replacing Stephanie Ramon as the AFCEC Contracting Officer Representative in June 2014.
AFB – Air Force Base
AFCEC – Air Force Civil Engineer Center
B.S. – Bachelor of Science
M.S. – Master of Science
NA – Not Applicable
Ph.D – Doctorate

QAPP Worksheet #8 – Special Personnel Training Requirements

(UFP-QAPP Manual Section 2.4.4)

Special Personnel Training Requirements Table

Project Function	Specialized Training – Title or Description of Course	Training Provider	Training Date	Personnel/Groups Receiving Training	Personnel Titles/ Organizational Affiliation	Location of Training Records/Certificates
Field Geology and Sampling	Health and Safety Training per 29 CFR 1910.120 Tailgate meeting to discuss sampling plan and procedures	URS	Prior to Start of Project	TBD	Project Scientist	URS Offices Certificate available upon request

Notes:
CFR – Code of Federal Regulations
TBD – to be determined

Additionally, the laboratory will have an established policy and procedure on training and documenting of the analyst's competency. Each staff member who performs sample preparation and analysis will demonstrate his or her proficiency through preparation and analysis of laboratory control samples (LCSs) as described in EPA SW-846 (EPA, 1986). Analysts will be considered proficient if the acceptance criteria for method accuracy and precision are met. The laboratory will maintain all training records on file.

QAPP Worksheet #9 – Project Scoping Session Participants Sheet
(UFP-QAPP Manual Section 2.5.1)

Project Name: Holloman AFB **Projected Date(s) of Sampling:** TBD **Project Manager:** Brian Powers	**Site Name:** Group 3 Former UST Sites (also applicable to the Group 2 Former UST Sites) **Site Location:** Otero County, New Mexico

Date of Session: December 16, 2013
Scoping Session Purpose: Project Kickoff Meeting with Regulators

Name	Affiliation	Phone #	E-mail Address	Project Role
Dave Cobrain	NMED	505-476-6055	Dave.cobrain@state.nm.us	Regulator
William Moats	NMED	505-222-9551	William.moats@state.nm.us	Regulator
David Strasser	NMED	505-222-9526	David.strasser@state.nm.us	Regulator
Brian Salem	NMED	505-222-9576	Brian.salem@state.nm.us	Regulator
DeAnna Rothhaupt	49CES/CEIE Chief	575-572-3931	Deanna.rothhaupt@us.af.mil	AFCEC COR
Maureen Whalen	FPM	315-336-7721 ext.216	m.whalen@fpm-remediations.com	FPM Project Manager
Steven Geiger	URS	505-672-2107	Steve.geiger@urs.com	URS Holloman Program Lead
Brian Powers	URS	303-740-3924	Brian.powers@urs.com	URS Project Manager
Rich Wells	URS	602-861-7409	Richard.wells@urs.com	URS Project Manager

Comments/Decisions: The Group 2 (Site TU515) and Group 3 UST sites (sites TU503, TU506, TU508, and TU518) can be grouped together for purposes of work planning and execution. Previous work for these sites has been completed under the Voluntary Corrective Measures permit program, but future work should be performed under Interim Measures (IMs) which can be converted into Final Remedies if appropriate. Metals background values should be considered on a case-by-case basis for specific sites.

Action Items: Refer to Meeting Minutes.

Consensus Decisions: See above Comments/Decisions and refer to Meeting Minutes.

Notes:
AFB – Air Force Base
AFCEC – U.S. Air Force Civil Engineer Center
COR – Contracting Officer Representative
FPM – FPM Remediations, Inc.
NMED – New Mexico Environment Department
TBD – to be determined
URS – URS Group, Inc.

QAPP Worksheet #10 – Problem Definition
(UFP-QAPP Manual Section 2.5.2)

Problem Definition

This IM Work Plan addresses one Group 2 UST Area of Concern located at Holloman AFB. The AOC consists of a former UST site, where the UST has been removed, but elevated concentrations of petroleum hydrocarbons (e.g., diesel fuel) have been documented in soil, groundwater, or both media. The site was partially investigated and some petroleum-impacted soil was removed by Shaw under the VCM program. Based on URS' review of the preliminary data collected under the VCM, additional investigative and remedial work is necessary at this site to achieve CAC. This work can most effectively be accomplished through the use of IM because the site is relatively small, the nature of the petroleum hydrocarbons is well understood, and the technologies to remove and/or destroy the hydrocarbons are well-proven.

Records for former UST site TU515 at Building 889 indicate that the associated UST was closed in 1992. Closure records report the UST was a bare steel tank with a capacity of 550 gallons. The tank had been in service for 9 years and was used for diesel fuel storage prior to closure. There was no known internal or external tank protection, and the associated piping was also bare steel. A visual inspection for leakage was performed following tank removal, and none was reported. During the 2012 VCM, approximately forty cubic yards of soil were excavated from the site between 7 and 8 feet below ground surface. Soil samples were collected from varying depths down to the water table at locations surrounding the former UST pit. The only parameters exceeding the soil screening criteria were TPH-GRO (in one floor sample) and TPH-DRO (in two floor and three wall samples). The limits of soil TPH contamination have been delineated to the north, west, and south of the former UST location, and to the foundation of Building 889 on the east. It is unknown if contamination extends under Building 889. The sampling programs described within this IM Work Plan were designed to further evaluate the nature and extent of potential hydrocarbon-related contamination at each of the former UST site and to demonstrate, via confirmation sampling, the effectiveness of any necessary excavation or injection of bioremediation augmentation substrates.

Project Decision Condition:

For this interim measure, information inputs to the decision-making process include the collection and chemical analysis of soil and groundwater. Following any necessary soil excavation and/or subsurface injection of bioremediation augmentation substrates, confirmation samples will be collected to demonstrate that affected areas no longer exhibit contaminant of concern concentrations

that exceed applicable screening levels. Chemicals detected in soil and groundwater will be compared to screening guidelines that are listed in Worksheet #15. With the exceptions noted in Worksheets #15, the planned laboratory analyses will meet the screening levels.

QAPP Worksheet #11 – Project Quality Objectives/Systematic Planning Process Statements
(UFP-QAPP Manual Section 2.6.1)

Who will use the data? Data will be used by the project team including URS, the U. S. Air Force at Holloman AFB, and AFCEC.
What will the data be used for? Data will be used to evaluate the presence of contaminants, to evaluate contaminate nature and extent, and to determine if further response or remedial action is necessary or if excavation or other remediation technologies adequately reduce contaminant of concern concentrations below applicable screening levels. A complete listing of the project action limits is provided in Worksheet #15.
What types of data are needed? Soil and groundwater samples will be collected as identified in the IM Work Plan and in Worksheet #20.
How much data are needed? The number of samples to be collected is presented in Worksheet #20.
How good does the data need to be? IM activities at this Holloman site will require the collection of both qualitative and quantitative data. From the Project Quality Objective perspective, qualitative data will be categorized as screening data (data of sufficient quality to support an intermediate or preliminary decision but must eventually be supported by definitive data) or definitive data (analytical data that are suitable for final decision making). Definitive site-specific data are required to document confirmatory sampling, and make determinations for site closure. Screening data may be collected to make and support qualitative assessments in the field, including intermediate steps preceding confirmation. Further discussion of data needs is provided in IM Work Plan Section 3. Definitive data will be compared to the screening criteria as applicable or historical data collected presented in Worksheet #15 as applicable. Definitive data will be validated in accordance with Worksheets #34, 35, and 36.
When will data be collected? The data will be collected in 2014.

QAPP Worksheet #12 – Measurement Performance Criteria Table
(UFP-QAPP Manual Section 2.6.2)

Measurement Performance Criteria Table

Matrix	**Soil / Groundwater**	**Laboratory criteria are listed in the DoD QSM Version 4.2 Appendix F Table. Full data verification and validation criteria are listed in Worksheet 36.**			
Analytical Groups	GRO, DRO/ORO, VOCs, SVOCs, PAHs, Metals				
Concentration Level	Low				
Sampling Procedure[1]	**Analytical Method/SOP[2]**	**Data Quality Indicators (DQIs)**	**Measurement Performance Criteria**	**QC Sample and/or Activity Used to Assess Measurement Performance**	**QC Sample Assesses Error for Sampling (S), Analytical (A) or both (S&A)**
GRO					
URS SOP 6 Soil Sample Collection URS SOP 11 Groundwater Sample Collection	USEPA SW846 8015/ ESC SOP 330351A	Accuracy/Bias - Laboratory	See Tables 12-1a-12-1b	LCS, MS/MSD, and surrogate recoveries	A
			See Worksheet 24	Calibration – initial and continuing	A
		Precision – Laboratory	See Tables 12-1a-12-1b	MS/MSDs and/or LCS/ LCSD	A
			See Worksheet 24	Calibration – initial and continuing	A
		Precision – Field	For Field Duplicates the following criteria will be used: • If the parent sample and duplicate values are >5xLOQ, then <30% RPD for water samples (<50% soil). • If the parent sample or duplicate sample value is <5xLOQ, then absolute difference is <2xLOQ for water samples (<3.5xLOQ for soil).	Field Duplicates	S & A
		Accuracy/Bias Contamination	No Target Analyte Detected > ½ LOQ	Method Blanks	A
		Sensitivity	Results reported to the LOD; LOQs meet those listed in Worksheet #15	Quarterly LOD verification; LOQs meet screening criteria	A
		Completeness	90%	Data Completeness Check	S & A

QAPP Worksheet #12 – Measurement Performance Criteria Table (continued)
(UFP-QAPP Manual Section 2.6.2)

Measurement Performance Criteria Table

Matrix	**Soil / Groundwater**	**Laboratory criteria are listed in the DoD QSM Version 4.2 Appendix F Table. Full data verification and validation criteria are listed in Worksheet 36.**			
Analytical Groups	GRO, DRO/ORO, VOCs, SVOCs, PAHs, Metals				
Concentration Level	Low				
Sampling Procedure[1]	**Analytical Method/SOP[2]**	**Data Quality Indicators (DQIs)**	**Measurement Performance Criteria**	**QC Sample and/or Activity Used to Assess Measurement Performance**	**QC Sample Assesses Error for Sampling (S), Analytical (A) or both (S&A)**
DRO					
URS SOP 6 Soil Sample Collection URS SOP 11 Groundwater Sample Collection	USEPA SW846 8015/ ESC SOP 330350A	Accuracy/Bias - Laboratory	See Table 12-2a-12-2b	LCS, MS/MSD, and surrogate recoveries	A
			See Worksheet 24	Calibration – initial and continuing	A
		Precision – Laboratory	See Table 12-2a-12-2b	MS/MSDs and/or LCS/LCSD	A
			See Worksheet 24	Calibration – initial and continuing	A
		Precision – Field	For Field Duplicates the following criteria will be used: • If the parent sample and duplicate values are >5xLOQ, then <30% RPD for water samples (<50% soil). • If the parent sample or duplicate sample value is <5xLOQ, then absolute difference is <2xLOQ for water samples (<3.5xLOQ for soil).	Field Duplicates	S & A
		Accuracy/Bias Contamination	No Target Analyte Detected > ½ LOQ	Method Blanks	A
		Sensitivity	Results reported to the LOD; LOQs meet those listed in Worksheet #15	Quarterly LOD verification; LOQs meet screening criteria	A
		Completeness	90%	Data Completeness Check	S & A

QAPP Worksheet #12 – Measurement Performance Criteria Table (continued)

(UFP-QAPP Manual Section 2.6.2)

Measurement Performance Criteria Table

Matrix	**Soil / Groundwater**	**Laboratory criteria are listed in the DoD QSM Version 4.2 Appendix F Table. Full data verification and validation criteria are listed in Worksheet 36.**			
Analytical Groups	GRO, DRO/ORO, VOCs, SVOCs, PAHs, Metals				
Concentration Level	Low				
Sampling Procedure[1]	**Analytical Method/SOP[2]**	**Data Quality Indicators (DQIs)**	**Measurement Performance Criteria**	**QC Sample and/or Activity Used to Assess Measurement Performance**	**QC Sample Assesses Error for Sampling (S), Analytical (A) or both (S&A)**
VOCs					
URS SOP 6 Soil Sample Collection URS SOP 11 Groundwater Sample Collection	USEPA SW846 8260B/ ESC SOP 330363	Accuracy/Bias - Laboratory	See Table 12-3a-12-3b	LCS, MS/MSD, and surrogate recoveries	A
			See Worksheet 24	Calibration – initial and continuing	A
		Precision – Laboratory	See Table 12-3a-12-3b	MS/MSDs and/or LCS/LCSD	A
			See Worksheet 24	Calibration – initial and continuing	A
		Precision – Field	For Field Duplicates the following criteria will be used: • If the parent sample and duplicate values are >5xLOQ, then <30% RPD for water samples (<50% soil). • If the parent sample or duplicate sample value is <5xLOQ, then absolute difference is <2xLOQ for water samples (<3.5xLOQ for soil).	Field Duplicates	S & A
		Accuracy/Bias Contamination	No Target Analyte Detected > ½ LOQ	Method Blanks	A
		Sensitivity	Results reported to the LOD; LOQs meet those listed in Worksheet #15	Quarterly LOD verification; LOQs meet screening criteria	A
		Completeness	90%	Data Completeness Check	S & A

QAPP Worksheet #12 – Measurement Performance Criteria Table (continued)

(UFP-QAPP Manual Section 2.6.2)

Measurement Performance Criteria Table

Matrix	**Soil / Groundwater**	**Laboratory criteria are listed in the DoD QSM Version 4.2 Appendix F Table. Full data verification and validation criteria are listed in Worksheet 36.**			
Analytical Groups	GRO, DRO/ORO, VOCs, SVOCs, PAHs, Metals				
Concentration Level	Low				
Sampling Procedure[1]	**Analytical Method/SOP[2]**	**Data Quality Indicators (DQIs)**	**Measurement Performance Criteria**	**QC Sample and/or Activity Used to Assess Measurement Performance**	**QC Sample Assesses Error for Sampling (S), Analytical (A) or both (S&A)**
SVOCs					
URS SOP 6 Soil Sample Collection URS SOP 11 Groundwater Sample Collection	USEPA SW846 8270C/ ESC SOP 330345	Accuracy/Bias - Laboratory	See Table 12-4a-12-4b	LCS, MS/MSD, and surrogate recoveries	A
			See Worksheet 24	Calibration – initial and continuing	A
		Precision – Laboratory	See Table 12-4a-12-4b	MS/MSDs and/or LCS/LCSD	A
			See Worksheet 24	Calibration – initial and continuing	A
		Precision – Field	For Field Duplicates the following criteria will be used: • If the parent sample and duplicate values are >5xLOQ, then <30% RPD for water samples (<50% soil). • If the parent sample or duplicate sample value is <5xLOQ, then absolute difference is <2xLOQ for water samples (<3.5xLOQ for soil).	Field Duplicates	S & A
		Accuracy/Bias Contamination	No Target Analyte Detected > ½ LOQ	Method Blanks	A
		Sensitivity	Results reported to the LOD; LOQs meet those listed in Worksheet #15	Quarterly LOD verification; LOQs meet screening criteria	A
		Completeness	90%	Data Completeness Check	S & A

QAPP Worksheet #12 – Measurement Performance Criteria Table (continued)

(UFP-QAPP Manual Section 2.6.2)

Measurement Performance Criteria Table

Matrix	**Soil / Groundwater**	**Laboratory criteria are listed in the DoD QSM Version 4.2 Appendix F Table. Full data verification and validation criteria are listed in Worksheet 36.**			
Analytical Groups	GRO, DRO/ORO, VOCs, SVOCs, PAHs, Metals				
Concentration Level	Low				
Sampling Procedure[1]	**Analytical Method/SOP[2]**	**Data Quality Indicators (DQIs)**	**Measurement Performance Criteria**	**QC Sample and/or Activity Used to Assess Measurement Performance**	**QC Sample Assesses Error for Sampling (S), Analytical (A) or both (S&A)**
PAHs					
URS SOP 6 Soil Sample Collection URS SOP 11 Groundwater Sample Collection	USEPA SW846 8270C-SIM/ESC SOP 330345	Accuracy/Bias - Laboratory	See Tables 12-5a-12-5b	LCS, MS/MSD, and surrogate recoveries	A
			See Worksheet 24	Calibration – initial and continuing	A
		Precision – Laboratory	See Tables 12-5a-12-5b	MS/MSDs and/or LCS/ LCSD	A
			See Worksheet 24	Calibration – initial and continuing	A
		Precision – Field	For Field Duplicates the following criteria will be used: • If the parent sample and duplicate values are >5xLOQ, then <30% RPD for water samples (<50% soil). • If the parent sample or duplicate sample value is <5xLOQ, then absolute difference is <2xLOQ for water samples (<3.5xLOQ for soil).	Field Duplicates	S & A
		Accuracy/Bias Contamination	No Target Analyte Detected > ½ LOQ	Method Blanks	A
		Sensitivity	Results reported to the LOD; LOQs meet those listed in Worksheet #15	Quarterly LOD verification; LOQs meet screening criteria	A
		Completeness	90%	Data Completeness Check	S & A

QAPP Worksheet #12 – Measurement Performance Criteria Table (continued)

(UFP-QAPP Manual Section 2.6.2)

Measurement Performance Criteria Table

Matrix	**Soil / Groundwater**	**Laboratory criteria are listed in the DoD QSM Version 4.2 Appendix F Table. Full data verification and validation criteria are listed in Worksheet 36.**			
Analytical Groups	GRO, DRO/ORO, VOCs, SVOCs, PAHs, Metals				
Concentration Level	Low				
Sampling Procedure[1]	**Analytical Method/SOP[2]**	**Data Quality Indicators (DQIs)**	**Measurement Performance Criteria**	**QC Sample and/or Activity Used to Assess Measurement Performance**	**QC Sample Assesses Error for Sampling (S), Analytical (A) or both (S&A)**
Metals					
URS SOP 6 Soil Sample Collection URS SOP 11 Groundwater Sample Collection	USEPA SW846 6010B, 6020A, 7470A, and 7471A/ ESC SOPs 340386, 340390, 340384A, and 340384B	Accuracy/Bias - Laboratory	See Tables 12-6a-12-6b	LCS, MS/MSD, and surrogate recoveries	A
			See Worksheet 24	Calibration – initial and continuing	A
		Precision – Laboratory	See Tables 12-6a-12-6b	MS/MSDs and/or LCS/LCSD	A
			See Worksheet 24	Calibration – initial and continuing	A
		Precision – Field	For Field Duplicates the following criteria will be used: • If the parent sample and duplicate values are >5xLOQ, then <30% RPD for water samples (<50% soil). • If the parent sample or duplicate sample value is <5xLOQ, then absolute difference is <2xLOQ for water samples (<3.5xLOQ for soil).	Field Duplicates	S & A
		Accuracy/Bias Contamination	No Target Analyte Detected > ½ LOQ	Method Blanks	A
		Sensitivity	Results reported to the LOD; LOQs meet those listed in Worksheet #15	Quarterly LOD verification; LOQs meet screening criteria	A
		Completeness	90%	Data Completeness Check	S & A

QAPP Worksheet #12 – Measurement Performance Criteria Table (continued)

(UFP-QAPP Manual Section 2.6.2)

Measurement Performance Criteria Table

Matrix	**Soil / Groundwater**	**Laboratory criteria are listed in the DoD QSM Version 4.2 Appendix F Table. Full data verification and validation criteria are listed in Worksheet 36.**			
Analytical Groups	GRO, DRO/ORO, VOCs, SVOCs, PAHs, Metals				
Concentration Level	Low				
Sampling Procedure[1]	**Analytical Method/SOP[2]**	**Data Quality Indicators (DQIs)**	**Measurement Performance Criteria**	**QC Sample and/or Activity Used to Assess Measurement Performance**	**QC Sample Assesses Error for Sampling (S), Analytical (A) or both (S&A)**
TDS					
URS SOP 11 Groundwater Sample Collection	USEPA 160.1/ ESC SOP340347	Accuracy/Bias - Laboratory	See Worksheet 24	Calibration – initial and continuing	A
		Precision – Laboratory	See Table 12-7	LD	A
			See Worksheet 24	Calibration – initial and continuing	A
		Precision – Field	For Field Duplicates the following criteria will be used: • If the parent sample and duplicate values are >5xLOQ, then <30% RPD for water samples. • If the parent sample or duplicate sample value is <5xLOQ, then absolute difference is <2xLOQ for water samples.	Field Duplicates	S & A
		Accuracy/Bias Contamination	No Target Analyte Detected > ½ LOQ	Method Blanks	A
		Sensitivity	Results reported to the LOD; LOQs meet those listed in Worksheet #15	Quarterly LOD verification; LOQs meet screening criteria	A
		Completeness	90%	Data Completeness Check	S & A

Notes:
[1]Reference number from QAPP Worksheet #21 (see Section 3.1.2).
[2]Reference number from QAPP Worksheet #23 (see Section 3.2).

A – Analytical
DRO/ORO – Diesel Range Organics/Oil Range Organics
DoD – Department of Defense
DQIs – Data Quality Indicators
ESC – ESC Lab Sciences of Mt. Juliet, Tennessee
GRO – Gasoline Range Organics
LCS – Laboratory Control Sample
LCSD – Laboratory Control Sample Duplicate
LOQ – Limit of Quantitation
MS/MSD – Matrix Spike/ Matrix Spike Duplicate
PAHs – Polynuclear Aromatic Hydrocarbons
QC – Quality Control
QSM – Quality Systems Manual
RPD – Relative Percent Difference
S – Sampling
SIM – Selective Ion Monitoring
SOP – Standard Operating Procedure
SVOCs – Semivolatile Organic Compounds
TDS – Total Dissolved Solids
VOCs – Volatile Organic Compounds

Table 12-1a
Accuracy and Precision Criteria for Method 8015 – GRO/Water

Analyte	Accuracy Limits (%R)	Precision (RPD)
GRO	80-120	20

Notes:
%R – Percent Recovery
GRO – Gasoline Range Organics
RPD – Relative Percent Difference

Table 12-1b
Accuracy and Precision Criteria for Method 8015 – GRO/Soil

Analyte	Accuracy Limits (%R)	Precision (RPD)
GRO	63-137	30

Notes:
%R – Percent Recovery
GRO – Gasoline Range Organics
RPD – Relative Percent Difference

Table 12-2a
Accuracy and Precision Criteria for Method 8015 – DRO/ORO/Water

Analyte	Accuracy Limits (%R)	Precision (RPD)
DRO	52-142	20
ORO	52-142	20

Notes:
%R – Percent Recovery
DRO – Diesel Range Organics
ORO – Oil Range Organics
RPD – Relative Percent Difference

Table 12-2b
Accuracy and Precision Criteria for Method 8015 – DRO/ORO/Soil

Analyte	Accuracy Limits (%R)	Precision (RPD)
DRO	61-145	30
ORO	61-145	30

Notes:
%R – Percent Recovery
DRO – Diesel Range Organics
ORO – Oil Range Organics
RPD – Relative Percent Difference

Table 12-3a
Accuracy and Precision Criteria for Method 8260B – Water

Analyte	Accuracy Limits (%R)	Precision (RPD)
1,1,1,2-Tetrachloroethane	80-130	30
1,1,1-Trichloroethane	65-130	30
1,1,2,2-Tetrachloroethane	65-130	30
1,1,2-Trichloroethane	75-125	30
1,1-Dichloroethane	70-135	30
1,1-Dichloroethene	70-130	30
1,1-Dichloropropene	75-130	30
1,2,3-Trichlorobenzene	55-140	30
1,2,3-Trichloropropane	75-125	30
1,2,4-Trichlorobenzene	65-135	30
1,2,4-Trimethylbenzene	75-130	30
1,2-Dibromo-3-chloropropane	50-130	30
1,2-Dibromoethane	80-120	30
1,2-Dichlorobenzene	70-120	30
1,2-Dichloroethane	70-130	30
1,2-Dichloropropane	75-125	30
1,3,5-Trimethylbenzene	75-130	30
1,3-Dichlorobenzene	75-125	30
1,3-Dichloropropane	75-125	30
1,4-Dichlorobenzene	75-125	30
2,2-Dichloropropane	70-135	30
2-Butanone	30-150	30
2-Chlorotoluene	75-125	30
2-Hexanone	55-130	30
4-Chlorotoluene	75-130	30
Methyl Isobutyl Ketone	60-135	30
Acetone	40-140	30
Benzene	80-120	30
Bromobenzene	75-125	30
Bromochloromethane	65-130	30
Bromodichloromethane	75-120	30
Bromoform	70-130	30
Bromomethane	30-145	30
Carbon disulfide	35-160	30
Carbon tetrachloride	65-140	30
Chlorobenzene	80-120	30
Dibromochloromethane	60-135	30
Chloroethane	60-135	30
Chloroform	65-135	30
Chloromethane	40-125	30
cis-1,2-Dichloroethene	70-125	30

Table 12-3a (continued)
Accuracy and Precision Criteria for Method 8260B – Water

Analyte	Accuracy Limits (%R)	Precision (RPD)
cis-1,3-Dichloropropene	70-130	30
Dibromomethane	75-125	30
Dichlorodifluoromethane	30-155	30
Ethylbenzene	75-125	30
Hexachlorobutadiene	50-140	30
Isopropyl benzene	75-125	30
m/p-Xylenes	75-130	30
MTBE	65-125	30
Methylene chloride	55-140	30
Naphthalene	55-140	30
n-Butylbenzene	70-135	30
n-Propylbenzene	70-130	30
o-Xylene	80-120	30
p-Isopropyltoluene	75-130	30
sec-Butylbenzene	70-125	30
Styrene	65-135	30
tert-Butylbenzene	70-130	30
Tetrachloroethylene	45-150	30
Toluene	75-120	30
trans-1,2-Dichloroethene	60-140	30
trans-1,3-Dichloropropene	55-140	30
Trichloroethene	70-125	30
Trichlorofluoromethane	60-145	30
Vinyl chloride	50-145	30

Notes:
%R – Percent Recovery
MTBE – Methyl tert-butyl ether
RPD – Relative Percent Difference

Table 12-3b
Accuracy and Precision Criteria for USEPA Method 8260B – Soil

Analyte	Accuracy Limits (%R)	Precision (RPD)
1,1,1,2-Tetrachloroethane	75-125	50
1,1,1-Trichloroethane	70-135	50
1,1,2,2-Tetrachloroethane	55-130	50
1,1,2-Trichloroethane	60-125	50
1,1-Dichloroethane	75-125	50
1,1-Dichloroethene	65-135	50
1,1-Dichloropropene	70-135	50
1,2,3-Trichlorobenzene	60-135	50
1,2,3-Trichloropropane	65-130	50
1,2,4-Trichlorobenzene	65-130	50
1,2,4-Trimethylbenzene	65-135	50
1,2-Dibromo-3-chloropropane	40-135	50
1,2-Dibromoethane	70-125	50
1,2-Dichlorobenzene	75-120	50
1,2-Dichloroethane	70-135	50
1,2-Dichloropropane	70-120	50
1,3,5-Trimethylbenzene	65-135	50
1,3-Dichlorobenzene	70-125	50
1,3-Dichloropropane	75-125	50
1,4-Dichlorobenzene	70-125	50
2,2-Dichloropropane	65-135	50
2-Butanone	30-160	50
2-Chlorotoluene	71-130	50
2-Hexanone	45-145	50
4-Chlorotoluene	75-125	50
Methyl Isobutyl Ketone	45-145	50
Acetone	20-160	50
Benzene	75-125	50
Bromobenzene	65-120	50
Bromochloromethane	70-125	50
Bromodichloromethane	70-130	50
Bromoform	55-135	50
Bromomethane	30-160	50
Carbon disulfide	45-160	50
Carbon tetrachloride	65-135	50
Chlorobenzene	75-125	50
Dibromochloromethane	65-130	50
Chloroethane	40-155	50
Chloroform	70-125	50
Chloromethane	50-130	50
cis-1,2-Dichloroethene	65-125	50

Table 12-3b (continued)
Accuracy and Precision Criteria for Method 8260B – Soil

Analyte	Accuracy Limits (%R)	Precision (RPD)
cis-1,3-Dichloropropene	70-125	50
Dibromomethane	75-130	50
Dichlorodifluoromethane	35-135	50
Ethylbenzene	75-125	50
Hexachlorobutadiene	55-140	50
Isopropyl benzene	75-130	50
m/p-Xylenes	80-125	50
MTBE	60-150	50
Methylene chloride	55-140	50
Naphthalene	40-125	50
n-Butylbenzene	65-140	50
n-Propylbenzene	65-135	50
o-Xylene	75-125	50
p-Isopropyltoluene	75-135	50
sec-Butylbenzene	65-130	50
Styrene	75-125	50
tert-Butylbenzene	65-130	50
Tetrachloroethylene	65-140	50
Toluene	70-125	50
trans-1,2-Dichloroethene	65-135	50
trans-1,3-Dichloropropene	65-125	50
Trichloroethene	75-125	50
Trichlorofluoromethane	25-185	50
Vinyl chloride	60-125	50

Notes:
%R – Percent Recovery
MTBE – Methyl tert-butyl ether
RPD – Relative Percent Difference

Table 12-4a
Accuracy and Precision Criteria for Method 8270C – Water

Analyte	Accuracy Limits (%R)	Precision (RPD)
2,4,5-Trichlorophenol	50-110	30
2,4,6-Trichlorophenol	50-115	30
2,4-Dichlorophenol	50-105	30
2,4-Dimethylphenol	30-110	30
2,4-Dinitrophenol	15-140	30
2-Chlorophenol	35-105	30
2-Methylphenol	40-110	30
2-Nitrophenol	40-115	30
4-Methylphenol	30-110	30
4,6-Dinitro-2-methylphenol	40-130	30
4-Chloro-3-methylphenol	45-110	30
4-Nitrophenol	10-125	30
Pentachlorophenol	40-115	30
Phenol	10-115	30
3,3'-Dichlorobenzidine	20-110	30
4-Chloroaniline	15-110	30
Bis(2-ethylhexyl)phthalate	40-125	30
Butylbenzylphthalate	45-115	30
Di-n-butylphthalate	55-115	30
Di-n-octylphthalate	35-135	30
Diethylphthalate	40-120	30
Dimethylphthalate	25-125	30
N-Nitroso-di-n-propylamine	35-130	30
N-Nitrosodimethylamine	25-110	30
n-Nitrosodiphenylamine	50-110	30
bis(2-Chloroethoxy)methane	45-105	30
bis(2-Chloroethyl)ether	35-110	30
bis(2-Chloroisopropyl)ether	25-130	30
Hexachlorobutadiene	25-105	30
Hexachloroethane	30-100	30
1,2,4-Trichlorobenzene	35-105	30
1,2-Dichlorobenzene	35-100	30
1,3-Dichlorobenzene	30-100	30
1,4-Dichlorobenzene	30-100	30
2-Chloronaphthalene	50-105	30
4-Bromophenyl-phenyl ether	50-115	30
4-Chlorophenyl-phenyl ether	50-110	30
Hexachlorobenzene	50-110	30
2,4-Dinitrotoluene	50-120	30
2,6-Dinitrotoluene	50-115	30
2-Nitroaniline	50-115	30

Table 12-4a (continued)
Accuracy and Precision Criteria for Method 8270C – Water

Analyte	Accuracy Limits (%R)	Precision (RPD)
3-Nitroaniline	20-125	30
4-Nitroaniline	35-120	30
Nitrobenzene	45-110	30
Carbazole	50-115	30
Dibenzofuran	55-105	30
1,2-Diphenylhydrazine	55-115	30
Benzyl alcohol	30-110	30
Isophorone	50-110	30
Benzoic acid	10-125	30

Notes:
%R – Percent Recovery
RPD – Relative Percent Difference

Table 12-4b
Accuracy and Precision Criteria for Method 8270C – Soil

Analyte	Accuracy Limits (%R)	Precision (RPD)
2,4,5-Trichlorophenol	50-110	50
2,4,6-Trichlorophenol	45-110	50
2,4-Dichlorophenol	45-110	50
2,4-Dimethylphenol	30-105	50
2,4-Dinitrophenol	15-130	50
2-Chlorophenol	45-105	50
2-Methylphenol	40-105	50
2-Nitrophenol	40-110	50
4-Methylphenol	40-105	50
4,6-Dinitro-2-methylphenol	30-135	50
4-Chloro-3-methylphenol	45-115	50
4-Nitrophenol	15-140	50
Pentachlorophenol	25-120	50
Phenol	40-100	50
3,3'-Dichlorobenzidine	10-130	50
4-Chloroaniline	10-100	50
Bis(2-ethylhexyl)phthalate	45-125	50
Butylbenzylphthalate	50-125	50
Di-n-butylphthalate	55-110	50
Di-n-octylphthalate	40-130	50
Diethylphthalate	50-115	50
Dimethylphthalate	50-110	50
N-Nitroso-di-n-propylamine	40-115	50
N-Nitrosodimethylamine	20-115	50
n-Nitrosodiphenylamine	50-115	50
bis(2-Chloroethoxy)methane	45-110	50
bis(2-Chloroethyl)ether	40-105	50
bis(2-Chloroisopropyl)ether	20-115	50
Hexachlorobutadiene	40-115	50
Hexachloroethane	35-110	50
1,2,4-Trichlorobenzene	45-110	50
1,2-Dichlorobenzene	45-100	50
1,3-Dichlorobenzene	40-100	50
1,4-Dichlorobenzene	35-105	50
2-Chloronaphthalene	45-105	50
4-Bromophenyl-phenyl ether	45-115	50
4-Chlorophenyl-phenyl ether	45-110	50
Hexachlorobenzene	45-120	50
2,4-Dinitrotoluene	50-115	50
2,6-Dinitrotoluene	50-110	50
2-Nitroaniline	45-120	50

Table 12-4b (continued)
Accuracy and Precision Criteria for Method 8270C – Soil

Analyte	Accuracy Limits (%R)	Precision (RPD)
3-Nitroaniline	25-110	50
4-Nitroaniline	35-115	50
Nitrobenzene	40-115	50
Carbazole	45-115	50
Dibenzofuran	50-105	50
1,2-Diphenylhydrazine	40-150	50
Benzyl alcohol	20-125	50
Isophorone	45-110	50
Benzoic acid	10-110	50

Notes:
%R – Percent Recovery
RPD – Relative Percent Difference

Table 12-5a
Accuracy and Precision Criteria for Method 8270-SIM – Water

Analyte	Accuracy Limits (%R)	Precision (RPD)
2-Methylnaphthalene	72.4-141	20
Acenaphthene	76.2-136	20
Acenaphthylene	71.3-139	20
Anthracene	77.3-144	20
Benzo(a)anthracene	71.4-142	20
Benzo(a)pyrene	70.8-140	20
Benzo(b)fluoranthene	68-142	20
Benzo(k)fluoranthene	70.1-144	20
Benzo(g,h,i)perylene	62.8-146	20
Chrysene	73.6-143	20
Dibenzo(a,h)anthracene	56.1-147	20
Fluoranthene	77.9-147	20
Fluorene	75.3-136	20
Indeno(1,2,3-cd)pyrene	61.6-147	20
Naphthalene	72.2-137	20
Phenanthrene	76-133	20
Pyrene	73-139	20

Notes:
%R – Percent Recovery
RPD – Relative Percent Difference
SIM – Selective Ion Monitoring

Table 12-5b
Accuracy and Precision Criteria for Method 8270-SIM – Soil

Analyte	Accuracy Limits (%R)	Precision (RPD)
2-Methylnaphthalene	68.6-120	30
Acenaphthene	69.1-118	30
Acenaphthylene	67.8-120	30
Anthracene	67.9-126	30
Benzo(a)anthracene	66.5-122	30
Benzo(a)pyrene	66.3-123	30
Benzo(b)fluoranthene	64.7-122	30
Benzo(k)fluoranthene	62.8-126	30
Benzo(g,h,i)perylene	64.6-129	30
Chrysene	67.9-122	30
Dibenzo(a,h)anthracene	64.3-131	30
Fluoranthene	64.0-131	30
Fluorene	65.3-120	30
Indeno(1,2,3-cd)pyrene	65.3-132	30
Naphthalene	64.1-115	30
Phenanthrene	68-118	30
Pyrene	65.7-124	30

Notes:
%R – Percent Recovery
RPD – Relative Percent Difference
SIM – Selective Ion Monitoring

Table 12-6a
Accuracy and Precision Criteria for Methods 6010B/6020A/7470 – Water

Analyte	Accuracy Limits (%R)	Precision (RPD)
Aluminum	80-120	30
Antimony	80-120	30
Arsenic	80-120	30
Barium	80-120	30
Beryllium	80-120	30
Cadmium	80-120	30
Chromium	80-120	30
Cobalt	80-120	30
Copper	80-120	30
Lead	80-120	30
Manganese	80-120	30
Mercury	80-120	30
Nickel	80-120	30
Selenium	80-120	30
Silver	80-120	30
Thallium	80-120	30
Vanadium	80-120	30
Zinc	80-120	30

Notes:
%R – Percent Recovery
RPD – Relative Percent Difference

Table 12-6b
Accuracy and Precision Criteria for Methods 6010B/6020A/7471 – Soil

Analyte	Accuracy Limits (%R)	Precision (RPD)
Aluminum	80-120	50
Antimony	80-120	50
Arsenic	80-120	50
Barium	80-120	50
Beryllium	80-120	50
Cadmium	80-120	50
Chromium	80-120	50
Cobalt	80-120	50
Copper	80-120	50
Lead	80-120	50
Manganese	80-120	50
Mercury	80-120	50
Nickel	80-120	50
Selenium	80-120	50
Silver	80-120	50
Thallium	80-120	50
Vanadium	80-120	50
Zinc	80-120	50

Notes:
%R – Percent Recovery
RPD – Relative Percent Difference

Table 12-7
Accuracy and Precision Criteria for Method 160.1 – Water

Analyte	Accuracy Limits (%R)	Precision (RPD)
TDS	80-120	30

Notes:
%R – Percent Recovery
RPD – Relative Percent Difference

QAPP Worksheet #13 – Secondary Data Criteria and Limitations Table
(UFP-QAPP Manual Section 2.7)

Secondary Data Criteria and Limitations Table

Secondary Data	Data Source (Originating Organization, Report Title, and Date)	Data Generator(s) (Originating Org., Data Types, Data Generation/ Collection Dates)	How Data Will Be Used	Limitations on Data Use
Background metals data	Final Background Study Report; Holloman AFB, New Mexico, Revision 3, July 2011	NationView Bhate JV III, LLC; metals concentrations in soils and groundwater; collected 2008	Historical data to serve as preliminary information pertaining to levels for metals at the sites currently under investigation	None
Group 2 UST Site soil and groundwater data	Working Copy RCRA Facility Investigation Report, Group 2 – Building 889 (TU/US-C515), Holloman AFB; 2011	Shaw; metals, VOCs, SVOCs, and TPH in soils and groundwater; 2011	Historical data to serve as preliminary information pertaining to levels for metals, VOCs, SVOCs, and TPH at the site currently under investigation	Some results may be considered screening level data.
Group 2 UST Site soil and groundwater data	Sample Completion Report, Group 2 Former UST Sites; Holloman AFB; 2013	Shaw; metals, VOCs, SVOCs, and TPH in soils and groundwater; 2012	Historical data to serve as preliminary information pertaining to levels for metals, VOCs, SVOCs, and TPH at the site currently under investigation	Some results may be considered screening level data.

Notes:
AFB – Air Force Base
PAHs – Polynuclear Aromatic Hydrocarbons
RFI – Resource Conservation and Recovery Act Facility Investigation
SVOCs – Semivolatile Organic Compounds
TPH – Total Petroleum Hydrocarbons
UST – Underground Storage Tanks
VOCs – Volatile Organic Compounds

QAPP Worksheet #14 – Summary of Project Tasks
(UFP-QAPP Manual Section 2.8.1)

Sampling Tasks:

General

1. Soil and groundwater samples will be collected as identified during the investigation as described in Worksheet #20. Discussion of the sampling approach and sampling design and rationale is provided in Worksheet #17 and IM Section 3.
2. Sampling locations, including temporary and permanent monitoring wells will be surveyed by a State of New Mexico-licensed surveyor. Horizontal coordinates will be referenced to the New Mexico Central State Plane Coordinate System, and surveyed to an accuracy of ±1.0 ft. Vertical elevations will be referenced to North American Datum 1983 coordinate system to an accuracy of ±0.01 ft.
3. Samples will be collected using the URS Standard Operating Procedures (SOPs). The SOPs are included as Appendix C to the IM Work Plan.

Analysis Tasks:

1. ESC will analyze for VOCs using USEPA SW-846 8260B, GRO and DRO using USEPA SW-846 8015, SVOCs using USEPA 8270C, metals using USEPA SW-846 6010B/ USEPA SW-846 6020A/ USEPA SW-846 7470A/ USEPA SW-7471A, and PAHs using USEPA 8270C-SIM. Aqueous samples will be analyzed for total and dissolved metals.

Quality Control Tasks:

1. ESC will be required to follow DoD QSM 4.2 and the analytical methods for requested analyses, as appropriate.
2. MS/MSDs will be collected at an approximate frequency of 5%.
3. Investigative samples will be duplicated in the field at a rate of 5% and analyzed by ESC to assess field and laboratory precision.
4. Equipment blanks will be collected from non-disposable, non-dedicated decontaminated sampling devices.

QAPP Worksheet #14 – Summary of Project Tasks (continued)
(UFP-QAPP Manual Section 2.8.1)

Secondary Data: Previously collected information will be evaluated and used to aid in the design of the sampling program, and for comparison of noted analyte concentrations to Holloman AFB background data. See Worksheet #13.
Data Management Tasks: Data will be delivered in an ERPIMS database compatible format after data verification/validation has been performed and data qualifiers have been added.
Documentation and Records: 1. All samples collected will have coordinate locations documented, records of each sample collected in field logbooks, and all field measurements documented in field logbooks. Chain-of-Custody (COC) forms, airbills, and sample logs will be prepared and retained for each sample. 2. ESC will notify project chemist of any sample receipt issues immediately before log in and sample analysis. Receipt issues include but are not limited to the following: • COC not signed and relinquished • Copies of COCs and not originals received by the laboratory • The absence of custody seals on the cooler • Cooler received at a temperature >6 degrees Celsius (°C) • Sample breakage • ID discrepancies between COC and bottle labels 3. A copy of finalized SAP/QAPP will be retained in central project file, and available for reference for onsite activities.
Data Packages:

ESC will complete analytical Level IV data packages (i.e. summary forms, results, and raw data) in accordance with the AFCEC approved forms, or similar, pre-approved forms, and in an ERPIMS database compatible format.

QAPP Worksheet #14 – Summary of Project Tasks (continued)
(UFP-QAPP Manual Section 2.8.1)

Assessment / Audit Tasks:

Field Sample Collection and Documentation Audits: (to be determined).

Data Review Tasks:

1. ESC will verify that all data are complete for samples received, that DoD QSM version 4.2 protocol have been followed, and that data package deliverable requirements have been met. Data will be 100% verified by URS per this Site-specific QAPP. A data verification report will be produced by URS for each sample delivery group (typically a lab data package).
2. Verified and validated data and related field logbooks/notes/records will be reviewed to assess total measurement error and determine overall usability of the data for project purposes. Data limitations will be determined and data will be compared to project quality objectives and required action limits. Corrective action will be initiated as necessary. Final validated data are placed in an ERPIMS database, with any necessary qualifiers and tables.

IM Report:

The IM Report will present interim measures implemented, a summary of results from both nature/extent delineation and confirmation sampling, and a summary of the effectiveness of the interim measures.

Notes:
°C – Degrees Celsius
CA – Corrective Action
COC – Chain of Custody
DoD – Department of Defense
DRO – Diesel Range Organics
ESC – ESC Lab Sciences of Mt. Juliet, Tennessee
ERPIMS – Environmental Resources Program Information Management System
GRO – Gasoline Range Organics
ID – Identification
MS/MSD – Matrix Spike/Matrix Spike Duplicate
PAHs – Polynuclear Aromatic Hydrocarbons
QSM – Quality Systems Manual
SAP – Sampling and Analysis Plan
SIM – Selective Ion Monitoring
SOPs – Standard Operating Procedures
SVOCs – Semivolatile Organic Compounds
TCLP – Toxicity Characteristic Leaching Procedure
USEPA – United States Environmental Protection Agency
VOCs – Volatile Organic Compounds

QAPP Worksheet #15 – Reference Limits and Evaluation Table
(UFP-QAPP Manual Section 2.8.1)

See attached Tables 15-1 through 15-2 for ESC's DLs and LOQs and the applicable project screening criteria.

Table 15-1
Groundwater Screening Level Criteria

Analyte	Units	LOQ	DL	New Mexico Human Health Standards, Other Standards for Domestic Water Supply, and Agricultural Standards (NMAC 2013)	USEPA MCLs Drinking Water (USEPA 2013)	Minimum Standard
Method 160.1						
TDS	mg/L	10	2.82	1.00E+03(1)	-	1.00E+03(1)
Method 8015						
TPH	mg/L	---	---	0.2 (2)	-	0.2 (2)
GRO	mg/L	0.1	0.0314	NA [a]	-	-
DRO	mg/L	0.1	0.0330	0.4 (2)	-	0.4 (2)
ORO	mg/L	0.1	0.0185	0.2 (2)	-	0.2 (2)
Methods 6010B/ 6020A/ 7470A						
Aluminum	mg/L	0.1	0.035	5.00E+00	-	5.00E+00
Antimony (6020A)	mg/L	0.001	0.0002	-	6.00E-03	6.00E-03
Arsenic (6020A)	mg/L	0.001	0.0003	1.00E-01	1.00E-02	1.00E-02
Barium	mg/L	0.005	0.001	1.00E+00	2.00E+00	1.00E+00
Beryllium	mg/L	0.002	0.0007	-	4.00E-03	4.00E-03
Cadmium (6020A)	mg/L	5E-04	0.0002	1.00E-02	5.00E-03	5.00E-03
Chromium (6020A)	mg/L	0.002	0.0005	5.00E-02	1.00E-01	5.00E-02
Cobalt (6020A)	mg/L	0.001	0.0003	5.00E-02	-	5.00E-02
Copper	mg/L	0.02	0.0053	1.00E+00	1.30E+00	1.00E+00
Lead (6020A)	mg/L	0.001	0.0002	5.00E-02	1.50E-02	1.50E-02
Manganese	mg/L	0.01	0.0011	2.00E-01	-	2.00E-01
Mercury (7470A)	mg/L	2E-04	5E-05	2.00E-03	2.00E-03	2.00E-03
Nickel (6020A)	mg/L	0.001	0.0004	2.00E-01	-	2.00E-01
Selenium (6020A)	mg/L	0.001	0.0004	5.00E-02	5.00E-02	5.00E-02
Silver (6020A)	mg/L	0.001	0.0003	5.00E-02	-	5.00E-02
Thallium (6020A)	mg/L	0.001	0.0002	-	2.00E-03	2.00E-03
Vanadium	mg/L	0.01	0.0022	-	-	-
Zinc	mg/L	0.03	0.0059	1.00E+01	-	1.00E+01
Method 8270-SIM						
2-Methylnaphthalene	ug/L	0.25	0.015	-	-	-
Acenaphthene	ug/L	0.05	0.008	-	-	-
Acenaphthylene	ug/L	0.05	0.0011	-	-	-
Anthracene	ug/L	0.05	0.013	-	-	-
Benzo(a)anthracene	ug/L	0.05	0.012	-	-	-
Benzo(a)pyrene	ug/L	0.05	0.016	7.00E-01	2.00E-01	2.00E-01
Benzo(b)fluoranthene	ug/L	0.05	0.019	-	-	-
Benzo(k)fluoranthene	ug/L	0.05	0.025	-	-	-
Benzo(g,h,i)perylene	ug/L	0.05	0.016	-	-	-
Chrysene	ug/L	0.05	0.014	-	-	-

Table 15-1
Groundwater Screening Level Criteria

Analyte	Units	LOQ	DL	New Mexico Human Health Standards, Other Standards for Domestic Water Supply, and Agricultural Standards (NMAC 2013)	USEPA MCLs Drinking Water (USEPA 2013)	Minimum Standard
Dibenzo(a,h)anthracene	ug/L	0.05	0.0045	-	-	-
Fluoranthene	ug/L	0.05	0.016	-	-	-
Fluorene	ug/L	0.05	0.0089	-	-	-
Indeno(1,2,3-cd)pyrene	ug/L	0.05	0.0073	-	-	-
Naphthalene	ug/L	0.25	0.012	-	-	-
Phenanthrene	ug/L	0.05	0.018	-	-	-
Pyrene	ug/L	0.05	0.0155	-	-	-
Method 8270						
2,4,5-Trichlorophenol	ug/L	10	0.236	-	-	-
2,4,6-Trichlorophenol	ug/L	10	0.297	-	-	-
2,4-Dichlorophenol	ug/L	10	0.284	-	-	-
2,4-Dimethylphenol	ug/L	10	0.264	-	-	-
2,4-Dinitrophenol	ug/L	10	3.25	-	-	-
2-Chlorophenol	ug/L	10	0.283	-	-	-
2-Methylphenol	ug/L	10	0.312	-	-	-
2-Nitrophenol	ug/L	10	0.32	-	-	-
4-Methylphenol	ug/L	10	0.266	-	-	-
4,6-Dinitro-2-methylphenol	ug/L	10	2.62	-	-	-
4-Chloro-3-methylphenol	ug/L	10	0.263	-	-	-
4-Nitrophenol	ug/L	10	2.01	-	-	-
Pentachlorophenol	ug/L	1	0.313	-	1.00E+00	1.00E+00
Phenol	ug/L	10	0.334	-	-	-
3,3'-Dichlorobenzidine	ug/L	10	2.02	-	-	-
4-Chloroaniline	ug/L	10	0.382	-	-	-
Bis(2-ethylhexyl)phthalate	ug/L	3	0.709	-	6.00E+00	6.00E+00
Butylbenzylphthalate	ug/L	3	0.275	-	-	-
Di-n-butylphthalate	ug/L	3	0.266	-	-	-
Di-n-octylphthalate	ug/L	1	0.278	-	-	-
Diethylphthalate	ug/L	3	0.282	-	-	-
Dimethylphthalate	ug/L	3	0.283	-	-	-
N-Nitroso-di-n-propylamine	ug/L	10	0.403	-	-	-
N-Nitrosodimethylamine	ug/L	10	1.26	-	-	-
n-Nitrosodiphenylamine	ug/L	10	0.304	-	-	-
bis(2-Chloroethoxy)methane	ug/L	10	0.329	-	-	-
bis(2-Chloroethyl)ether	ug/L	10	1.62	-	-	-
bis(2-Chloroisopropyl)ether	ug/L	10	0.445	-	-	-
Hexachlorobutadiene	ug/L	10	0.329	-	-	-

Table 15-1
Groundwater Screening Level Criteria

Analyte	Units	LOQ	DL	New Mexico Human Health Standards, Other Standards for Domestic Water Supply, and Agricultural Standards (NMAC 2013)	USEPA MCLs Drinking Water (USEPA 2013)	Minimum Standard
Hexachloroethane	ug/L	10	0.365	-	-	-
1,2,4-Trichlorobenzene	ug/L	10	0.355	-	7.00E+01	7.00E+01
2-Chloronaphthalene	ug/L	1	0.33	-	-	-
4-Bromophenyl-phenyl ether	ug/L	10	0.335	-	-	-
4-Chlorophenyl-phenyl ether	ug/L	10	0.303	-	-	-
Hexachlorobenzene	ug/L	1	0.341	-	1.00E+00	1.00E+00
2,4-Dinitrotoluene	ug/L	10	1.65	-	-	-
2,6-Dinitrotoluene	ug/L	10	0.279	-	-	-
2-Nitroaniline	ug/L	10	1.9	-	-	-
3-Nitroaniline	ug/L	10	0.308	-	-	-
4-Nitroaniline	ug/L	10	0.349	-	-	-
Nitrobenzene	ug/L	10	0.367	-	-	-
Carbazole	ug/L	10	0.162	-	-	-
Dibenzofuran	ug/L	10	0.338	-	-	-
1,2-Diphenylhydrazine	ug/L	10	0.318	-	-	-
Benzyl alcohol	ug/L	10	0.393	-	-	-
Isophorone	ug/L	10	0.272	-	-	-
Benzoic acid	ug/L	10	2.5	-	-	-
Method 8260						
1,1,1,2-Tetrachloroethane	ug/L	1	0.39	-	-	-
1,1,1-Trichloroethane	ug/L	1	0.32	6.00E+01	2.00E+02	6.00E+01
1,1,2,2-Tetrachloroethane	ug/L	1	0.59	1.00E+01	-	1.00E+01
1,1,2-Trichloroethane	ug/L	1	0.38	1.00E+01	5.00E+00	5.00E+00
1,1-Dichloroethane	ug/L	1	0.26	2.50E+01	-	2.50E+01
1,1-Dichloroethene	ug/L	1	0.40	5.00E+00	7.00E+00	5.00E+00
1,1-Dichloropropene	ug/L	1	0.35	-	-	-
1,2,3-Trichlorobenzene	ug/L	1	0.23	-	-	-
1,2,3-Trichloropropane	ug/L	2.5	0.81	-	-	-
1,2,4-Trichlorobenzene	ug/L	1	0.21	-	7.00E+01	7.00E+01
1,2,4-Trimethylbenzene	ug/L	1	0.37	-	-	-
1,2-Dibromo-3-chloropropane	ug/L	5	1.33	-	2.00E-01	2.00E-01
1,2-Dibromoethane	ug/L	1	0.38	1.00E-01	5.00E-02	5.00E-02
1,2-Dichlorobenzene	ug/L	1	0.35	-	6.00E+02	6.00E+02
1,2-Dichloroethane	ug/L	1	0.36	1.00E+01	5.00E+00	5.00E+00
1,2-Dichloropropane	ug/L	1	0.31	-	5.00E+00	5.00E+00
1,3,5-Trimethylbenzene	ug/L	1	0.39	-	-	-
1,3-Dichlorobenzene	ug/L	1	0.22	-	-	-

Table 15-1
Groundwater Screening Level Criteria

Analyte	Units	LOQ	DL	New Mexico Human Health Standards, Other Standards for Domestic Water Supply, and Agricultural Standards (NMAC 2013)	USEPA MCLs Drinking Water (USEPA 2013)	Minimum Standard
1,3-Dichloropropane	ug/L	1	0.37	-	-	-
1,4-Dichlorobenzene	ug/L	1	0.27	-	7.50E+01	7.50E+01
2,2-Dichloropropane	ug/L	1	0.32	-	-	-
2-Butanone	ug/L	10	3.93	-	-	-
2-Chlorotoluene	ug/L	1	0.38	-	-	-
2-Hexanone	ug/L	10	1.57	-	-	-
4-Chlorotoluene	ug/L	1	0.35	-	-	-
Methyl Isobutyl Ketone	ug/L	10	2.14	-	-	-
Acetone	ug/L	50	10.0	-	-	-
Benzene	ug/L	1	0.33	1.00E+01	5.00E+00	5.00E+00
Bromobenzene	ug/L	1	0.35	-	-	-
Bromochloromethane	ug/L	1	0.52	-	-	-
Bromodichloromethane(3)	ug/L	1	0.38	-	8.00E+01	8.00E+01
Bromoform(3)	ug/L	1	0.47	-	8.00E+01	8.00E+01
Bromomethane	ug/L	5	0.87	-	-	-
Carbon disulfide	ug/L	1	0.32	-	-	-
Carbon tetrachloride	ug/L	1	0.38	1.00E+01	5.00E+00	5.00E+00
Chlorobenzene	ug/L	1	0.35	-	1.00E+02	1.00E+02
Dibromochloromethane(3)	ug/L	1	0.33	-	8.00E+01	8.00E+01
Chloroethane	ug/L	5	0.45	-	-	-
Chloroform(3)	ug/L	5	0.32	1.00E+02	8.00E+01	8.00E+01
Chloromethane	ug/L	2.5	0.28	-	-	-
cis-1,2-Dichloroethene	ug/L	1	0.26	-	7.00E+01	7.00E+01
cis-1,3-Dichloropropene	ug/L	1	0.42	-	-	-
Dibromomethane	ug/L	1	0.35	-	-	-
Dichlorodifluoromethane	ug/L	5	0.55	-	-	-
Ethylbenzene	ug/L	1	0.38	7.50E+02	7.00E+02	7.00E+02
Hexachlorobutadiene	ug/L	1	0.26	-	-	-
Isopropyl benzene	ug/L	1	0.33	-	-	-
m/p-Xylenes(4)	ug/L	2	0.72	6.20E+02	1.00E+01	1.00E+01
MTBE	ug/L	1	0.37	-	-	-
Methylene chloride	ug/L	5	1.00	1.00E+02	5.00E+00	5.00E+00
Naphthalene	ug/L	5	1.00	-	-	-
n-Butylbenzene	ug/L	1	0.36	-	-	-
n-Propylbenzene	ug/L	1	0.35	-	-	-
o-Xylene(4)	ug/L	1	0.34	6.20E+02	1.00E+01	1.00E+01
p-Isopropyltoluene	ug/L	1	0.35	-	-	-

Table 15-1
Groundwater Screening Level Criteria

Analyte	Units	LOQ	DL	New Mexico Human Health Standards, Other Standards for Domestic Water Supply, and Agricultural Standards (NMAC 2013)	USEPA MCLs Drinking Water (USEPA 2013)	Minimum Standard
sec-Butylbenzene	ug/L	1	0.37	-	-	-
Styrene	ug/L	1	0.31	-	1.00E+02	1.00E+02
tert-Butylbenzene	ug/L	1	0.40	-	-	-
Tetrachloroethylene	ug/L	1	0.37	2.00E+01	5.00E+00	5.00E+00
Toluene	ug/L	5	0.78	7.50E+02	1.00E+03	7.50E+02
trans-1,2-Dichloroethene	ug/L	1	0.40	-	1.00E+02	1.00E+02
trans-1,3-Dichloropropene	ug/L	1	0.42	-	-	-
Trichloroethene	ug/L	1	0.40	1.00E+02	5.00E+00	5.00E+00
Trichlorofluoromethane	ug/L	5	1.20	-	-	-
Vinyl chloride	ug/L	1	0.26	1.00E+00	2.00E+00	1.00E+00

- – multi–fraction analysis
mg/L – milligrams per liter
ug/L – micrograms per liter
DL – Detection Limit
DRO – Diesel Range Organics
GRO – Gasoline Range Organics
LOD – Limit of Detection
LOQ – Limit of Quantitation
MCL – Maximum Contamination Level
MTBE – Methyl tert–butyl ether
NA [a] – Not applicable; regulated via individual contaminants in Appendix A (NMED 2012).
SIM – Selective Ion Monitoring
TDS – Total Dissolved Solids
TPH – Total Petroleum Hydrocarbon
USEPA – U.S. Environmental Protection Agency

Notes:

The DL and LOQ do not meet the screening values.

1.00 Value is a New Mexico Human Health Standard
1.00 Value is a New Mexico Other Standard for Domestic Water Supply
1.00 Value is a New Mexico Standard for Irrigation Use

(1) Per NMAC 2013 (below), the TDS Standard of 1,000 mg/L applies for Ground Water of 10,000 mg/L TDS concentration or less, unless the existing condition exceeds the standard.
(2) The NMED TPH groundwater screening level reflects aggregate TPH, and is dependent upon classification of the TPH, as described in NMED 2012 (below). The appropriate TPH screening level may vary depending upon site historical data together with TPH analytical results that indicate the class of TPH encountered (e.g., diesel).
(3) USEPA MCL value is for total trihalomethanes.
(4) New Mexico standard and USEPA MCL values are for total xylene.

Sources:
New Mexico Administrative Code (NMAC). 2013. Title 20 Environmental Protection. Chapter 6. Water Quality. Part 2. Ground and Surface Water Protection. 20.6.2.3103. Standards for Ground Water of 10,000 mg/l TDS Concentration or Less.

New Mexico Environment Department (NMED). 2012. Risk Assessment Guidance for Site Investigations and Remediation. Table 6-2: TPH Screening Guidelines for Potable Groundwater. Table 6-3 TPH Screening Guidelines - Vapor Migration and Inhalation of Groundwater. June.

U.S. Environmental Protection Agency (USEPA). 2013. National Primary Drinking Water Regulations. Accessed online at: http://water.epa.gov/drink/contaminants/index.cfm#List.

Table 15-2
Soil Screening Level Criteria

Analyte	Units	LOQ	DL	NMED SSLs Residential Land Use (NMED 2012)	USEPA RSLs Residential Soil (USEPA 2013) [1]
Method 8015					
TPH	mg/kg	-	-	1000 [5]	-
GRO	mg/kg	0.1	0.0217	NA [a]	-
DRO	mg/kg	4	1.33	-	-
ORO	mg/kg	4	2.5	-	-
Methods 6010B/7471A					
Aluminum	mg/kg	5	1.75	7.80E+04	-
Antimony	mg/kg	1	0.375	3.13E+01	-
Arsenic	mg/kg	1	0.325	3.90E+00	-
Barium	mg/kg	0.25	0.85	1.56E+04	-
Beryllium	mg/kg	0.1	0.035	1.56E+02	-
Cadmium	mg/kg	0.25	0.035	7.03E+01	-
Chromium[2]	mg/kg	0.5	0.07	1.17E+05	-
Cobalt	mg/kg	0.5	0.115	-	2.30E+01
Copper	mg/kg	1	0.265	3.13E+03	-
Lead	mg/kg	0.25	0.095	4.00E+02	-
Manganese	mg/kg	0.5	0.06	1.86E+03	-
Mercury[3]	mg/kg	0.02	0.0014	2.35E+01	-
Nickel	mg/kg	1	0.245	1.56E+03	-
Selenium	mg/kg	1	0.37	3.91E+02	-
Silver	mg/kg	0.5	0.14	3.91E+02	-
Thallium	mg/kg	1	0.325	7.82E-01	-
Vanadium	mg/kg	0.5	0.12	3.91E+02	-
Zinc	mg/kg	1.5	0.295	2.35E+04	-
Method 8270-SIM					
2-Methylnaphthalene	ug/kg	20.0	2.0	-	2.30E+05
Acenaphthene	ug/kg	6.0	1.6	3.44E+06	-
Acenaphthylene	ug/kg	6.0	1.1	-	-
Anthracene	ug/kg	6.0	0.8	1.72E+07	-
Benzo(a)anthracene	ug/kg	6.0	1.1	1.48E+03	-
Benzo(a)pyrene	ug/kg	6.0	0.8	1.48E+02	-
Benzo(b)fluoranthene	ug/kg	6.0	1.1	1.48E+03	-

Table 15-2
Soil Screening Level Criteria

Analyte	Units	LOQ	DL	NMED SSLs Residential Land Use (NMED 2012)	USEPA RSLs Residential Soil (USEPA 2013) (1)
Benzo(k)fluoranthene	ug/kg	6.0	0.6	1.48E+04	-
Benzo(g,h,i)perylene	ug/kg	6.0	0.6	-	-
Chrysene	ug/kg	6.0	0.6	1.48E+05	-
Dibenzo(a,h)anthracene	ug/kg	6.0	0.6	1.48E+02	-
Fluoranthene	ug/kg	6.0	0.6	2.29E+06	-
Fluorene	ug/kg	6.0	0.6	2.29E+06	-
Indeno(1,2,3-cd)pyrene	ug/kg	6.0	0.6	1.48E+03	-
Naphthalene	ug/kg	20.0	2.0	4.30E+04	-
Phenanthrene	ug/kg	6.0	0.6	1.83E+06	-
Pyrene	ug/kg	6.0	0.6	1.72E+06	-
Method 8270					
2,4,5-Trichlorophenol	ug/kg	333	10.4	6.11E+06	-
2,4,6-Trichlorophenol	ug/kg	333	7.79	6.11E+04	-
2,4-Dichlorophenol	ug/kg	333	7.46	1.83E+05	-
2,4-Dimethylphenol	ug/kg	333	47.1	1.22E+06	-
2,4-Dinitrophenol	ug/kg	333	98.0	1.22E+05	-
2-Chlorophenol	ug/kg	333	8.31	3.91E+05	-
2-Methylphenol	ug/kg	333	9.86	-	3.10E+06
2-Nitrophenol	ug/kg	333	13.0	-	-
4-Methylphenol	ug/kg	333	7.80	-	6.10E+06
4,6-Dinitro-2-methylphenol	ug/kg	333	124	4.89E+03	-
4-Chloro-3-methylphenol	ug/kg	333	4.77	-	6.10E+06
4-Nitrophenol	ug/kg	333	52.5	-	-
Pentachlorophenol	ug/kg	333	48.0	8.94E+03	-
Phenol	ug/kg	333	6.95	1.83E+07	-
3,3'-Dichlorobenzidine	ug/kg	333	79.4	1.08E+04	-
4-Chloroaniline	ug/kg	333	35.2	-	2.40E+04
Bis(2-ethylhexyl)phthalate	ug/kg	333	12.0	3.47E+05	-
Butylbenzylphthalate	ug/kg	333	10.30	-	2.60E+06
Di-n-butylphthalate	ug/kg	333	10.90	6.11E+06	-
Di-n-octylphthalate	ug/kg	333	9.07	-	6.10E+05

Table 15-2
Soil Screening Level Criteria

Analyte	Units	LOQ	DL	NMED SSLs Residential Land Use (NMED 2012)	USEPA RSLs Residential Soil (USEPA 2013) (1)
Diethylphthalate	ug/kg	333	6.91	4.89E+07	-
Dimethylphthalate	ug/kg	333	5.40	6.11E+08	-
N-Nitroso-di-n-propylamine	ug/kg	333	9.06	-	6.90E+02
N-Nitrosodimethylamine	ug/kg	333	64.7	2.26E+01	-
n-Nitrosodiphenylamine	ug/kg	333	5.94	9.93E+05	-
bis(2-Chloroethoxy)methane	ug/kg	333	7.70	-	1.80E+05
bis(2-Chloroethyl)ether	ug/kg	333	8.96	2.68E+03	-
bis(2-Chloroisopropyl)ether	ug/kg	333	7.60	9.15E+04	-
Hexachlorobutadiene	ug/kg	333	10.00	6.11E+04	-
Hexachloroethane	ug/kg	333	13.4	4.28E+04	-
1,2,4-Trichlorobenzene	ug/kg	333	8.76	7.30E+04	-
2-Chloronaphthalene	ug/kg	33	6.39	-	6.30E+06
4-Bromophenyl-phenyl ether	ug/kg	333	11.40	-	-
4-Chlorophenyl-phenyl ether	ug/kg	333	6.27	-	-
Hexachlorobenzene	ug/kg	333	8.56	3.04E+03	-
2,4-Dinitrotoluene	ug/kg	333	6.07	1.57E+04	-
2,6-Dinitrotoluene	ug/kg	333	7.37	6.11E+04	-
2-Nitroaniline	ug/kg	333	7.55	-	6.10E+05
3-Nitroaniline	ug/kg	333	8.50	-	-
4-Nitroaniline	ug/kg	333	6.39	-	2.40E+05
Nitrobenzene	ug/kg	333	6.95	5.35E+04	-
Carbazole	ug/kg	333	5.24	-	-
Dibenzofuran	ug/kg	333	5.18	-	7.80E+04
1,2-Diphenylhydrazine	ug/kg	333	5.28	6.08E+03	-
Benzyl alcohol	ug/kg	333	7.50	-	6.10E+06
Isophorone	ug/kg	333	5.22	5.12E+06	-
Benzoic acid	ug/kg	333	123	-	2.40E+08
Method 8260					
1,1,1,2-Tetrachloroethane	ug/kg	1	0.264	2.91E+04	-
1,1,1-Trichloroethane	ug/kg	1	0.286	1.56E+07	-
1,1,2,2-Tetrachloroethane	ug/kg	1	0.365	8.02E+03	-

Table 15-2
Soil Screening Level Criteria

Analyte	Units	LOQ	DL	NMED SSLs Residential Land Use (NMED 2012)	USEPA RSLs Residential Soil (USEPA 2013) (1)
1,1,2-Trichloroethane	ug/kg	1	0.277	2.81E+03	-
1,1-Dichloroethane	ug/kg	1	0.199	6.45E+04	-
1,1-Dichloroethene	ug/kg	1	0.303	4.49E+05	-
1,1-Dichloropropene	ug/kg	1	0.317	-	-
1,2,3-Trichlorobenzene	ug/kg	1	0.306	-	4.90E+04
1,2,3-Trichloropropane	ug/kg	2.5	0.741	4.97E+01	-
1,2,4-Trichlorobenzene	ug/kg	1	0.388	7.30E+04	-
1,2,4-Trimethylbenzene	ug/kg	1	0.211	-	6.20E+04
1,2-Dibromo-3-chloropropane	ug/kg	5	1.05	1.86E+03	-
1,2-Dibromoethane	ug/kg	1	0.343	5.88E+02	-
1,2-Dichlorobenzene	ug/kg	1	0.305	2.31E+06	-
1,2-Dichloroethane	ug/kg	1	0.265	7.89E+03	-
1,2-Dichloropropane	ug/kg	1	0.358	1.52E+04	-
1,3,5-Trimethylbenzene	ug/kg	1	0.266	-	7.80E+05
1,3-Dichlorobenzene	ug/kg	1	0.239	-	-
1,3-Dichloropropane	ug/kg	1	0.207	-	1.60E+06
1,4-Dichlorobenzene	ug/kg	1	0.226	3.17E+04	-
2,2-Dichloropropane	ug/kg	1	0.279	-	-
2-Butanone	ug/kg	10	4.68	3.71E+07	-
2-Chlorotoluene	ug/kg	1	0.301	1.56E+06	-
2-Hexanone	ug/kg	10	1.37	-	2.10E+05
4-Chlorotoluene	ug/kg	1	0.24	-	1.60E+06
Methyl Isobutyl Ketone	ug/kg	10	1.88	5.82E+06	-
Acetone	ug/kg	50	10	6.66E+07	-
Benzene	ug/kg	1	0.27	1.54E+04	-
Bromobenzene	ug/kg	1	0.284	-	3.00E+05
Bromochloromethane	ug/kg	1	0.39	-	1.60E+05
Bromodichloromethane	ug/kg	1	0.254	5.41E+03	-
Bromoform	ug/kg	1	0.424	6.16E+05	-
Bromomethane	ug/kg	5	1.34	1.65E+04	-

Table 15-2
Soil Screening Level Criteria

Analyte	Units	LOQ	DL	NMED SSLs Residential Land Use (NMED 2012)	USEPA RSLs Residential Soil (USEPA 2013) [1]
Carbon disulfide	ug/kg	1	0.221	1.53E+06	-
Carbon tetrachloride	ug/kg	1	0.328	1.08E+04	-
Chlorobenzene	ug/kg	1	0.212	3.76E+05	-
Dibromochloromethane	ug/kg	1	0.373	1.21E+04	-
Chloroethane	ug/kg	5	0.946	2.98E+07	-
Chloroform	ug/kg	5	0.229	5.86E+03	-
Chloromethane	ug/kg	2.5	0.375	2.75E+05	-
cis-1,2-Dichloroethene	ug/kg	1	0.235	1.56E+05	-
cis-1,3-Dichloropropene	ug/kg	1	0.262	-	-
Dibromomethane	ug/kg	1	0.382	5.16E+04	-
Dichlorodifluoromethane	ug/kg	5	0.713	1.68E+05	-
Ethylbenzene	ug/kg	1	0.297	6.84E+04	-
Hexachlorobutadiene	ug/kg	1	0.342	6.11E+04	-
Isopropyl benzene	ug/kg	1	0.243	2.43E+06	-
m/p-Xylenes[4]	ug/kg	2	0.332	-	5.90E+05
MTBE	ug/kg	1	0.212	9.01E+05	-
Methylene chloride	ug/kg	5	1	4.09E+05	-
Naphthalene	ug/kg	5	1	4.30E+04	-
n-Butylbenzene	ug/kg	1	0.258	-	3.90E+06
n-Propylbenzene	ug/kg	1	0.206	-	3.40E+06
o-Xylene	ug/kg	1	0.366	8.98E+05	-
p-Isopropyltoluene	ug/kg	1	0.204	-	-
sec-Butylbenzene	ug/kg	1	0.201	-	7.80E+06
Styrene	ug/kg	1	0.234	7.28E+06	-
tert-Butylbenzene	ug/kg	1	0.206	-	7.80E+06
Tetrachloroethylene	ug/kg	1	0.276	7.02E+03	-
Toluene	ug/kg	5	0.434	5.27E+06	-
trans-1,2-Dichloroethene	ug/kg	1	0.264	2.70E+05	-
trans-1,3-Dichloropropene	ug/kg	1	0.267	-	-
Trichloroethene	ug/kg	1	0.279	8.77E+03	-
Trichlorofluoromethane	ug/kg	5	0.382	1.41E+06	-

Table 15-2
Soil Screening Level Criteria

Analyte	Units	LOQ	DL	NMED SSLs Residential Land Use (NMED 2012)	USEPA RSLs Residential Soil (USEPA 2013) [(1)]
Vinyl chloride	ug/kg	1	0.291	7.28E+02	-

mg/kg - milligram per kilogram
ug/kg - microgram per kilogram
DL - Detection Limit
DRO - Diesel Range Organics
GRO - Gasoline Range Organics
LOD - Limit of Detection
LOQ - Limit of Quantitation
MTBE - Methyl tert-butyl ether
NA [a] - Not applicable; regulated via individual contaminants in Appendix A (NMED 2012).
NMED - New Mexico Environment Department
RSL - Regional Screening Level
SIM - Selective Ion Monitoring
SSL - Soil Screening Level
TPH - Total Petroleum Hydrocarbon
USEPA - U.S. Environmental Protection Agency

Notes:

The DL and LOQ do not meet the screening values.

(1) USEPA RSLs are shown only for chemicals that do not have an NMED SSL, and have been adjusted to a 1E-05 risk level for carcinogenic RSLs, consistent with NMED Risk Assessment Guidance. Soil sample results will be compared to NMED SSLs, or to USEPA RSLs in instances where there is no SSL. In cases where a detected analyte has neither a SSL or RSL, screening levels will be evaluated as appropriate using NMED guidance.
(2) NMED SSL for chromium III is shown.
(3) NMED SSL for mercury (salts) is shown.
(4) USEPA RSL for p-xylene is shown.
(5) NMED regulates TPH which is comprised of GRO, DRO and ORO. The Residential Direct Exposure screening level is dependent upon the classification of the TPH, as described in NMED 2012, and reflects aggregate TPH of GRO, DRO, and ORO classification.

Sources:
New Mexico Environment Department (NMED). 2012. Risk Assessment Guidance for Site Investigations and Remediation. Table A-1: NMED Soil Screening Levels. Table 6-2: TPH Screening Guidelines for Potable Groundwater. Table 6-3 TPH Screening Guidelines - Vapor Migration and Inhalation of Groundwater. June.

U.S. Environmental Protection Agency (USEPA). 2013. USEPA Regional Screening Level (RSL) Chemical-specific Parameters Supporting Table. November. Accessed online at: http://www.epa.gov/region9/superfund/prg/.

QAPP Worksheet #16 – Project Schedule & Milestones Chart
(UFP-QAPP Manual Section 2.8.2)

The Project Schedule is included in IM Work Plan Section 5.

QAPP Worksheet #17 – Sampling Approach, Sampling Design, and Rationale
(UFP-QAPP Manual Section 3.1.1)

Sampling Approach, Sampling Design, and Rationale:

Section 3 of the IM Work Plan discusses the sampling approach, design, and rationale for the site.

Field parameter measurements will be documented on field forms or field log books, as appropriate. The number of samples to be collected for each site will be determined during field activities as described in IM Work Plan Section 3.

QAPP Worksheet #18 – Sampling Locations and Methods/SOP Requirements Table
(UFP-QAPP Manual Section 3.1.1)

Site	Matrix	Analytical Group	Concentration Level	Number of Samples (identify field duplicates)	Sampling SOP Reference	Rationale for Sampling Location
AOC-UST-889 (TU515)	Soil	GRO, DRO/ORO, VOCs, SVOCs, PAHs, Metals	Low	TBD	SOPs 4 & 6	Analysis for COCs. Section 3 of the IM Work Plan discusses sampling rationale.
	Groundwater	GRO, DRO/ORO, VOCs, SVOCs, PAHs, Total and Dissolved Metals, TDS	Low	TBD	SOPs 4, 9, and 11	

Notes:
AOC – Area of Concern
DRO/ORO – Diesel Range Organics/Oil Range Organics
GRO – Gasoline Range Organics
IM – Interim Measures
PAHs – Polynuclear Aromatic Hydrocarbons
SOP – Standard Operating Procedure
SVOCs – Semivolatile Organic Compounds
TBD – To Be Determined
TDS – Total Dissolved Solids
UST – Underground Storage Tank
VOCs – Volatile Organic Compounds

THIS PAGE INTENTIONALLY BLANK

QAPP Worksheet #19 – Analytical Requirements Table
(UFP-QAPP Manual Section 3.1.1)

Analytical Requirements Table

Matrix	Analytical Group	Concentration Level	Analytical and Preparation Method/SOP Reference[1]	Sample Preparation Volume	Containers (number, size, and type)[2]	Preservation Requirements (chemical, temperature, light protected)	Maximum Holding Time (preparation/ analysis)
Soil	GRO	Low	SW846 5035 & 8015/ESC SOPs 330751 & 330351A	2 Encores or 2 Pre-weighed, Preserved Vials	2 Encores or 2 Pre-weighed, Preserved Vials	Cool ≤ 6 °C	48 hours – Encores 14 days - Vials
Soil	DRO/ORO	Low	SW846 3546 & 8015/ESC SOPs 330705, 330350A	30 g	1 4-oz Glass Jar	Cool ≤ 6 °C	14 days to extract/ 40 days to analyze
Soil	VOCs	Low	SW846 5035 & 8260B/ESC SOPs 330751 & 330363	2 Encores or 2 Pre-weighed, Preserved Vials	2 Encores or 2 Pre-weighed, Preserved Vials	Cool ≤ 6 °C	48 hours – Encores 14 days - Vials
Soil	SVOCs	Low	SW846 3546 & 8270C/ESC SOPs 330707 & 330345	30 g	1 4-oz Glass Jar	Cool ≤ 6 °C	14 days to extract/ 40 days to analyze
Soil	PAHs	Low	SW846 3546 & 8270C-SIM/ESC SOPs 330707 & 330345	30 g	1 4-oz Glass Jar	Cool ≤ 6 °C	14 days to extract/ 40 days to analyze
Soil	Metals	Low	SW846 3050B & 6010B, 6020A, 7471A/ESC SOPs 340388, 340386, 340390, & 340384B	10 g	1 4-oz Glass Jar	Cool ≤ 6 °C	180 days to analyze, except for mercury which is 28 days to analyze
Water	GRO	Low	SW846 5030B & 8015/ESC SOPs 330752 & 330351A	2 Vials	2 40-mL Vials	HCl, Cool ≤6°C	14 days
Water	DRO/ORO	Low	SW846 3511 & 8015/ESC SOPs 330709 & 330350A	3 Vials	3 40-mL Vials	Cool ≤6°C	7 days to extract/ 40 days to analyze
Water	VOCs	Low	SW846 5030B & 8260B/ESC SOPs 330752 & 330363	2 Vials	2 40-mL Vials	HCl, Cool ≤6°C	14 days
Water	SVOCs	Low	SW846 3510C & 8270C/ESC SOPs 330709 & 330345	2 Vials	2 40-mL Vials	Cool ≤6°C	7 days to extract/ 40 days to analyze
Water	PAHs	Low	SW846 3511 & 8270C-SIM/ESC SOPs 330709 & 330345	2 Vials	2 40-mL Vials	Cool ≤6°C	7 days to extract/ 40 days to analyze

QAPP Worksheet #19 – Analytical Requirements Table (continued)

(UFP-QAPP Manual Section 3.1.1)

Matrix	Analytical Group	Concentration Level	Analytical and Preparation Method/SOP Reference[1]	Sample Preparation Volume	Containers (number, size, and type)[2]	Preservation Requirements (chemical, temperature, light protected)	Maximum Holding Time (preparation/ analysis)
Water	Metals	Low	SW846 3015A & 6010B, 6020A, 7470A/ESC SOPs 340389, 340386, 340390, & 340384A	500 mL	1 – 500mL Poly	pH<2, HNO_3, Cool ≤6°C	180 days
Water	TDS	Low	EPA Method 160.1/ ESC SOP 340347	500 mL	1 – 500 mL Glass Amber	Cool ≤6°C	7 days

Notes:
[1] Refer to ESC Analytical SOP References table (Worksheet #23).
[2] The minimum sample size is based on allowing for sufficient sample for reanalysis. Additional volume is needed for laboratory MS/MSD analysis.

≤ – Less Than or Equal to
ESC – ESC Lab Sciences
HCl – Hydrochloric Acid
mL – Milliliter
SIM – Selective Ion Monitoring
TDS – Total Dissolved Solids
°C – Degrees Celsius
g – Gram
HNO_3 – Nitric Acid
oz – Ounce
SOP – Standard Operating Procedure
VOCs – Volatile Organic Compounds
DRO/ORO – Diesel Range Organics/Oil Range Organics
GRO – Gasoline Range Organics
L – Liter
PAHs – Polynuclear Aromatic Hydrocarbons
SVOCs – Semivolatile Organic Compounds

QAPP Worksheet #20 – Field Quality Control Sample Summary Table
(UFP-QAPP Manual Section 3.1.1)

Field Quality Control Sample Summary Table

Site	Matrix	Analytical Group	Concentration Level	Analytical and Preparation SOP Reference[1]	No. of Sampling Locations[2]	No. of Field Duplicates[3]	No. of MS/MSD[3]	No. of FB[3]	No. of EB[3]	No. of TB[3]	Total No. of Samples to Lab
AOC-UST-889 (TU515))	Soil	GRO	Low	ESC SOPs 330751 & 330351A	TBD	1 per 20 samples	1 per 20 samples	1 per 20 samples	1 per 20 samples	1 per 20 samples	TBD
		DRO/ORO	Low	ESC SOPs 330705, 330350A	TBD	1 per 20 samples	1 per 20 samples	0	1 per 20 samples	0	TBD
		VOCs	Low	ESC SOPs 330751 & 330363	TBD	1 per 20 samples	1 per 20 samples	1 per 20 samples	1 per 20 samples	1 per 20 samples	TBD
		SVOCs	Low	ESC SOPs 330707 & 330345	TBD	1 per 20 samples	1 per 20 samples	0	1 per 20 samples	0	TBD
		PAHs	Low	ESC SOPs 330707 & 330345	TBD	1 per 20 samples	1 per 20 samples	0	1 per 20 samples	0	TBD
		Metals	Low	ESC SOPs 340388, 340386, 340390, & 340384B	TBD	1 per 20 samples	1 per 20 samples	0	1 per 20 samples	0	TBD
	Groundwater	GRO	Low	ESC SOPs 330752 & 330351A	TBD	1 per 20 samples	1 per 20 samples	1 per 20 samples	1 per 20 samples	1 per 20 samples	TBD
		DRO/ORO	Low	ESC SOPs 330709 & 330350A	TBD	1 per 20 samples	1 per 20 samples	0	1 per 20 samples	0	TBD
		VOCs	Low	ESC SOPs 330752 & 330363	TBD	1 per 20 samples	1 per 20 samples	1 per 20 samples	1 per 20 samples	1 per 20 samples	TBD
		SVOCs	Low	ESC SOPs 330709 & 330345	TBD	1 per 20 samples	1 per 20 samples	0	1 per 20 samples	0	TBD
		PAHs	Low	ESC SOPs 330709 & 330345	TBD	1 per 20 samples	1 per 20 samples	0	1 per 20 samples	0	TBD
		Metals	Low	ESC SOPs 340389, 340386, 340390, & 340384A	TBD	1 per 20 samples	1 per 20 samples	0	1 per 20 samples	0	TBD
		TDS	Low	ESC SOP 340347	TBD	1 per 20 samples	0	0	1 per 20 samples	0	TBD

QAPP Worksheet #20 – Field Quality Control Sample Summary Table (continued)
(UFP-QAPP Manual Section 3.1.1)

Notes:
[1]Refer to Analytical SOP References table, Worksheet #23.
[2]If samples will be collected at different depths at the same location, each discrete sampling depth will be counted as a separate sampling location.
[3]One field duplicate, MS/MSD, and EB must be collected per 20 investigatory samples sent to ESC, as appropriate for the listed analytical methods and sampling equipment used. The locations of these QC samples will be determined in the field. One TB must be included per each cooler shipment containing VOCs and/or GRO volumes. EBs will be collected only if non-disposable and non-dedicated sampling equipment is used. For FBs and EBs, laboratory grade DI water supplied by ESC will be used.

AOC – Area of Concern
DI – Deionized Water
DRO/ORO – Diesel Range Organics/Oil Range Organics
EB – Equipment Blank
ESC – ESC Lab Sciences of Mt. Juliet, Tennessee
FB – Field Blank
TDS – Total Dissolved Solids
UST – Underground Storage Tank
VOCs – Volatile Organic Compounds
PAHs – Polynuclear Aromatic Hydrocarbons
QC – Quality Control
SOP – Standard Operating Procedure
SVOCs – Semivolatile Organic Compounds
TB – Trip Blank
TBD –To be Determined (refer to IM work Plan Section 3)
GRO – Gasoline Range Organics
MS/MSD – Matrix Spike/ Matrix Spike Duplicate

QAPP Worksheet #21 – Project Specific Sampling SOP Reference Table
(UFP-QAPP Manual Section 3.1.2)
SOPs are included in IM Work Plan Appendix C.

Project Specific Sampling SOP References Table

Reference Number	Title, Revision Date and/or Number	Originating Organization	Equipment Type	Modified for Project Work? (Y/N)	Comments
SOP 1	Utility Clearance	URS Group	Geophysical survey equipment	N	Includes descriptions and procedures for performing utility clearance.
SOP 2	Documentation	URS Group	NA	N	Includes descriptions and procedures for documenting field activities.
SOP 3	Decontamination	URS Group	Decontamination Equipment	N	Includes descriptions and procedures for decontaminating field equipment.
SOP 4	Sample Management	URS Group	NA	N	Includes sampling handling, packaging, shipping, and chain-of-custody requirements.
SOP 5	Drilling and Lithologic Logging	URS Group	Drill rig, hand lens, rock hammer	N	Includes descriptions and procedures for logging soil borings and soil types.
SOP 6	Soil Sample Collection	URS Group	Shovel, trowel, hand auger, or direct push rig, PID, sample containers	N	Includes descriptions and procedures for grab and composite soil sampling.
SOP 7	Monitoring Well Installation	URS Group	Drill rig	N	Includes descriptions and procedures for monitoring well installation.
SOP 8	Groundwater Level Measurement	URS Group	Water level meter	N	Includes procedures for collection of groundwater level measurements.
SOP 9	Field Parameters	URS Group	YSI, Horiba (or equivalent), photoionization detector (PID)	N	Includes descriptions and procedures for field parameter measurements, including equipment calibration.
SOP 10	Well Development	URS Group	Submersible pump, drums for purge water	N	Includes descriptions and procedures for monitoring well development.
SOP 11	Groundwater Sample Collection	URS Group	Pump or bailer	N	Includes descriptions and procedures for groundwater sampling.
SOP 12	Investigation Derived Waste (IDW) Management	URS Group	Waste bins, tanks, or drums	N	Includes descriptions and procedures for the handling and disposal of IDW.
SOP 13	Surveying	URS Group	Surveying Equipment/ GPS Unit	N	Includes descriptions and procedures for field surveying and field GPS measurements.

QAPP Worksheet #21 – Project Specific Sampling SOP Reference Table (continued)

(UFP-QAPP Manual Section 3.1.2)
SOPs are included in IM Work Plan Appendix C.

Project Specific Sampling SOP References Table

Reference Number	Title, Revision Date and/or Number	Originating Organization	Equipment Type	Modified for Project Work? (Y/N)	Comments
SOP 14	Data Validation	URS Group	NA	N	Includes procedures for validation of analytical data.
SOP 15	Data Management	URS Group	NA	N	Includes procedures for management of project data, including analytical data and electronic deliverables.

Notes:
GPS – Global Positioning System
IDW – Investigation Derived Waste
N – No
NA – Not Applicable
PID – Photoionization Detector
SOP – Standard Operating Procedure
YSI – YSI Incorporated

QAPP Worksheet #22 – Field Equipment Calibration, Maintenance, Testing, and Inspection Table
(UFP-QAPP Manual Section 3.1.2.4)

Field Equipment	Calibration Activity	Maint. Activity	Testing Activity	Inspection Activity	Frequency	Acceptance Criteria	Corrective Action	Resp. Person	SOP[1]
YSI 556 man portable system (MPS) water quality meter or equivalent	Calibrate pH and conductivity with autocal solution; calibrate dissolved oxygen (DO) to water saturated air, calibrate oxygen reduction potential (ORP) with Zobell solution	Clean unit weekly	Check with pH (4 and 7 solution) and conductivity solutions 1409 milliSiemens per centimeter (mS/cm)	Inspect probe sensors, clean sensors as necessary	Daily	± 0.2 pH units. ± 10% for conductivity	Clean probe tip and re-analyze standard sample	Field personnel	SOP 9
Turbidity Meter	Calibrate using standard provided with unit	Clean sample test vials after each use	Use standard periodic checks	Inspect weekly	Daily	Within error range indicated by equipment	Follow manufacturers specifications	Field personnel	SOP 9
PID	Calibrate using isobutylene provided by manufacturer	Clean unit daily	Every time the instrument is turned on and every 4 hours after	Inspect weekly	Daily	Within error range indicated by equipment	Follow manufacturers specifications	Field personnel	SOP 9

Notes:

[1] The Project Sampling SOP References table is found on Worksheet #21.
± – Plus or Minus
% – Percent
DO – Dissolved Oxygen
MPS – Man Portable System
mS/cm – MilliSiemens per Centimeter
ORP – Oxidation Reduction Potential
SOP – Standard Operating Procedure
YSI – YSI Incorporated

QAPP Worksheet #23 – ESC Analytical SOP References Tables
(UFP-QAPP Manual Section 3.2.1)

ESC Analytical SOP References Table

ESC Reference Number [a]	Title, Revision Date, and/or Number	Definitive or Screening Data	Analytical Group	Instrument	Organization Performing Analysis	Modified for Project Work?
DoD QSM	Department of Defense Quality Systems Manual (DoD QSM), Version 4.2, April October 2010	NA	NA	NA	NA	No
010103	Document Control and Distribution	Definitive	All	Not applicable	ESC	No
030201	Data Handling and Reporting	Definitive	All	Not applicable	ESC	No
060105	Sample Receiving	Definitive	All	Not applicable	ESC	No
060106	Sample Storage, Disposal and Sample Control Technicians	Definitive	All	Not applicable	ESC	No
060110	Sample Shipping	Definitive	All	Not applicable	ESC	No
330345	Semi-Volatile Organics by Gas Chromatography/Mass Spectrometry Using Capillary Column (EPA Method 8270C, EPA 8270D, EPA Method 625, SM 6410B), Including Provisions for Analysis in SIM Mode.	Definitive	SVOCs by SW846 8270C and PAHs by SW846 8270C-SIM	Gas chromatograph (GC) (HP 6890/7890 or equivalent) and mass spectrometer (MS) (HP-5973/ 5975 or equivalent)	ESC	No
330350A	Diesel Range Organics/Total Petroleum Hydrocarbons (C_{10} to C_{28}) by Gas Chromatography With #2 Diesel Fuel (EPA Methods 8015B/C/D)	Definitive	TPH by SW846 8015	GC, model HP 6890 or HP7890	ESC	No
330351A	Gasoline Range Organics (C_6 to C_{10}) (Based on EPA Method 8015B) by Gas Chromatography Using Component Standard Calibration	Definitive	TPH by SW846 8015	GC, model HP 5890 or equivalent	ESC	No
330363	Volatile Organic Compounds by GC/MS (EPA 8260B, 8260C, 624 and SM6200B 20_{TH} Edition)	Definitive	VOCs by SW846 8260B	GC/MS, model HP 5890 or equivalent	ESC	No
330705	Ultrasonic Extraction (EPA Method 3550C)	Definitive	PAHs by SW846 8270C-SIM	Ultrasonic Disrupter	ESC	No

QAPP Worksheet #23 – ESC Analytical SOP References Tables (continued)
(UFP-QAPP Manual Section 3.2.1)

ESC Analytical SOP References Table

ESC Reference Number [a]	Title, Revision Date, and/or Number	Definitive or Screening Data	Analytical Group	Instrument	Organization Performing Analysis	Modified for Project Work?
330707	Microwave Extraction (EPA Method 3546)	Definitive	SVOCs and PAHs by SW846 8270C	CEM Microwave MARSX	ESC	No
330709	Microextraction Procedure (EPA Method 3511)	Definitive	SVOCs and PAHs by SW846 8270C	Not applicable	ESC	No
330739	Silica Gel Cleanup (EPA 3630C)	Definitive	All	Not applicable	ESC	No
330740	Sulfuric Acid Cleanup (EPA Method 3665A)	Definitive	As needed	Not applicable	ESC	No
330751	Closed System Purge-and-Trap Extraction for Volatile Organics in Soil and Waste Samples (EPA 5035)	Definitive	VOCs by SW846 8260B	Autosampler and Traps	ESC	No
330752	Purge and Trap for Aqueous Samples (EPA 5030B)	Definitive	VOCs by SW846 8260B	Autosampler and Traps	ESC	No
340347	Total Dissolved Solids (EPA Method 160.1, SM 2540C, 20_{TH} Edition)	Definitive	TDS by EPA 160.1	Not applicable	ESC	No
340384A	Mercury in Aqueous/Liquid Samples (Cold-Vapor Technique) (EPA Methods 7470A & 245.1)	Definitive	Mercury by SW846 7470A	Perkin Elmer FIMS400 Mercury Analyzer or equivalent	ESC	No
340384B	Mercury in Solid Waste (Cold-Vapor Technique) (EPA Methods 7471A & 7471B)	Definitive	Mercury by SW846 7471A	Perkin Elmer FIMS400 Mercury Analyzer or equivalent	ESC	No
340386	Determination of Metals and Trace Elements in Various Matrices by ICP-AES (EPA Methods 6010B, 6010C, and 200.7) Including Hardness (EPA Methods 200.7 and 6010B/C and SM 2340B, 20_{TH} Edition) and Industrial Hygiene Samples (NIOSH 7300, 7301, and 7303 and OSHA ID-125G)	Definitive	Metals by SW846 6010B	Perkin Elmer 4300 DV ICP, Perkin Elmer 5300 DV ICP or equivalent	ESC	No

QAPP Worksheet #23 – ESC Analytical SOP References Tables (continued)
(UFP-QAPP Manual Section 3.2.1)

ESC Analytical SOP References Table

ESC Reference Number [a]	Title, Revision Date, and/or Number	Definitive or Screening Data	Analytical Group	Instrument	Organization Performing Analysis	Modified for Project Work?
340388	Acid Digestion of Sediments, Sludge, Soils, and Oils (EPA Methods 3050B, 3051, and 3051A)	Definitive	Metals by SW846 6010B and 6020A	CEM Mars 5 or equivalent Microwave	ESC	No
340389	Acid Digestion of Aqueous Samples and Extracts, Including Total Recoverable and Dissolved Metals (EPA Methods 3005A, 3010A, 3015, 3015A and SM 3030C)	Definitive	Metals by SW846 6010B and 6020A	CEM Microwave	ESC	No
340390	Determination of Metals and Inductively Coupled Plasma Mass Spectroscopy (ICP-MS) (EPA Methods 6020, 6020A, and 200.8)	Definitive	Metals by SW846 6020A	Perkin-Elmer ELAN 9000 ICP-MS, Perkin-Elmer ELAN DRCII ICP-MS and Perkin Elmer ELAN DRC-e	ESC	No

Notes:
[a] ESC SOPs can be provided upon request.

CVAA – Cold Vapor Atomic Absorption
DoD – Department of Defense
DRO – Diesel Range Organics
EPA – U. S. Environmental Protection Agency
ESC – ESC Lab Sciences of Mt. Juliet, Tennessee
GC – Gas Chromatography
GC/ MS – Gas Chromatograph with Mass Spectrometry
GFAA – Graphite Furnace Atomic Absorption
GRO – Gasoline Range Organics
IC – Ion Chromatography
ICP – Inductively Coupled Plasma
ICP-AES - Inductively Coupled Plasma-Atomic Emission Spectrometry
ICP/ MS – Inductively Coupled Plasma Mass Spectrometry
MS – Mass Spectrometry
NA – Not Applicable
NIOSH – National Institute for Occupational Safety and Health
OSHA - Occupational Safety and Health Administration
PAHs – Polynuclear Aromatic Hydrocarbons
QSM – Quality Systems Manual
SIM – Selective Ion Monitoring
SM – Standard Methods
SVOCs – Semivolatile Organic Compounds
TDS – Total Dissolved Solids
TPH – Total Petroleum Hydrocarbons
VOCs – Volatile Organic Compounds

QAPP Worksheet #24 – Analytical Instrument Calibration Table
(UFP-QAPP Manual Section 3.2.2)

Analytical Instrument Calibration Table

Instrument	Calibration Procedure	Frequency of Calibration	Acceptance Criteria	Corrective Action (CA)	Person Responsible for CA	SOP Reference[1]
GC	Performed in accordance with DoD QSM v4.2				Analyst	330350A, 330351A
GC/MS	Performed in accordance with DoD QSM v4.2				Analyst	330345, 330363
ICP	Performed in accordance with DoD QSM v4.2				Analyst	340386
ICP/MS	Performed in accordance with DoD QSM v4.2				Analyst	340390
CVAA	Performed in accordance with DoD QSM v4.2				Analyst	340384A, 340384B

Notes:
[1]Refer to the Analytical SOP References table (Worksheet #23).

CA – Corrective Action
CVAA – Cold Vapor Atomic Absorption
DoD – Department of Defense
ESC – ESC Lab Sciences of Mt. Juliet, Tennessee
GC – Gas Chromatography
GC/ MS – Gas Chromatograph with Mass Spectrometry
ICP – Inductively Coupled Plasma
ICP/ MS – Inductively Coupled Plasma Mass Spectrometry
QSM – Quality Systems Manual
SOP – Standard Operating Procedure

QAPP Worksheet #25 – Analytical Instrument and Equipment Maintenance, Testing, and Inspection Table
(UFP-QAPP Manual Section 3.2.3)

Analytical Instrument and Equipment Maintenance, Testing, and Inspection Table

Instrument/ Equipment	Maintenance Activity	Testing Activity	Inspection Activity	Frequency	Acceptance Criteria	Corrective Action	Responsible Person	ESC SOP Reference[1]
GC	Maintenance specified in the Laboratory SOP	Refer to the SOP	Refer to the SOP	Refer to the SOP	Refer to the SOP	Refer to the SOP	Analyst	330350A, 330351A
GC/MS		Refer to the SOP	Refer to the SOP	Refer to the SOP	Refer to the SOP	Refer to the SOP	Analyst	330345, 330363
ICP		Refer to the SOP	Refer to the SOP	Refer to the SOP	Refer to the SOP	Refer to the SOP	Analyst	340386
ICP/MS		Refer to the SOP	Refer to the SOP	Refer to the SOP	Refer to the SOP	Refer to the SOP	Analyst	340390
CVAA		Refer to the SOP	Refer to the SOP	Refer to the SOP	Refer to the SOP	Refer to the SOP	Analyst	340384A, 340384B

Notes:
[1]Refer to the ESC Analytical SOP References table (Worksheet #23).

CA – Corrective Action
CVAA – Cold Vapor Atomic Absorption
DoD – Department of Defense
ESC – ESC Lab Sciences of Mt. Juliet, Tennessee
GC – Gas Chromatography
GC/ MS – Gas Chromatograph with Mass Spectrometry
ICP – Inductively Coupled Plasma
ICP/ MS – Inductively Coupled Plasma Mass Spectrometry
QSM – Quality Systems Manual
SOP – Standard Operating Procedure

QAPP Worksheet #26 – Sample Handling System
(UFP-QAPP Manual Appendix A)

Sample Handling System

SAMPLE COLLECTION, PACKAGING, AND SHIPMENT
Sample Collection (Personnel/Organization): Field Personnel/URS
Sample Packaging (Personnel/Organization): Field Personnel /URS
Coordination of Shipment (Personnel/Organization): Field Personnel /URS
Type of Shipment/Carrier: Overnight/Fedex
SAMPLE RECEIPT AND ANALYSIS
Sample Receipt (Personnel/Organization): Sample Receiving Staff, ESC
Sample Custody and Storage (Personnel/Organization): Sample Management Staff, ESC
Sample Preparation (Personnel/Organization): Chemists and Technicians, ESC
Sample Determinative Analysis (Personnel/Organization): Chemists, Technicians and Analysts, ESC
SAMPLE ARCHIVING
Field Sample Storage (No. of days from sample collection): 60 days
Sample Extract/Digestate Storage (No. of days from extraction/digestion): 60 days
Biological Sample Storage (No. of days from sample collection): NA
SAMPLE DISPOSAL
Personnel/Organization: Sample Management Staff, ESC
Number of Days from Analysis: 60 days, but confirm first with URS Group.

Notes:
NA – Not Applicable

QAPP Worksheet #27 – Sample Custody Requirements
(UFP-QAPP Manual Section 3.3.3)

Sample Custody Requirements

Field Sample Custody Procedures (sample collection, packaging, shipment, and delivery to laboratory): URS SOP 4 - Sample Management URS SOP 6 - Soil Sample Collection URS SOP 11 - Groundwater Sample Collection
Laboratory Sample Custody Procedures (receipt of samples, archiving, disposal): ESC SOP 010103 - Document Control and Distribution ESC SOP 030201 - Data Handling and Reporting ESC SOP 060105 - Sample Receiving ESC SOP 060106 - Sample Storage, Disposal and Sample Control Technicians ESC SOP 060110 - Sample Shipping
Sample Identification Procedures: URS SOP 4 - Sample Management
Chain-of-custody Procedures: URS SOP 4 - Sample Management

Notes:
ESC – ESC Lab Sciences of Mt. Juliet, Tennessee URS – URS Group, Inc.
SOP – Standard Operating Procedure

QAPP Worksheet #28-1 – QC Samples – GRO
(UFP-QAPP Manual Section 3.4)

QC Samples – GRO

Matrix	Soil/ Water
Analytical Group	GRO
Analytical Method/ SOP Reference	SW-846 8015/ ESC SOP 330351A

QC Sample:	Frequency / Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Method Blank	One per preparation batch	See DoD QSM v4.2	See DoD QSM v4.2	Laboratory QA Manager	Accuracy/Bias	See DoD QSM v4.2
Laboratory Control Sample (LCS)	One per preparation / analytical batch	See Tables 12-1a and 12-1b	See DoD QSM v4.2	Laboratory QA Manager	Precision/Accuracy	See Tables 12-1a and 12-1b
Matrix Spike (MS)	One per preparation / analytical batch	See Tables 12-1a and 12-1b	See DoD QSM v4.2	Laboratory QA Manager	Precision/Accuracy	See Tables 12-1a and 12-1b
Matrix Spike Duplicate (MSD) or sample duplicate	One per preparation / analytical batch	See Tables 12-1a and 12-1b	See DoD QSM v4.2	Laboratory QA Manager	Precision/Accuracy	See Tables 12-1a and 12-1b
Surrogates	In each sample	See DoD QSM v4.2	See DoD QSM v4.2	Laboratory QA Manager	Accuracy/Bias	See Tables 12-1a and 12-1b

Notes:
DoD – Department of Defense
DQI – Data Quality Indicator
ESC – ESC Lab Sciences of Mt. Juliet, Tennessee
GRO – Gasoline Range Organics
LCS – Laboratory Control Sample
MS – Matrix Spike
MSD – Matrix Spike Duplicate
QA – Quality Assurance
QC – Quality Control
QSM – Quality Systems Manual
SOP – Standard Operating Procedure

QAPP Worksheet #28-2 – QC Samples – DRO
(UFP-QAPP Manual Section 3.4)

QC Samples - DRO

Matrix	Soil/ Water
Analytical Group	DRO
Analytical Method/ SOP Reference	SW-846 8015B/ ESC 330350A

QC Sample:	Frequency / Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Method Blank	One per preparation batch	See DoD QSM v4.2	See DoD QSM v4.2	Laboratory QA Manager	Accuracy/Bias	See DoD QSM v4.2
Laboratory Control Sample (LCS)	One per preparation / analytical batch	See Tables 12-2a and 12-2b	See DoD QSM v4.2	Laboratory QA Manager	Precision/Accuracy	See Tables 12-2a and 12-2b
Matrix Spike (MS)	One per preparation / analytical batch	See Tables 12-2a and 12-2b	See DoD QSM v4.2	Laboratory QA Manager	Precision/Accuracy	See Tables 12-2a and 12-2b
Matrix Spike Duplicate (MSD) or sample duplicate	One per preparation / analytical batch	See Tables 12-2a and 12-2b	See DoD QSM v4.2	Laboratory QA Manager	Precision/Accuracy	See Tables 12-2a and 12-2b
Surrogates	In each sample	See DoD QSM v4.2	See DoD QSM v4.2	Laboratory QA Manager	Accuracy/Bias	See Tables 12-2a and 12-2b

Notes:
DoD – Department of Defense
DQI – Data Quality Indicator
DRO – Diesel Range Organics
LCS – Laboratory Control Sample
MS – Matrix Spike
MSD – Matrix Spike Duplicate
QA – Quality Assurance
QC – Quality Control
QSM – Quality Systems Manual
SOP – Standard Operating Procedure
ESC – ESC Lab Sciences of Mt. Juliet, Tennessee

QAPP Worksheet #28-3 – QC Samples - VOCs
(UFP-QAPP Manual Section 3.4)

QC Samples - VOCs

Matrix	Soil/ Water
Analytical Group	VOCs
Analytical Method/ SOP Reference	SW-846 8260B/ ESC 330363

QC Sample:	Frequency / Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Method Blank	One per preparation batch	See DoD QSM v4.2	See DoD QSM v4.2	Laboratory QA Manager	Accuracy/Bias	See DoD QSM v4.2
Laboratory Control Sample (LCS)	One per preparation / analytical batch	See Tables 12-3a and 12-3b	See DoD QSM v4.2	Laboratory QA Manager	Precision/Accuracy	See Tables 12-3a and 12-3b
Matrix Spike (MS)	One per preparation / analytical batch	See Tables 12-3a and 12-3b	See DoD QSM v4.2	Laboratory QA Manager	Precision/Accuracy	See Tables 12-3a and 12-3b
Matrix Spike Duplicate (MSD) or sample duplicate	One per preparation / analytical batch	See Tables 12-3a and 12-3b	See DoD QSM v4.2	Laboratory QA Manager	Precision/Accuracy	See Tables 12-3a and 12-3b
Surrogates/ Internal Standards	In each sample	See DoD QSM v4.2	See DoD QSM v4.2	Laboratory QA Manager	Accuracy/Bias	See Tables 12-3a and 12-3b

Notes:
DoD – Department of Defense
MS – Matrix Spike
QC – Quality Control
VOCs – Volatile Organic Compounds
DQI – Data Quality Indicator
MSD – Matrix Spike Duplicate
QSM – Quality Systems Manual
ESC – ESC Lab Sciences of Mt. Juliet, Tennessee
LCS – Laboratory Control Sample
QA – Quality Assurance
SOP – Standard Operating Procedure

QAPP Worksheet #28-4 – QC Samples - SVOCs
(UFP-QAPP Manual Section 3.4)

QC Samples - SVOCs

Matrix	Soil/ Water
Analytical Group	SVOCs
Analytical Method/ SOP Reference	SW-846 8270C/ ESC 330345

QC Sample:	Frequency / Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Method Blank	One per preparation batch	See DoD QSM v4.2	See DoD QSM v4.2	Laboratory QA Manager	Accuracy/Bias	See DoD QSM v4.2
Laboratory Control Sample (LCS)	One per preparation / analytical batch	See Tables 12-4a and 12-4b	See DoD QSM v4.2	Laboratory QA Manager	Precision/Accuracy	See Tables 12-4a and 12-4b
Matrix Spike (MS)	One per preparation / analytical batch	See Tables 12-4a and 12-4b	See DoD QSM v4.2	Laboratory QA Manager	Precision/Accuracy	See Tables 12-4a and 12-4b
Matrix Spike Duplicate (MSD) or sample duplicate	One per preparation / analytical batch	See Tables 12-4a and 12-4b	See DoD QSM v4.2	Laboratory QA Manager	Precision/Accuracy	See Tables 12-4a and 12-4b
Surrogates/ Internal Standards	In each sample	See DoD QSM v4.2	See DoD QSM v4.2	Laboratory QA Manager	Accuracy/Bias	See Tables 12-4a and 12-4b

Notes:
DoD – Department of Defense
DQI – Data Quality Indicator
LCS – Laboratory Control Sample
MS – Matrix Spike
MSD – Matrix Spike Duplicate
QA – Quality Assurance
QC – Quality Control
QSM – Quality Systems Manual
SOP – Standard Operating Procedure
SVOCs – Semivolatile Organic Compounds
ESC – ESC Lab Sciences of Mt. Juliet, Tennessee

QAPP Worksheet #28-5 – QC Samples - PAHs
(UFP-QAPP Manual Section 3.4)

QC Samples - PAHs

Matrix	Soil/ Water
Analytical Group	PAHs
Analytical Method/ SOP Reference	SW-846 8270C-SIM/ ESC 330345

QC Sample:	Frequency / Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Method Blank	One per preparation batch	See DoD QSM v4.2	See DoD QSM v4.2	Laboratory QA Manager	Accuracy/Bias	See DoD QSM v4.2
Laboratory Control Sample (LCS)	One per preparation / analytical batch	See Tables 12-5a and 12-5b	See DoD QSM v4.2	Laboratory QA Manager	Precision/Accuracy	See Tables 12-5a and 12-5b
Matrix Spike (MS)	One per preparation / analytical batch	See Tables 12-5a and 12-5b	See DoD QSM v4.2	Laboratory QA Manager	Precision/Accuracy	See Tables 12-5a and 12-5b
Matrix Spike Duplicate (MSD) or sample duplicate	One per preparation / analytical batch	See Tables 12-5a and 12-5b	See DoD QSM v4.2	Laboratory QA Manager	Precision/Accuracy	See Tables 12-5a and 12-5b
Surrogates/ Internal Standards	In each sample	See DoD QSM v4.2	See DoD QSM v4.2	Laboratory QA Manager	Accuracy/Bias	See Tables 12-5a and 12-5b

Notes:
DoD – Department of Defense
MS – Matrix Spike
QA – Quality Assurance
SIM – Selective Ion Monitoring
DQI – Data Quality Indicator
MSD – Matrix Spike Duplicate
QC – Quality Control
SOP – Standard Operating Procedure
LCS – Laboratory Control Sample
PAHs – Polyaromatic Hydrocarbons
QSM – Quality Systems Manual
ESC – ESC Lab Sciences of Mt. Juliet, Tennessee

QAPP Worksheet #28-6 – QC Samples - Metals
(UFP-QAPP Manual Section 3.4)

QC Samples - Metals

Matrix	Soil/ Water
Analytical Group	Metals
Analytical Method/ SOP Reference	SW-846 6010B, 6020A, 7470A, 7471A/ESC 340386, 340390, 340384B

QC Sample:	Frequency / Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Method Blank	One per preparation batch	See DoD QSM v4.2	See DoD QSM v4.2	Laboratory QA Manager	Accuracy/Bias	See DoD QSM v4.2
Laboratory Control Sample (LCS)	One per preparation / analytical batch	See Tables 12-6a and 12-6b	See DoD QSM v4.2	Laboratory QA Manager	Precision/Accuracy	See Tables 12-6a and 12-6b
Matrix Spike (MS)	One per preparation / analytical batch	See Tables 12-6a and 12-6b	See DoD QSM v4.2	Laboratory QA Manager	Precision/Accuracy	See Tables 12-6a and 12-6b
Matrix Spike Duplicate (MSD) or sample duplicate	One per preparation / analytical batch	See Tables 12-6a and 12-6b	See DoD QSM v4.2	Laboratory QA Manager	Precision/Accuracy	See Tables 12-6a and 12-6b
Serial Dilution	When the PDS fails (only applicable for analytes with concentrations > 50X LOQ)	See Tables 12-6a and 12-6b	See DoD QSM v4.2	Laboratory QA Manager	Precision/Accuracy	See DoD QSM v4.2
Post Digestion Spike (PDS)	When the MS/MSD fails	See Tables 12-6a and 12-6b	See DoD QSM v4.2	Laboratory QA Manager	Precision/Accuracy	See DoD QSM v4.2

Notes:
DoD – Department of Defense
LCS – Laboratory Control Sample
MSD – Matrix Spike Duplicate
QC – Quality Control
DQI – Data Quality Indicator
LOQ – Limit of Quantitation
PDS – Post Digestion Spike
QSM – Quality Systems Manual
ESC – ESC Lab Sciences of Mt. Juliet, Tennessee
MS – Matrix Spike
QA – Quality Assurance
SOP – Standard Operating Procedure

QAPP Worksheet #28-7 – QC Samples - TDS
(UFP-QAPP Manual Section 3.4)

QC Samples - TDS

Matrix	Water
Analytical Group	TDS
Analytical Method/ SOP Reference	USEPA 160.1/ ESC 340347

QC Sample:	Frequency / Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Method Blank	One per preparation batch	See DoD QSM v4.2	See DoD QSM v4.2	Laboratory QA Manager	Accuracy/Bias	See DoD QSM v4.2
Laboratory Duplicate (LD)	One per preparation / analytical batch	See Table 12-7	See DoD QSM v4.2	Laboratory QA Manager	Precision/Accuracy	See Table 12-7

Notes:
DoD – Department of Defense
QA – Quality Assurance
SOP – Standard Operating Procedure
ESC – ESC Lab Sciences of Mt. Juliet, Tennessee
DQI – Data Quality Indicator
QC – Quality Control
TDS – Total Dissolved Solids
LD – Laboratory Duplicate
QSM – Quality Systems Manual
USEPA – United States Environmental Protection Agency

QAPP Worksheet #29 – Project Documents and Records Table

(UFP-QAPP Manual Section 3.5.1)

Project Documents and Records Table

Sample Collection Documents and Records	On-site Analysis Documents and Records	Off-site Analysis Documents and Records	Data Assessment Documents and Records	Other
• Field Logbook or field forms • Chain-of-Custody Records • Air Bills • Custody Seals • Corrective Action Forms	• Sample Receipt, Custody, and Tracking Records • Standard Traceability Logs • Equipment Maintenance, Testing, and Inspection Logs • Corrective Action Forms • Reported Field Sample Results • Investigation Derived Waste management and disposal	• Sample Receipt, Custody, and Tracking Records • Standard Traceability Logs • Sample Prep Logs • Equipment Maintenance, Testing, and Inspection Logs • Corrective Action Forms • Reported Field Sample Results • Reported Results for Standards, QC Checks, and QC Samples • Data Package Completeness Checklist • Sample Disposal Records • Extraction/Cleanup-up Records • Raw Data (stored on disk CD) • Investigation Derived Waste management and disposal	• Field Sampling Audit Checklists • Data Validation Reports • Corrective Action Forms	

Notes:
CD – Compact Disc
QC – Quality Control

QAPP Worksheet #30 – Analytical Services Table
(UFP-QAPP Manual Section 3.5.2.3)

Analytical Services Table

Matrix	Analytical Group	Concentration Level	Sample Location/ ID Numbers	ESC Analytical SOP	Data Package Turnaround Time (a)	Primary Laboratory/Organization (Name and Address, and Telephone Number)	QA Laboratory/ Organization (Name and Address, and Telephone Number
Water/ Soil	GRO	Low	TBD	330351A	3-21 days as needed	ESC Lab Sciences 12065 Lebanon Road Mount Juliet, TN 37122 (800) 767-5859	Not Applicable
Water/ Soil	DRO/ORO	Low	TBD	330350A	3-21 days as needed	ESC Lab Sciences 12065 Lebanon Road Mount Juliet, TN 37122 (800) 767-5859	Not Applicable
Water/ Soil	VOCs	Low	TBD	330363	3-21 days as needed	ESC Lab Sciences 12065 Lebanon Road Mount Juliet, TN 37122 (800) 767-5859	Not Applicable
Water/ Soil	SVOCs	Low	TBD	330345	3-21 days as needed	ESC Lab Sciences 12065 Lebanon Road Mount Juliet, TN 37122 (800) 767-5859	Not Applicable
Water/ Soil	PAHs	Low	TBD	330345-SIM	3-21 days as needed	ESC Lab Sciences 12065 Lebanon Road Mount Juliet, TN 37122 (800) 767-5859	Not Applicable
Water/ Soil	Metals	Low	TBD	340386, 340390, 340384A, 340384B	3-21 days as needed	ESC Lab Sciences 12065 Lebanon Road Mount Juliet, TN 37122 (800) 767-5859	Not Applicable
Water	TDS	Low	TBD	340347	3-21 days as needed	ESC Lab Sciences 12065 Lebanon Road Mount Juliet, TN 37122 (800) 767-5859	Not Applicable

QAPP Worksheet #30 – Analytical Services Table (continued)

(UFP-QAPP Manual Section 3.5.2.3)

Notes:

(a) Data package turnaround requirements will be determined prior to sampling based on project data needs and communicated to the laboratory.

DRO/ORO – Diesel Range Organics/Oil Range Organics

ESC – ESC Lab Sciences of Mt. Juliet, Tennessee

GRO – Gasoline Range Organics

ID – Identification

PAHs – Polynuclear Aromatic Hydrocarbons

SIM – Selected Ion Monitoring

SOP – Standard Operating Procedure

SVOCs – Semivolatile Organic Compounds

TBD – To be determined

TDS – Total Dissolved Solids

QAPP Worksheet #31 – Planned Project Assessment Table
(UFP-QAPP Manual Section 4.1.1)

Planned Project Assessments Table

Assessment Type	Frequency	Internal or External	Organization Performing Assessment	Person(s) Responsible for Performing Assessment (Title and Organizational Affiliation)	Person(s) Responsible for Responding to Assessment Findings (Title and Organizational Affiliation)	Person(s) Responsible for Identifying and Implementing Corrective Actions (CA) (Title and Organizational Affiliation)	Person(s) Responsible for Monitoring Effectiveness of CA (Title and Organizational Affiliation)
Review of Work Plans and QAPP	Prior to start of fieldwork	Internal	URS	Project Manager, URS	Field Team Leader, URS	Field Team Leader, URS	QA/QC Manager or Project Manager, URS
Readiness review	At startup of fieldwork	Internal	URS	QA/QC Manager or Project Manager, URS	Field Team Leader, URS	Field Team Leader, URS	QA/QC Manager or Project Manager, URS
Review field logbooks and chain-of-custody forms	As work progresses	Internal	URS	QA/QC Manager or Project Manager, URS	Field Team Leader, URS	Field Team Leader, URS	QA/QC Manager or Project Manager, URS
Internal Laboratory Assessment	Once per project	Internal	ESC	ESC QA Manager	ESC Laboratory Manager	ESC Laboratory Manager	ESC QA Manager and Project Chemist, URS
Field Sampling Audit	As needed as project progresses	Internal	URS	QA/QC Officer, or Project Manager, URS	Field Team Leader, URS	Field Team Leader, URS	QA/QC Manager or Project Manager, URS

Notes:
QA/QC –Quality Assurance/ Quality Control
CA – Corrective Action
ESC – ESC Lab Sciences of Mt. Juliet, Tennessee
URS – URS Group, Inc.

QAPP Worksheet #32 – Assessment Findings and Corrective Action Responses

(UFP-QAPP Manual Section 4.1.2)

Assessment Findings and Corrective Action Responses

Assessment Type	Nature of Deficiencies Documentation	Individual(s) Notified of Findings (Title, Organization)	Timeframe of Notification	Nature of Corrective Action Response Documentation	Individual(s) Receiving Corrective Action Response (Title, Organization)	Timeframe for Response
Readiness review	Memorandum/ e-mail	Field Team Leader and Project Manager, URS	Within 24-hours of finding deficiency	Memorandum/e-mail, review of corrected documentation	QA/QC Manager or Project Manager, URS	24-hours after notification
Review field logbooks and chain-of-custody forms	Marked up copy of document	Field Team Leader and Project Manager, URS	Within 24-hours of finding deficiency	Memorandum/e-mail, review of corrected documentation	QA/QC Manager or Project Manager, URS	24-hours after notification
Internal Laboratory Assessment	Lab Report to detail project deviations	ESC Project Manager	Within 5 days of sample analysis	Documented in the lab report	ESC QA Manager and Project Chemist, URS	2 weeks
Field Sampling Audit	E-mail or verbal report to detail the deviation from QAPP	Field Team Leader and Project Manager, URS	Within 2 days of the start of sampling	E-mail and/or phone log	QA/QC Manager or Project Manager, URS	2 days

Notes:
QA/QC –Quality Assurance/ Quality Control
CA – Corrective Action
ESC – ESC Lab Sciences of Mt. Juliet, Tennessee
URS – URS Group, Inc.

QAPP Worksheet #33 – QA Management Reports Table
(UFP-QAPP Manual Section 4.2)

QA Management Reports Table

Type of Report	Frequency (daily, weekly monthly, quarterly, annually, etc.)	Projected Delivery Date(s)	Person(s) Responsible for Report Preparation (Title and Organizational Affiliation)	Report Recipient(s) (Title and Organizational Affiliation)
Off-site laboratory technical system audit (if performed)	Prior to sample analysis.	Within 5 days of on-site audit.	URS Project Chemist	Installation Lead, URS Project Manager, URS QA Manager, ESC Project Manager, ESC
Data review report	One report, after sample analysis and data review are complete.	Following completion of all analyses and receipt of final laboratory reports.	URS Project Chemist	Installation Lead, URS Project Manager, URS Contracting Officer Representative, AFCEC Chief Environmental, Holloman AFB Regulator, NMED
IM Report	After completion of all fieldwork activities, and review of all data.	See Worksheet 16, Project Schedule.	URS Installation Lead or URS Project Manager	Contracting Officer Representative, AFCEC Chief Environmental, Holloman AFB Regulator, NMED

Notes:
AFB – Air Force Base
AFCEC – Air Force Civil Engineer Center
ESC – ESC Lab Sciences of Mt. Juliet, Tennessee
NMED – New Mexico Environment Department
QA – Quality Assurance
URS – URS Group, Inc.

QAPP Worksheet #34 – Verification (Step I) Process Table

(UFP-QAPP Manual Section 5.2.1)

Verification (Step I) Process Table

Verification Input	Description	Internal/ External	Responsible for Verification (Name, Organization)
Field logbooks and field data sheets	Field logbooks and field data sheets will be completed per URS SOP 2 (Documentation) and written in ink unless field conditions preclude use. The logbooks and sheets will be reviewed for proper daily entries such as dates and names of personnel, and for completeness. In addition, items not understood will be reviewed with the author. Field logbooks and field data sheets will be placed in the project file.	Internal	Field Team Leader or Project Chemist, URS
Chain-of-custody and shipping forms	COCs and shipping documentation will be completed per URS SOP 4 (Sample Management) and reviewed internally upon their completion and verified against the packed sample coolers they represent. COCs will also be compared against planned sample collection to verify completeness. A copy of the COCs will be retained in the project file; the original and remaining copies will be taped inside the cooler for shipment.	Internal	Field Team Leader or Project Chemist, URS
Sample Acknowledgment	The sample acknowledgment generated by the laboratory will be reviewed against the COC for accuracy and for potential analytical issues.	External and Internal	Project Manager, ESC Project Chemist, URS
Laboratory data package/ electronic data	Prior to submittal to URS, the laboratory will review the laboratory data and associated data packages for completeness, compliance with governing documents, and technical accuracy/readiness.	External	Project Manager, ESC
Laboratory data package/ electronic data	The laboratory data and electronic data will be reviewed by URS to confirm all sample analyses requested have been provided and that all of the required information for validation has been included in the data package. URS will also spot check the electronic data to the hard copy report for consistency. URS SOPs 14 (Data Validation) and 15 (Data Management) will be applied as appropriate for these steps.	Internal	Project Chemist, URS

Note:
COC – Chain of Custody
ESC – ESC Lab Sciences of Mt. Juliet, Tennessee
URS – URS Group, Inc.

QAPP Worksheet #35 – Validation (Steps IIa and IIb) Process Table
(UFP-QAPP Manual Section 5.2.2)

Validation (Steps IIa and IIb) Process Table

Step IIa/IIb [a]	Validation Input	Description	Responsible for Validation (Name, Organization)
IIb	Field Analytical Measurements	All field analytical parameters will be reviewed against the QAPP requirements for completeness and accuracy based on field calibration records.	Field Team Leader, URS
IIa	SOPs, SAP	Check that sample collection was performed per the plan, and that SOPs were followed. Determine impacts of any deviations from sample collection.	Field Team Leader, URS Project Chemist, URS
IIa	Chain-of-custody forms	Examine COC forms against SAP requirements such as analytical methods, sample identification, etc.	Field Team Leader, URS Project Chemist, URS
IIb	Documentation of QC sample results	Using SOP 14 (Data Validation), establish that all required QC samples were analyzed, results reported, and evaluation criteria met.	Project Chemist, URS
IIb	Laboratory data package	Using SOP 14 (Data Validation), examine laboratory package against SAP requirements and COCs (i.e., sample identification, holding times, quality control samples, field replicates, analytical methods, etc.) Determine impacts of any deviations or quality issues associated with analytical data.	Project Chemist, URS
IIb	Laboratory data package	Using SOP 14 (Data Validation), perform validation on 10% of reported data to confirm calculations.	Project Chemist, URS
IIb	Quantitation limits	Using SOP 14 (Data Validation), determine whether Quantitation Limits identified in the QAPP were met.	Project Chemist, URS

Notes:
[a]IIa = Compliance with methods, procedures, and contracts
IIb = Comparison with measurement performance criteria in the QAPP

COC – Chain of Custody
QAPP – Quality Assurance Project Plan
QC – Quality Control
SAP – Sampling and Analysis Plan
SOPs – Standard Operating Procedures
URS – URS Group, Inc.

QAPP Worksheet #36 – Validation (Steps IIa and IIb) Summary Table
(UFP-QAPP Manual Section 5.2.2)

Validation (Steps IIa and IIb) Summary Table

Step IIa/IIb [a]	Matrix	Analytical Group	Concentration Level	Validation Criteria[b]	Data Validator (title and organizational affiliation)
IIa	Soil/Water	GRO, DRO, VOC, SVOCs, PAHs, Metals, TDS (water)	Low	Criteria presented in the DoD QSM Final Version 4.2, the Analytical Method, and Worksheet #12 and its supporting tables in this SAP/QAPP should be used together with SOP 14 (Data Validation) to perform data validation.	Project Chemist, URS
IIb	Soil/Water	GRO, DRO, VOC, SVOCs, PAHs, Metals, TDS (water)	Low	Criteria presented in the Analytical Method, and Worksheets #12, #15, #19, #24, and #28 and supporting tables in this SAP/QAPP should be used together with SOP 14 (Data Validation) to perform data validation.	Project Chemist, URS

Notes:
DoD – Department of Defense
DRO – Diesel Range Organics
GRO – Gasoline Range Organics
PAHs – Polynuclear Aromatic Hydrocarbons
QAPP – Quality Assurance Project Plan
QSM – Quality Systems Manual
SVOCs – Semivolatile Organic Compounds
TDS – Total Dissolved Solids
URS – URS Group, Inc.
VOCs – Volatile Organic Compounds

[a] IIa = Compliance with methods, procedures, and contracts
IIb = Comparison with measurement performance criteria in the QAPP

[b] Data review will be performed per SOP 14, Data Validation, and any necessary data qualifiers will be assigned as described within SOP 14.

QAPP Worksheet #37 – Usability Assessment
(UFP-QAPP Manual Section 5.2.3)

Usability Assessment

The Data Usability Assessment will be performed by URS personnel. The URS Project Manager will be responsible for information in the Usability Assessment. He will also be responsible for assigning task work to the individual task members who will be supporting the Data Usability Assessment. The Data Usability Assessment will be conducted on verified/validated data to determine whether the project execution and resulting data meet project quality objectives. Both the sampling and analytical activities will be considered, with the ultimate goal of assessing whether the final, qualified results support the decisions to be made with the data. After the Data Usability Assessment has been performed, data deemed appropriate for decision-making purposes will be used for assessment of risks posed to potential receptors. The results of the Data Usability Assessment will be presented in the Remedial Investigation Report. The following items will be assessed and conclusions drawn based on their results.
Precision – Results of field duplicate samples will be presented separately in tabular format for each sample set. For each field duplicate set, the results will be assessed as stated in Tables 12-1 through 12-7; MS/MSD RPDs are calculated by the laboratory and those with RPDs outside the criteria established in Tables 12-1 through 12-7 will be listed in tabular form in the data verification report. A discussion will follow summarizing the results of the laboratory precision. Any conclusions about the precision of the analyses will be drawn and any limitations on the use of the data will be described.
Accuracy/Bias Contamination – Results for all laboratory method blanks will be evaluated and analytes detected in these blanks will be listed in tabular form in the data verification report. Laboratory data will be qualified based on the criteria listed in Tables 12-1 through 12-7. A discussion will follow summarizing the results of the laboratory accuracy/bias. Any conclusions about the accuracy/bias of the analyses based on contamination will be drawn and any limitations on the use of the data will be described.
Overall Accuracy/Bias – Results for all laboratory control sample, surrogate and matrix spike/matrix spike duplicate recoveries that are outside evaluation criteria will be presented in tabular format in the data verification reports. The results will be checked versus those listed in Tables 12-1 through 12-7. A discussion will follow summarizing the overall accuracy/bias. Any conclusions about the accuracy/bias of the analyses based on contamination will be drawn and any limitations on the use of the data will be described.

QAPP Worksheet #37 – Usability Assessment (continued)
(UFP-QAPP Manual Section 5.2.3)

Usability Assessment

Sensitivity –The results for each analyte will be checked against the performance criteria presented on Worksheet #12 and cross checked against the quantitation limits presented on Worksheet #15. Results for analytes that exceed criteria will be identified on the tables. A discussion will follow summarizing the results of the laboratory sensitivity. Any conclusions about the sensitivity of the analyses will be drawn and any limitations on the use of the data will be described.
Representativeness –Representativeness is a qualitative measure of the degree to which data accurately and precisely represent a characteristic of a population, and is mainly addressed in the sample design. A measure of representativeness will be provided by assessing if the proper analytical procedures, appropriate methods, laboratory SOPs, holding times and field duplicate procedures were followed. Any conclusions about the representativeness of the analyses will be drawn and any limitations on the use of the data will be described.
Comparability – In accordance with this UFP QAPP, project data are comparable when sample collection techniques, measurement methods and reporting procedures are the same for each data set.
Completeness – A completeness check will be performed on all data generated by the laboratory. Completeness criteria are presented on Worksheet #12. Completeness will be calculated as the number of data points for each analyte that is deemed useable (not rejected) divided by the total number of data points for each analyte. A discussion will follow summarizing the results of the calculation of data completeness. Any conclusions about the completeness of the data will be drawn and any limitations on the use of the data will be described.

QAPP Worksheet #37 – Usability Assessment (continued)
(UFP-QAPP Manual Section 5.2.3)

Usability Assessment

Reconciliation – Each of the measurement performance criteria listed in Worksheet #12 will be examined to determine if the objective was met. Each analysis will be evaluated separately in terms of the major impacts observed from the data verification/validation, Project Quality Indicators and measurement performance criteria assessments. Based on the results of these assessments, the quality of the data will be determined. Usability of the data will be based on the quality assessment. After establishing the usability of the data, it will be determined if the project quality objective was met and if project action limits were met. The Interim Measures Report will include a summary of all points that comprised the reconciliation of each objective. Any conclusions or limitations on the usability of any of the data will be described.

Notes:
MS/MSD – Matrix Spike/Matrix Spike Duplicate
QAPP – Quality Assurance Project Plan
RPDs – Relative Percent Differences
SOPs – Standard Operating Procedures
UFP – Uniform Federal Policy

THIS PAGE INTENTIONALLY BLANK

REFERENCES

Department of Defense (DoD). 2010. DoD Quality Systems Manual for Environmental Laboratories, Version 4.2. 25 October.

New Mexico Administrative Code (NMAC). 2013. Title 20 Environmental Protection. Chapter 6. Water Quality. Part 2. Ground and Surface Water Protection. 20.6.2.3103. Standards for Ground Water of 10,000 mg/l TDS Concentration or Less.

New Mexico Environment Department (NMED). 2004. Resource Conservation and Recovery Act Permit EPA ID NM6572124422 to U. S. Department of the Air Force for Holloman Air Force Base, Hazardous Waste Bureau, New Mexico Environment Department, February.

NMED. 2012. Risk Assessment Guidance for Site Investigations and Remediation. Table A-1: NMED Soil Screening Levels. June.

Shaw Environmental & Infrastructure, Inc., (Shaw). 2011. Working Copy RCRA Facility Investigation Report, Group 2 - Building 889 (TU/US-C515), Holloman AFB, NM. December.

Shaw. 2013. Sample Completion Report, Group 2 Former UST Sites; Holloman AFB, NM. March.

U.S. Environmental Protection Agency (USEPA). 2013. USEPA Regional Screening Level (RSL) Chemical-specific Parameters Supporting Table. November. Accessed online at: http://www.epa.gov/region9/superfund/prg/.

USEPA. 2013. National Primary Drinking Water Regulations. Accessed online at: http://water.epa.gov/drink/contaminants/index.cfm#List.

USEPA. 2011. USEPA Regional Screening Level (RSL) Chemical-specific Parameters Supporting Table. November. Online at: http://www.epa.gov/region9/superfund/prg/.

USEPA. 2008. Test Methods for Evaluating Solid Waste Physical/Chemical Methods, Update IVB. 3 January.

USEPA, DoD, and United States Department of Energy. 2005. Intergovernmental Data Quality Task Force. Uniform Federal Policy for Quality Assurance Project Plans. Evaluating, Assessing, and Documenting Environmental Data Collection and Use Programs. Part 1: UFP-QAPP Manual. Final, Version 1. March.

THIS PAGE INTENTIONALLY BLANK

FINAL
INTERIM MEASURES WORK PLAN

Group 2 Former Underground Storage Tank Site:

AOC-UST-889 (TU515)

Holloman Air Force Base, New Mexico

Prepared for
Air Force Civil Engineer Center
2261 Hughes Ave, Suite 155
Joint Base San Antonio Lackland, Texas 78236-9853

Contract No.: FA8903-13-C-0008

URS Group, Inc.
Denver, Colorado

September 2014

TABLE OF CONTENTS

1.0 INTRODUCTION 1-1
1.1 Interim Measures Purpose 1-1
1.2 Interim Measures Objectives 1-2
1.3 Regulatory Setting 1-2
1.4 Interim Measures Work Plan Organization 1-3

2.0 PREVIOUS INVESTIGATIONS AND BACKGROUND INFORMATION 2-1
2.1 Previous Investigations 2-1
2.1.1 TU515 2-1
2.2 General Background Information 2-2
2.2.1 Physical Setting 2-2
2.2.2 Holloman AFB History 2-2
2.2.3 Physiography and Topography 2-2
2.2.4 Climate 2-3
2.2.5 Regional Geology and Soils 2-3

3.0 PROCEDURES FOR IMPLEMENTATION 3-1
3.1 Applicable Regulations and Standards 3-2
3.2 Pre-mobilization Activities 3-3
3.3 Mobilization Setup 3-3
3.4 Exploratory Soil and Groundwater Sampling 3-3
3.5 Excavation/Soil Removal 3-4
3.6 Confirmation Soil Sampling 3-5
3.7 Subsurface Injection 3-6
3.8 Monitoring Well Installation and Development 3-6
3.8.1 Monitoring Well Installation 3-6
3.8.2 Monitoring Well Development 3-8
3.9 Confirmation Groundwater Monitoring 3-9
3.10 Waste Management 3-10
3.11 Site Restoration 3-10
3.12 Surveying 3-11
3.13 Reporting 3-11

4.0 INTERIM MEASURES REPORT 4-1

5.0 PROJECT SCHEDULE 5-1

6.0 REFERENCES 6-1

LIST OF FIGURES

Figure 1-1 Location Map, Holloman Air Force Base
Figure 2-1 Building 889, TU515 Site Map
Figure 2-2 Regional Soils
Figure 2-3 Regional Hydrogeology
Figure 5-1 Preliminary Project Schedule

LIST OF APPENDICES

Appendix A Meeting Minutes: Interim Measures at TU-Sites. 19 June 2014

LIST OF ACRONYMS AND ABBREVIATIONS

°F	degree Fahrenheit
AFB	Air Force Base
AFCEC	Air Force Civil Engineer Center
AOC	Area of Concern
bgs	below ground surface
CAC	Corrective Action Complete
CFR	Code of Federal Regulations
COC	Contaminant of Concern
CY	cubic yard
DERA	Defense Environmental Restoration Account
DOT	Department of Transportation
DPT	direct-push technology
DRO	diesel range organics
FPM	FPM Remediations, LLC
ft	foot/feet
GIS	geographic information system
GRO	gasoline range organics
HSA	hollow stem auger
HASP	Health and Safety Plan
HWA	Hazardous Waste Act
HWB	Hazardous Waste Bureau
IDW	investigation derived waste
IM	Interim Measure
IRP	Installation Restoration Program
MCL	maximum contaminant level
mg/kg	milligrams per kilogram
mg/L	milligrams per liter
NM	New Mexico
NMAC	New Mexico Administrative Code
NMED	New Mexico Environment Department
NMWQCC	New Mexico Water Quality Control Commission
NRCS	Natural Resources Conservation Service
NTU	nephelometric turbidity unit
ORO	oil range organics
PAH	polynuclear aromatic hydrocarbon
PBR	Performance Based Remediation
PID	photoionization detector
PPE	personal protective equipment
ppm	parts per million
PVC	polyvinyl chloride
QA	quality assurance
QAPP	Quality Assurance Project Plan
QC	Quality Control
RCRA	Resource Conservation and Recovery Act

RFI	RCRA Facility Investigation
RSL	Regional Screening Level
Shaw	Shaw Environmental & Infrastructure, Inc.
SOP	Standard Operating Procedure
sq ft	square foot/feet
SSL	soil screening levels
SVOC	Semi-volatile organic compound
TAL	Target Analyte List
TAT	turn-around time
TCLP	Toxicity Characterization Leachate Procedure
TDS	total dissolved solids
TPH	total petroleum hydrocarbons
URS	URS Group, Inc.
USAF	United States Air Force
U.S. Census	United States Census Bureau
USEPA	United States Environmental Protection Agency
USGS	United States Geological Survey
UST	underground storage tank
VCM	Voluntary Corrective Measures
VOC	volatile organic compound
WMSR	White Sands Missile Range

1.0 INTRODUCTION

This Interim Measures (IM) Work Plan addresses one Group 2 Underground Storage Tank (UST) Area of Concern (AOC) located at Holloman Air Force Base (AFB) near Alamogordo, New Mexico (NM) (**Figure 1-1**). The AOC consists of a former UST site, where the UST has been removed, but elevated concentrations of petroleum hydrocarbons (e.g., diesel fuel) have been documented in soil. The former UST site discussed in this IM Work Plan is identified as:

- AOC-UST-889 (TU515, formerly TU/US-C515).

This IM Work Plan has been prepared by FPM Remediations, LLC (FPM)/URS Group, Inc. (URS) on behalf of the United States Air Force Civil Engineer Center (AFCEC), under Contract Number FA8903-12-R-0050, in accordance with Holloman AFB's Resource Conservation and Recovery Act (RCRA) Permit (Permit Number - NM6572124422) (NMED 2004) and Notice to Approve a Class 3 Permit Modifications (NMED 2012a), which added the site to the RCRA Permit.

As part of a Defense Environmental Restoration Account (DERA) study for AFCEC, this site was evaluated to determine eligibility for cleanup funding under DERA. The DERA Evaluation Report evaluated historical site information and recommended that this site be further investigated (URS 2009).

The site was partially investigated and some petroleum-impacted soil was removed by Shaw Environmental & Infrastructure, Inc. (Shaw, now a part of CB&I) under the Voluntary Corrective Measures (VCM) program. The VCM Request (Shaw 2011) was prepared by Shaw, on behalf of AFCEC under the Midwest Performance Based Remediation (PBR) Contract (Contract Number FA8903-09-D-8580) and submitted to the New Mexico Environment Department (NMED) for review by the United States Air Force (USAF) on 15 February 2012. In a letter dated 21 January 2014, NMED approved this VCM Request (NMED 2014). The technical approach utilized by Shaw mirrored that used for several "Group 3" UST sites at Holloman AFB; however, the Group 3 VCM Request (Shaw 2012) was not reviewed by NMED.

Based on URS' review of the preliminary data collected under the VCM, additional investigative and remedial work are necessary at this site to achieve Corrective Action Complete (CAC). This work can most effectively be accomplished through the use of IM because the site is relatively small, the nature of the petroleum hydrocarbons is well understood, and the technologies to remove and/or destroy the hydrocarbons are well-proven.

1.1 Interim Measures Purpose

The purpose of these IM is to facilitate a timely corrective measure which will minimize or prevent the further migration of contaminants and limit actual or potential human and environmental exposure to contaminants. The ultimate goal of this project is to bring this site to CAC status, with no requirement for further land use controls. The IM approach for this TU site was discussed with NMED during a meeting on 16 December 2013 between NMED, Holloman AFB, and URS (URS 2013), and in more specific detail during a second meeting on 19 June 2014 (URS 2014b). Minutes for the 19 June 2014 meeting with NMED are provided as **Appendix A**.

1.2 Interim Measures Objectives

The primary objectives of the IM are to:

- Clearly delineate the nature and extent of petroleum hydrocarbons in subsurface soil and groundwater;
- Remove and/or destroy petroleum hydrocarbons present in the soil and/or groundwater at concentrations above applicable screening values;
- Provide confirmatory sampling data to demonstrate that each site has achieved regulatory cleanup levels; and
- Provide the necessary data to support a CAC proposal to NMED to delist the site from the RCRA Permit.

These IM objectives will be achieved in part through the following field activities, which are described in this Work Plan:

- utility clearance;
- soil and groundwater reconnaissance sampling for contaminants of concern (COCs);
- excavation and disposal of contaminated soil;
- temporary well point and/or monitoring well installation;
- subsurface injection of bioremediation augmentation substrates (if necessary);
- confirmation sampling of soil and/or groundwater;
- surveying; and
- site restoration.

1.3 Regulatory Setting

Pursuant to the RCRA Permit, IM activities conducted at Holloman AFB are performed under the New Mexico Hazardous Waste Act (HWA), the New Mexico Hazardous Waste Management Regulations, and RCRA. The NMED Hazardous Waste Bureau (HWB) has regulatory enforcement authority for the State of New Mexico.

The media of concern for the UST sites referenced in this document include subsurface soil and groundwater. Pursuant to the RCRA Permit, and with guidance provided by NMED, cleanup levels for impacted soil under these IM will be to the latest revision of NMED and EPA documents at the time of work plan approval and/or execution of the fieldwork. Currently, these levels include the residential soil screening levels (SSLs) presented in the *Risk Assessment Guidance for Site Investigations and Remediation* (NMED 2012b), or the United States Environmental Protection Agency's (USEPA) *Regional Screening Levels (RSLs)* for residential soil (USEPA 2013), if no SSL has been identified for a specific compound. Additionally, the RCRA Permit requires groundwater cleanup levels (latest revision as of work plan approval) to be set at the more conservative of those specified by either the New Mexico Water Quality Control Commission (NMWQCC) as protective of human health (20.6.2.3103 New Mexico

Annotated Code [NMAC]), or by USEPA's Maximum Contaminant Levels (MCLs) (USEPA 2013).

The risk associated with vapor intrusion of subsurface contaminants into installation buildings will also be assessed. Preliminary analytical data collected during the VCM (Shaw 2013) indicate no significant risk due to vapor intrusion; however, these data were not satisfactorily reviewed and validated prior to publication.

In addition to the prescribed regulatory guidance, the *Final Background Study Report; Holloman AFB, New Mexico, Revision 3* (NationView 2011) provides reference data for comparison to metals concentrations in soils and groundwater under these IM. The background levels of metals in soil and groundwater published in that report have been accepted by NMED (NMED 2011) and will be used as secondary screening data to determine whether soil or groundwater have been impacted by metals at the former UST site. In the event that there are detected metals in excess of established background concentrations, it may be appropriate to further evaluate the data and propose a weight-of-evidence argument for selected values if it appears as though they may be naturally occurring.

1.4 Interim Measures Work Plan Organization

This IM Work Plan is divided into six sections and includes one appendix. The sections of this Work Plan include:

- Section 1 - Introduction, Purpose, Objectives, and Regulatory Setting;
- Section 2 - Previous Investigations and Background Information;
- Section 3 - The technical approach for implementing IM at the site, including general procedures and typical methods and materials that may be used;
- Section 4 - A brief discussion of the IM Report structure and contents;
- Section 5 - An estimated project schedule for IM implementation and reporting; and
- Section 6 - A list of documents referenced in this Work Plan.

This page intentionally left blank

2.0 PREVIOUS INVESTIGATIONS AND BACKGROUND INFORMATION

2.1 Previous Investigations

As stated in Section 1.0, initial investigative work was performed and documented in the DERA Evaluation Report (URS 2009). This work mostly involved a review of historical records with a resulting recommendation for further investigation based on the potential presence of contaminants. Subsequent environmental investigation and remediation was conducted under both the USAF's Installation Restoration Program (IRP) and the RCRA Corrective Action Program.

The following sections provide brief descriptions of work performed under the previously approved VCM Request (Shaw 2011). Shaw performed the VCM along with investigative work with the intention of concurrently conducting a RCRA Facility Investigation (RFI). However, the corresponding RFI Work Plan and Report were not reviewed by NMED. Data obtained from these activities were compiled in a Sample Completion Report, Group 2 – Five Former UST Sites (Shaw 2013), which has also not been reviewed or commented on by NMED as of the time of preparation of this IM Work Plan (April 2014). There is no indication that the results of the work previously performed will be submitted for review by NMED as a standalone document. The analytical data reported in the Sample Completion Report (Shaw 2013) will be re-evaluated within the context of the data generated under these IM, and a determination on its appropriateness as either a screening or compliance/confirmation tool will be made at that time. The 2012 investigation data will be submitted for review within the IM Report prepared in accordance with this Work Plan regardless of whether it is used for screening or confirmation purposes. References to the sample locations and results are discussed below, but will be formally presented in the IM Report.

2.1.1 TU515

Records for former UST site TU515 at Building 889 (**Figure 2-1**) indicate that the associated UST was closed in 1992 (URS 2009). Closure records report the UST was a bare steel tank with a capacity of 550 gallons. The tank had been in service for 9 years and was used for diesel fuel storage prior to closure. There was no known internal or external tank protection, and the associated piping was also bare steel. A visual inspection for leakage was performed following tank removal, and none was reported. There are no records to show that soil remediation or removal was performed at that time.

During the 2012 VCM, approximately forty cubic yards (cy) of soil were excavated from the site down to between 7 and 8 feet below ground surface (bgs). Nineteen soil samples were collected from both direct-push boreholes and excavated test pits at varying depths down to the water table at locations surrounding the former UST pit (Appendix A soil figure). The only parameters exceeding the soil screening criteria were TPH-GRO (in one floor sample) and TPH-DRO (in two floor and three wall samples). The limits of soil TPH contamination have been delineated to the north, west, and south of the former UST location, and to the foundation of Building 889 on the east. It is unknown if contamination extends under Building 889.

Three monitoring wells were installed as part of the VCM (**Figure 2-1**), with water table depth observed at approximately 8 ft bgs. Groundwater samples were collected from all three site monitoring wells and compared to the NMWQCC water quality standards. The only parameter

detected above the groundwater screening criteria was manganese in downgradient/cross-gradient well MW-02 (347 µg/L, which is above the 200 µg/L criteria). This detection is presumed to be a naturally-occurring concentration.

2.2 General Background Information

2.2.1 Physical Setting

Holloman AFB is situated in south central New Mexico, in the northwest central part of Otero County, approximately 75 miles north–northeast of El Paso, Texas (USAF 2013). Holloman AFB has a population of 3,054 (U.S. Census 2010) and occupies 59,639 acres in the northeast quarter of Section 1, Township 17 South, Range 8 East. The White Sands Missile Range (WSMR) testing facilities occupy additional land extending northward from the Base. Privately and publicly owned lands border the remainder of Holloman AFB. The major highway servicing Holloman AFB is Highway 70, which runs southwest from the town of Alamogordo, New Mexico, and separates Holloman AFB from publicly owned lands to the south. Alamogordo, which has a population of 30,401 according to (U.S. Census 2010), is located approximately 7 miles east of the Base.

2.2.2 Holloman AFB History

Holloman AFB was first established in 1942 as Alamogordo Army Air Field. From 1942 through 1945, Alamogordo Army Air Field served as the training grounds for over 20 different flight groups, flying primarily B-17s, B-24s, and B-29s. After World War II, most operations had ceased at the Base. In 1947, Air Material Command announced that the air field would be its primary site for the testing and development of unmanned aircraft, guided missiles, and other research programs (USAF 2013). On 13 January 1948, the Alamogordo installation was renamed in honor of the late Colonel George V. Holloman, a pioneer in guided missile research. In 1968, the 49th Tactical Fighter Wing arrived at Holloman AFB and has remained since. Today, Holloman AFB also serves as the training center for the German Air Force's Tactical Training Center.

2.2.3 Physiography and Topography

Holloman AFB is located within the Basin and Range Province physiographic province in the Sacramento Section on the western edge of the Sacramento Mountains at a mean elevation of 4,093 ft above mean sea level (USGS 2003). The region is characterized by high tablelands with rolling summit plains, cuesta-formed mountains dipping eastward, and west-facing escarpments with the wide bracketed basin forming the basin and range complex. Holloman AFB is within the Tularosa Basin, which is part of the Central Closed Basins (NMED 2004). The bordering mountains rise abruptly to altitudes of 7,000 to 12,000 ft above mean sea level. The San Andres Mountains approximately 30 miles to the west bound the basin to the west, with the Sacramento Mountains approximately 10 miles to the east (**Figure 1-1**). At its widest, the basin is approximately 60 miles east to west and stretches approximately 150 miles north to south.

2.2.4 Climate

As a whole, New Mexico has a mild, arid to semiarid continental climate characterized by light precipitation totals, abundant sunshine, relatively low humidity, and relatively large annual and diurnal temperature ranges (Western Regional Climate Center 2013). The climate of the Central Closed Basins varies with elevation. The Base is located in the lower elevation areas, characterized by warm temperatures and dry air. Daytime temperatures often exceed 100 degrees Fahrenheit (°F) in the summer months and are in the middle 50-degree range in the winter. A preponderance of clear skies and relatively low humidity permits rapid cooling resulting in average diurnal temperature ranges of 25° to 35°F. Potential evapotranspiration, at 73 inches per year, significantly exceeds annual precipitation, usually less than 10 inches. Arid conditions resulting from very low rainfall amounts, coupled with topographically induced wind patterns and combined with sparse vegetation, tend to cause localized "dust devils." The annual rainfall for Alamogordo is 12 inches per year. Much of the precipitation falls during the mid-summer monsoonal period (July and August) from brief, yet frequent, intense thunderstorms culminating in 30 to 40 percent of the total annual rainfall.

2.2.5 Regional Geology and Soils

2.2.5.1 Regional Geology

The sedimentary rocks, which make up the adjacent mountain ranges, are between 500 and 250 million years old (Weir, Jr. 1965). During the period when the area was submerged beneath the shallow intracontinental sea, the layers of limestone, shale, gypsum, and sandstone were deposited. In time, these layers were pushed upward through various tectonic forces, forming a large bulge on the surface. Approximately 10 million years ago, the center began to subside, resulting in a vertical drop of thousands of feet leaving the edges still standing (the present-day Sacramento and San Andres mountain ranges). In the millions of years following, rainfall, snowmelt, and wind eroded the mountain sediments, depositing them in the valley (i.e., Tularosa Basin). Water carrying eroded limestone, dolomite, gravel, and other materials continued to flow into the basin.

As the Tularosa Basin is a bolson-type basin, which is a basin with no surface drainage outlet, sediments carried by surface water into a closed basin are bolson deposits. The overlying alluvium generally consists of unconsolidated gravels, sands, and clays. Soils in the basin are derived from the adjacent ranges as erosional deposits of limestone, dolomite, and gypsum. A fining sequence from the ranges towards the basin's center characterizes the area with the near surface soils being alluvial, eolian, and lacustrine deposits. The alluvial fan deposits are laterally discontinuous units of interbedded sand, silt, and clay, while the eolian deposits consist primarily of gypsum sands. The eolian and alluvial deposits are usually indistinguishable due to the reworking of the alluvial sediment by eolian processes. The playa, or lacustrine deposits, consist of clay containing gypsum and are contiguous with the alluvial fan and eolian deposits throughout the Base. Stiff caliche layers, varying in thickness, have been identified at different areas of the Base.

2.2.5.2 Soils

The United States Natural Resources Conservation Service (NRCS) (formerly Soil Conservation Service) has identified two soil associations in the vicinity of Holloman AFB—the Holloman-Gypsum Land-Yesum Complex and the Mead silty clay loam (Derr 1981)(**Figure 2-2**). The hydraulic conductivity of these horizons ranges from 4×10^{-4} to 1×10^{-3} centimeters per second.

The Holloman-Gypsum Land-Yesum Complex (0 to 5 percent slopes) consists of larger areas of shallow and deep, well-drained soils and areas of exposed gypsum. The Holloman soil makes up about 35 percent of the complex. Typically, the surface layer is light brown, very fine sandy loam approximately 3 inches thick. The upper 13 inches of the substratum is pink, very fine sandy loam that is very high in gypsum. Below that, the substratum is white gypsum to a depth of more than 60 inches. This soil is calcareous and mildly alkaline to moderately alkaline throughout. Permeability is moderate, and available water capacity is very low.

Gypsum Land makes up approximately 30 percent of the Holloman-Gypsum Land-Yesum Complex (0 to 5 percent slopes). Typically less than 1 inch of very fine sandy loam overlies soft to hard, white gypsum. The deeper Yesum horizon consists of very fine sandy loam that makes up approximately 20 percent of the complex. Typically, the surface layer is light brown, very fine sandy loam approximately 3 inches thick. The upper 9 inches of the substratum is light brown, fine sandy loam that is very high in gypsum. Below that, the substratum is pink, very fine sandy loam to a depth of more than 60 inches. The soil is calcareous throughout and is mildly alkaline. Permeability is moderate, and available water capacity is moderate. Many fine gypsum crystals are found throughout the profile.

The soil type found across the main drainage area for the Base is Mead silty clay loam (0 to 1 percent slopes). This deep, poorly drained, nearly level soil occurs on outer fringes of alluvial fans. This soil formed in fine-textured alluvium over lacustrine lake sediment. It is very high in salt content because of periodic flooding and poor drainage. Slopes are smooth and concave. Typically, the surface layer is reddish-brown, silty clay loam and clay loam approximately 5 inches thick. The substratum, to a depth of 48 inches, is light reddish-brown clay that has a high salt content. Below that, the substratum is lacustrine material of variable texture and color to a depth of more than 60 inches. Included within this soil are areas of Holloman soils and Gypsum Land along the margins of the unit of steep, short gully sides and knolls.

These inclusions make up approximately 15 percent of the map unit for this soil type. Individual areas are generally smaller than 10 acres. This soil is moderately calcareous throughout and is moderately to strongly alkaline. It has a layer of salt that is more soluble than gypsum. Permeability is very low, and available water capacity is low (URS 2009).

2.2.5.3 Regional Hydrogeology

Groundwater occurs as an unconfined aquifer in the unconsolidated deposits of the central basin, with the primary source of recharge as rainfall percolation and minor amounts of stream runoff along the western edge of the Sacramento Mountains (Basabilvazo, Myers, and Nickerson 1994). Surface water/rainfall migrates downward into the alluvial sediments at the edge of the shallow aquifer near the ranges and flows downgradient through progressively finer-grained sediments towards the central basin. Because the Tularosa Basin is a closed system, water that enters the area leaves either through evaporation or percolation. This elevated amount of percolation results

in a fairly high water table. Beneath Holloman AFB, groundwater ranges from 5 to 50 ft bgs. Flow for the Base is generally towards the southwest with localized influences from variations in topography (**Figure 2-3**). In the northern and western portions of the Base, groundwater flows more to the west towards the Ritas Draw, Malone Draw, and Lost River drainages. Groundwater flow is affected by local topography in areas immediately adjacent to arroyos, where groundwater flows directly toward the drainages regardless of the regional flow pattern.

Groundwater in the Tularosa Basin is of potable quality at the recharge areas in close proximity to the Sacramento Mountains and becomes increasingly mineralized toward the central portion of the basin and discharge areas. The majority (over 70 percent) of the Installation Restoration Program sites located across Holloman AFB have groundwater monitoring wells containing water with an average TDS concentration greater than 10,000 mg/L. These TDS data support the hypothesis that TDS concentrations below 10,000 mg/L at Holloman AFB are caused by dilution of natural groundwater quality from leaking water lines and surface irrigation from the domestic water supply. TDS concentrations greater than 10,000 mg/L exceed the NMWQCC limit for potable water, and therefore, the groundwater beneath Holloman AFB has been designated as unfit for human consumption. Likewise, the USEPA guidelines have identified the groundwater as a Class IIIB water source, characterized by TDS concentrations exceeding 10,000 mg/L and a low degree of interconnection with adjacent surface water or groundwater of a higher class. Groundwater at Holloman AFB does not discharge or connect to any adjacent aquifers because the Tularosa Basin is a closed basin. Adjacent surface waters include Lost River and Lake Holloman, which also have high concentrations of TDS and are not considered potential drinking water sources.

2.2.5.4 Surface Water Hydrology

The Tularosa Basin contains all of the surface flow in its boundaries (NMWQCC 2006). The nearest inflow of surface waters to the Base comes from the Lost River, located in the north central region of the Base. The upper reaches of the Three Rivers and Sacramento River are perennial in the basin. Holloman AFB is dissected by several southwest-trending arroyos that control surface drainage. Hay Draw arroyo is located in the far north. Malone and Ritas draws, which drain into the Lost River and Dillard Draw arroyos, are located along the eastern perimeter of the Base. Indications are that the climate was much wetter approximately 10,000 years ago. The present-day Lake Otero formerly encompassed a much larger area, possibly upwards of several hundred square miles. Its remains are the Alkali Flat and Lake Lucero. Lake Lucero is a temporary feature merely a few inches deep during the rainy season. Ancient lakes and streams deposited water-bearing deposits over older bedrock basement materials. Fractures, cracks, and fissures in the Permian and Pennsylvanian bedrock yield small quantities of relatively good quality water in the deeper periphery. Potable water is only found in wells near the edges of the basin with more saline water found towards the center. Two of the principal sources of potable water are a long narrow area on the upslope sides of Tularosa and Alamogordo and another area in the far southwestern part of the basin. A portion of the city of Alamogordo's water, as well as the Holloman AFB's water, was formerly supplied from Bonito Lake (which is in the Pecos River Basin) prior to the Little Bear Fire, in 2012.

2.2.5.5 Current and Future Land Use

The land surrounding Holloman AFB consists of residential areas to the east and northeast (city of Alamogordo), rangeland to the south, White Sands National Monument to the west, and areas where military activities are conducted to the north. The desert terrain immediately surrounding Holloman AFB has limited development, Mesa Verde Ranch operates along the eastern border, and there are no residential communities, or large industrial operations located adjacent to the Base. Holloman AFB is an active military installation and is expected to remain active for the foreseeable future. No transfer of military property to the public is anticipated, and public access to the Base is restricted (Foster Wheeler 2002). Future land use is not expected to differ significantly from current land use practices (Foster Wheeler 2002).

Building 889 is located within the Holloman AFB airfield, and has presently and historically been used for industrial purposes. There is no indication that the USAF will modify land use at the TU515 site.

2.2.5.6 Current and Future Water Use

Currently, there are no potable supplies of groundwater or surface water located on the Base (Foster Wheeler 2002). Holloman AFB obtains its water supply from the city of Alamogordo and Holloman AFB wells in the Boles, San Andres, and Douglas well fields at the Base of the Sacramento Mountains. No water supply wells are located on or near the Base because of poor groundwater quality with TDS concentrations greater than 10,000 mg/L. There are no potable or irrigation wells near or immediately downgradient of the Base.

3.0 PROCEDURES FOR IMPLEMENTATION

This section includes general procedures for implementing the delineation and remedial action activities to be undertaken. Several supporting project-related plans have also been prepared as a Technical Memorandum to supplement this IM Work Plan and provide a more thorough framework for URS to conduct these IM (URS 2014c):

- A site-specific Quality Assurance Project Plan (QAPP)establishes the overarching analytical and data collection protocols and documentation requirements so that data are generated, reviewed, and analyzed in a consistent manner, for the investigation and remediation activities performed in the scope of work presented in this Work Plan.
- A site-specific Health and Safety Plan (HASP) defines the health and safety guidelines developed to protect URS personnel, subcontractors, and government personnel involved in the IM.
- URS Standard Operating Procedures (SOPs) outline the general procedures used to conduct various activities associated with IM implementation.

The following specific tasks will be applied to the former UST site subject to IM under this Work Plan:

- Pre-mobilization activities;
- Mobilization/site setup;
- Exploratory soil and groundwater sampling;
- Excavation/soil removal;
- Confirmation soil sampling;
- Subsurface injection (if necessary);
- Monitoring well installation and development;
- Confirmation groundwater sampling;
- Waste management;
- Site restoration;
- Site surveying; and
- Reporting.

URS has evaluated the VCM approach proposed by Shaw for the TU515 site (Shaw 2011) as approved by NMED (NMED 2014), and prepared this IM Work Plan with recognition of the existing VCM Request, but with proposed changes to more effectively achieve the goals of IM. The primary changes between the previously approved VCM Request (Shaw 2011) and this IM Work Plan are:

- Removal of the 40 CY excavation limit contained within the VCM Request, which was a contractual limitation for that work. Impacted soil with COC concentrations above the applicable cleanup levels will be removed (or otherwise remediated), whenever feasible, with no fixed limit on the volume of excavation at a given site.

- Modification of the previous monitoring well installation plan which stipulated only three wells per site. Instead, additional monitoring wells and/or temporary well points will be installed as necessary to achieve objectives of the IM including delineation of the nature and extent of contamination. At the site, at least three properly constructed monitoring wells will be used to perform site delineation, remediation performance monitoring, and/or compliance monitoring.
- Pursuant to Part 4, Section F of the Holloman AFB RCRA Permit, planned IM activities at the former UST site are not limited to remediation of impacted soil. IM will be implemented to "mitigate any current or potential threat(s) to human health or the environment and [are] consistent with and integrated into any long-term solution at the facility" (NMED 2004), including the remediation of impacted groundwater and soil vapor intrusion. Following identification of the nature and extent of contamination at the site, soil removal and bioremediation will be utilized to remediate contaminated soil and groundwater, if necessary.

3.1 Applicable Regulations and Standards

Federal and state regulations and standards that may be applicable to these IM include the following:

- Holloman AFB RCRA Permit No. NM6572124422, February 2004 (NMED 2004).
- RCRA Permit No. NM6572124422 Modification, October 2009 (NMED 2009).
- NMED residential SSLs (NMED 2012).
- USEPA residential RSLs (USEPA 2013).
- NMWQCC groundwater cleanup levels protective of human health (20.6.2.3103 NMAC).
- USEPA MCLs (USEPA 2013).
- New Mexico HWA (NMSA 1978, §74-4-1).
- New Mexico Hazardous Waste Management Regulations, (20.4.1.100 NMAC).
- RCRA, 40 Code of Federal Regulations (CFR) 260-268, Management of Hazardous Waste. In the event that investigation derived waste (IDW) sampling and analysis indicate the presence of constituents of potential concern at concentrations rendering them hazardous, storage and disposal protocols will be followed in accordance with RCRA hazardous waste regulations, as adopted by NMED.
- United States Department of Transportation (DOT) 49 CFR 172, 173, and 178: Applies to packaging IDW for removal off site and addresses hazard-class diamond labeling.

The latest revision of NMED and EPA documents at the time of work plan approval and/or execution of the fieldwork will be used.

3.2 Pre-mobilization Activities

Prior to mobilization of equipment, subcontractors (e.g., drilling subcontractor, New Mexico-licensed surveyor, and approved analytical laboratory) will be procured. All necessary permits (e.g., digging permits) will be initiated. All site activities will be coordinated with appropriate Holloman AFB personnel.

Prior to initiating intrusive activities, a completed and approved Air Force Form 332 will be obtained for authorization of construction work at Holloman AFB. A request for locating underground utilities in the area will be submitted to the local one-call utility notification center, as applicable. Additionally, Air Force Form 103 will be submitted to request that the location of underground utilities be marked at the specific sites. Drilling and excavation locations will be identified with paint, flags, or stakes, as appropriate to the surface material. Utility clearance approvals will be completed by the appropriate Holloman AFB utility office (e.g., telephone, sewer, water, natural gas, etc.).

3.3 Mobilization Setup

Personnel, equipment, and resources necessary to implement this IM Work Plan will be mobilized to the site. Site setup will occur at the former UST site. Warning signs and safety fencing may be used, where necessary, to indicate the danger of entering a work zone and to keep the work area clear of obstructions such as facility-worker vehicles. Setup will also include establishing a location for material storage and other equipment staging areas.

Site work at TU515 is anticipated to be performed in conjunction with other IM to be implemented at Holloman AFB Group 3 UST sites discussed in a separate IM Work Plan (URS 2014a).

3.4 Exploratory Soil and Groundwater Sampling

Exploratory (pre-remediation) soil and groundwater sampling are intended to be utilized as a screening tool; therefore, the protocols for exploratory delineation sampling may differ from the more stringent requirements of confirmatory and compliance sampling that will be conducted following remedial activities. The sample collection and preparation procedures utilized during delineation will be implemented to provide guidance for excavation and subsurface injection, if needed, and will not provide analytical data to be relied upon as a boundary condition or to achieve site closure directly. The results of exploratory sampling may also be used to determine placement of more formal confirmation and compliance sample locations. As opposed to confirmatory sampling, exploratory samples may be analyzed in the field by a screening test or in a setting other than a fully-accredited laboratory and will not be required to adhere to criteria specified in the QAPP or SOPs.

The main types of sampling that will be conducted during implementation of this IM Work Plan include:

- Pre-remediation delineation soil and groundwater sampling for chemical contamination;
- Performance monitoring sampling, as warranted, during any ongoing remedial actions; and

- Post-remediation confirmation sampling for contaminated soil and groundwater.

The more formal confirmatory sampling activities are described in greater detail in **Section 3.6** (Confirmation Soil Sampling) and **Section 3.9** (Confirmation Groundwater Sampling). Exploratory samples will be clearly identified as exploratory, delineation, or with similar wording to avoid confusion with confirmation samples.

To differentiate exploratory from confirmatory samples, an exploratory sample is defined as a field-screening tool to be used for determining more precise application of the IM, whereas a confirmation sample is defined as a representative sample that has been collected, analyzed, and validated in accordance with the QAPP and applicable SOPs, and is subsequently used to document that the concentrations of COCs in soil or groundwater are below the applicable cleanup levels. Pre-excavation exploratory sample data will not be validated; however, the data will be included in the IM Report for reference.

At the former UST site, exploratory sampling will be conducted using DPT, trenching, or other appropriate methods. In addition to standard vertical DPT drilling methods, angled and/or horizontal soil borings may be utilized to access otherwise obstructed areas such as beneath building foundations. Subsurface investigation will be conducted to determine the horizontal and vertical extent of soil and groundwater contamination, as required. During trenching or DPT drilling, soil screening will be conducted using a photoionization detector (PID), visual and olfactory observations, and collection of screening samples (as described above) to guide the exploration and identify the extent of soil contamination.

The maximum extent of accessible soil contamination will be determined based on field observation, site conditions, and physical restrictions. Visual observation of stained soil; field and/or laboratory soil screening; and proximity of existing underground utilities, surface structures, and building foundations may also define the limits of accessible contamination.

Exploratory samples will be analyzed for TPH-GRO, -DRO, and -oil range organics (ORO) using Modified USEPA Method 8015. Target Analyte List (TAL) metals, polynuclear aromatic hydrocarbons (PAHs), and VOCs will also be analyzed. The QAPP (URS 2014c) indicates the sampling and analytical method requirements for confirmation soil and groundwater samples; however, not all elements of the QAPP are applicable to exploratory sample collection and analysis. The SOPs (URS 2014c) describe the general methods and equipment to be used in the collection and handling of environmental samples; exploratory sampling for soil and groundwater will be in general accordance with the applicable SOPs.

Proposed delineation sample locations were discussed between URS, Holloman AFB, and NMED during a meeting on 19 June 2014 (URS 2014b). The meeting minutes presented in **Appendix A** include an excerpted summary table of estimated monitoring well installations, soil, and groundwater samples, as well as planning figures showing approximate proposed sample locations and historical analytical data.

3.5 Excavation/Soil Removal

Once contamination in site soil has been delineated, removal of contaminated soil may be performed using a backhoe or hydraulic excavator. Should the soil removal require access to areas completed in concrete or asphalt, the surface covering will be removed prior to excavation and replaced following backfill and compaction.

If contaminated soil appears to extend past the expected excavation limits, excavation will continue until soil is no longer considered to be potentially contaminated, based on visual evidence, field- or laboratory-screening, or other appropriate screening methods. However, excavation may be limited by the presence of buildings and/or utilities. Once the screening inspection indicates that soil is not potentially contaminated, confirmation samples will be collected in accordance with the QAPP and SOPs (URS 2014c). Confirmation samples will be collected at a frequency of one from each side wall of the excavation per 20 linear feet along the area of contamination within the excavation. This applies to excavations with less than 50,000 CYs of soil. For excavations greater than 50,000 CYs, the frequency of sampling will be every 50 linear feet. A minimum of one excavation floor sample will be collected and for larger excavations floor samples will be collected at intervals of approximately 500 square feet (sq ft). Excavation activities and subsequent sampling and analysis will continue until confirmation sampling and analysis indicate that concentrations of COCs do not exceed the applicable NMED residential SSLs (NMED 2012b).

Following removal of contaminated soil and confirmation sampling, the excavations will be backfilled with clean fill material (verified clean by analytical results, or other appropriate certification) and compacted by methods appropriate to fulfill Holloman AFB requirements. There is no pre-defined limit to the volume, depth, or horizontal extent of excavation.

The excavated soil will be placed in appropriate roll-off containers (lined and covered, if necessary) for off-site disposal, or on 20-mil plastic sheeting for temporary stockpiling. Waste characterization samples may be collected to facilitate off-site transport and disposal of IDW at an appropriate permitted disposal facility or on-Base land farm. Management of IDW is further described in **Section 3.10**.

Open trenches will be lined with plastic sheeting to prevent contact between rainwater and contaminated soil. When necessary, soil berms or other appropriate methods may be used to control storm water. Rainwater may be pumped out of open trenches to the ground surface or to the storm water drainage system. Groundwater encountered in an excavation will be pumped from the excavation and contained as IDW for treatment/disposal prior to backfilling.

3.6 Confirmation Soil Sampling

Following discussion with NMED, confirmation soil samples will be analyzed for TPH-GRO, -DRO, and -ORO using Modified USEPA Method 8015. TAL metals, PAHs, and VOCs will also be analyzed. The QAPP (URS 2014c) indicates the sampling and analytical method requirements for confirmation soil samples.

Pursuant to the Holloman AFB RCRA Permit, soil analytical results will be compared with the corresponding NMED residential SSLs (NMED 2012b), or USEPA RSLs (USEPA 2013) if no SSL has been designated. Excavation activities and subsequent sampling and analysis will continue until confirmation sampling and analysis indicate that COC concentrations do not exceed the applicable cleanup levels.

If a confirmation soil sample result exceeds the applicable screening levels, then an additional amount of wall or floor material will be excavated, and one additional confirmation soil sample (wall or floor) will be collected. This process will continue until the confirmation soil samples indicate concentrations are below applicable cleanup levels.

All samples will be collected and delivered to the laboratory under chain-of-custody protocol with request for expedited turn-around time (TAT) for analytical results. These samples will be collected, handled, and analyzed according to the QAPP and SOPs (URS 2014c).

Quality Assurance (QA)/Quality Control (QC) samples will be collected for the appropriate COCs so that sample results can be properly validated and eventually used as confirmation samples. The QA/QC samples will be collected at the following frequencies, per matrix, as detailed in the QAPP (URS 2014c):

- Trip Blanks: one for every 20 field samples analyzed for GRO and/or VOCs;
- Field Duplicates: one for every 20 field samples;
- Matrix Spike, Matrix Spike Duplicate pairs: one for every 20 field samples; and
- Rinsate (Equipment) Blanks: one for every 20 field samples collected with non-disposable/non-dedicated equipment.

3.7 Subsurface Injection

Due to the relatively small size of the site, the generally straightforward nature of hydrocarbon remediation, and the established effectiveness of bioremediation for petroleum hydrocarbons, selected bioremediation augmentation substrates will be injected into the subsurface where COC concentrations in the vadose zone or groundwater exceed the applicable screening levels following any remedial excavation. The appropriateness of remedial injections under IM was confirmed in the 19 July 2014 meeting between NMED, Holloman AFB, and URS (URS 2014b). The injection locations will be spaced at appropriate horizontal and vertical intervals, and are anticipated to be set on approximate 10- to 20-ft centers, with injection depths ranging from approximately 5 to 20 ft bgs, with specific injection details to be determined in the field.

The optimum method to deliver bioremediation augmentation substrates into the subsurface is to inject the material through direct push rods using hydraulic mixing and pumping equipment. This approach increases the spreading and mixing of substrates into the aquifer. Upon completion of injection, each direct-push hole will be properly sealed to the surface.

The quantity of substrate dosing required at the site will be based on the results of exploratory soil and groundwater sample analysis, and consultation with the selected substrate manufacturer, among other pertinent factors.

Bioremediation augmentation substrates under consideration for these IM (i.e., BOS 200® and ORC Advanced®) are non-toxic and proven remediation technologies that have been used successfully by both URS and the USAF at multiple sites. These bioremediation augmentation substrates are also suitable for use in groundwater with elevated TDS concentrations.

3.8 Monitoring Well Installation and Development

3.8.1 Monitoring Well Installation

Additional monitoring wells may be installed in the vicinity of the former UST location to determine the impact to groundwater. As discussed in Section 1.0, the site already has three monitoring wells in place. Additional monitoring wells will be installed as necessary to fulfill

the objectives of the IM. At least three properly constructed monitoring wells will be utilized at the site to perform compliance monitoring.

Well-drilling activities will be performed by an individual with a current and valid well driller license issued by the State of New Mexico. Monitoring wells will be installed using the hollow-stem auger (HSA) drilling technique in accordance with NMED Ground Water Quality Bureau Monitoring Well Construction and Abandonment Guidelines (NMED 2011b). The boreholes will be advanced into the water table using HSAs such that the borehole diameter will be at least 4 inches larger than the outside diameter of the well casing to allow for proper placement of the filter pack and sealant. Care will be taken so that the completed monitoring wells are sufficiently straight and plumb to allow passage of measuring and sampling devices.

During drilling, a URS Geologist will document the following information for each boring:

- Boring or well identification (this identification will be unique, and ensure it has not been used previously at the Base);
- Purpose of the boring (e.g., soil sampling, monitoring well);
- Location in relation to an easily identifiable landmark;
- Names of drilling subcontractor and logger;
- Start and finish dates and times;
- Drilling method;
- Diameters of surface casing, casing type, and methods of installation;
- Depth at which saturated conditions were first encountered;
- Lithologic descriptions and depths of lithologic boundaries;
- Sampling-interval depths; and
- Other pertinent field observations.

Field forms including soil boring logs for documentation of field activities are provided in in SOPs. Well installation equipment will be decontaminated according to the specifications of the Decontamination SOP (URS 2014c).

Approximately two to three soil samples will be collected from split-spoons during the advancement of each well boring at the 0 to 2 ft interval and the interval with the highest PID field screen result, or the interval immediately above groundwater if no elevated PID readings are observed. Soil samples collected from the well borings will be analyzed for the same parameters as the exploratory soil samples described in **Section 3.4**; however, well boring soil samples will be treated as confirmatory/compliance samples, and will be subject to the protocols established in the QAPP and SOPs (URS 2014c).

Well borings will be advanced approximately 8 ft into the water table and completed such that the well screen intersects the water table. The wells will be constructed of 2-inch diameter Schedule 40 polyvinyl chloride (PVC) riser and screen. The screened section of the wells will consist of 10 ft of 0.010-inch slotted screen (or other field determined slot size). A silica sand filter pack will be placed around the screen to approximately 2 ft above the top of the screen. A

2-ft thick bentonite seal will be placed above the filter pack. The remaining annular space will be grouted with neat cement.

For wells that will be finished aboveground ("stick-up"), the casing will extend from the top of the screen to approximately 2 to 3 ft above ground surface. The top of the casing will be fitted with a removable cap, and the exposed casing will be protected by a locking steel protective casing. The protective casing will be large enough in diameter to allow easy access for removal of the cap. A concrete pad (2-ft minimum radius, 4-inch minimum thickness) will be installed around the protective casing and wellhead. The concrete and surrounding soil will be sloped to direct rainfall and runoff away from the wellhead. Protective steel posts (bollards) will be installed around the wells, where needed, to protect the wellhead from damage by vehicles or equipment.

Monitoring wells that are completed as "flush-mounted" will be constructed with water-tight well vaults that are rated to withstand traffic loads and fitted with locking, expandable well plugs. Concrete pads (2-ft minimum radius, 4-inch minimum thickness) will be poured around the well vaults. Vault covers will be secured with bolts. Additionally, the vault cover will indicate that the wellhead of a monitoring well is contained within the vault. The concrete and surrounding soil must be sloped to direct rainfall and runoff away from the well vault.

To document specific details of the monitoring well installations, the URS Geologist will prepare drilling logs and as-built well construction diagrams in the field as the activity is taking place. Specific procedures and example forms for installing monitoring wells are provided in SOPs (URS 2014c). The monitoring wells will be constructed in accordance with NMED guidance (NMED 2011b).

3.8.2 Monitoring Well Development

The newly installed monitoring wells will be developed to create an effective filter pack around the well screen, remove fine particles from the formation near the borehole, and assist in restoring the natural water quality of the aquifer in the vicinity of the well. All newly installed monitoring wells will be developed no sooner than 48 hours after installation to allow for grout curing.

Monitoring wells will be developed using surge blocks, bailers, or pumps to achieve effective well development.

During well development, documentation of the activity will take place in accordance with SOPs (URS 2014c) and will include recording of water level and depth-to-bottom measurements, water quality parameters, discharge water color, water volume, and time period.

Well development will continue until the following criteria are met:

- Water that has been removed from the well is visually clear, and the turbidity measures less than or equal to 10 nephelometric turbidity units (NTUs); and
- The pH, temperature, and specific conductance parameters have stabilized (less than 10 percent variation for three successive readings).

In the event that fine-grained deposits are present in the subsurface, it may be difficult to achieve a turbidity of 10 NTUs during well development. This is primarily a concern when a well has been screened in a formation that contains a high level of fine material (silt and clay). Silt and

clay can occasionally travel through filter packs on properly constructed wells, resulting in turbid water. While selection of proper filter pack and screen materials minimizes turbidity, fine-grained particles may still flow through. Proper well construction and development procedures will be followed to reduce measured turbidity in monitoring wells. If turbidity remains greater than 10 NTUs after 4 hours of continuous well development, well development will cease. If the well is pumped dry, it will be allowed to recharge and be re-pumped as much as practical within the 4-hour time limit.

3.9 Confirmation Groundwater Monitoring

Following remedial actions taken at the site, confirmation groundwater samples will be collected based on recommendations in the IM Report. It is estimated that quarterly sampling for a period of 1 year will be required.

Following discussion with NMED, confirmation groundwater samples will be analyzed for TPH-GRO, -DRO, and -ORO using Modified USEPA Method 8015. TAL metals, PAHs, and VOCs will also be analyzed. The QAPP (URS 2014c) indicates the sampling and analytical method requirements for confirmation soil samples.

Groundwater samples will be collected from site monitoring wells in accordance with the procedures provided in QAPP and SOPs (URS 2014c). If groundwater at the site exceeds NMED water quality standards, the TDS levels from nearby monitoring wells will be used to develop a TDS survey to determine if the present-day groundwater in the immediate vicinity of the site is above the NMED 10,000-mg/L TDS potable water threshold. The Groundwater Bureau does not regulate groundwater that has a TDS over this threshold. However, if contaminant concentrations exceed regulatory thresholds, it may be necessary to assess potential risks associated with vapor intrusion and/or ecological receptors.

Groundwater sampling will occur no sooner than 2 days following monitoring well development at any monitoring well. Groundwater monitoring wells will be purged and samples will be collected using low-flow sampling techniques in accordance with the QAPP and SOPs (URS 2014c). Field parameters (e.g., temperature, conductivity, pH, and turbidity) will be measured during well purging. Groundwater samples will be collected when the field parameters stabilize with minor fluctuation between consecutive readings. Groundwater samples collected from monitoring wells will be analyzed for the same parameters as the exploratory groundwater samples described in **Section 3.4**; however, monitoring well groundwater samples will be treated as confirmatory/compliance samples, and will be subject to the protocols established in the QAPP and SOPs (URS 2014c). Groundwater samples for metals analysis will be submitted to the analytical laboratory for both total and dissolved metals analyses; samples for dissolved metals analysis will be field filtered prior to submittal.

Quality Assurance (QA)/Quality Control (QC) samples will be collected for the appropriate COCs so that sample results can be properly validated and eventually used as confirmation samples. The QA/QC samples will be collected at the following frequencies, per matrix, as detailed in the QAPP (URS 2014c):

- Trip Blanks: one for every 20 field samples analyzed for GRO and/or VOCs;
- Field Duplicates: one for every 20 field samples;

- Matrix Spike, Matrix Spike Duplicate pairs: one for every 20 field samples; and
- Rinsate (Equipment) Blanks: one for every 20 field samples collected with non-disposable/non-dedicated equipment. Dedicated/disposable equipment is anticipated to be used for groundwater sampling.

3.10 Waste Management

Waste management options in order of preference are reuse, recycling, treatment, and disposal. Waste may be classified as non-investigative waste or investigative waste:

- Non-investigative waste, such as trash and office garbage, will be collected on an as-needed basis to maintain the site in a clean and orderly manner. This waste will be accumulated in plastic garbage bags and transported to a designated sanitary landfill or collection bin.
- IDW generated during these IM will be segregated into the following categories:
    - Suspected contaminated soil
    - Concrete or asphalt rubble
    - Decontamination, well development, seepage water in excavations, and purge water
    - Personnel protective equipment (PPE), sampling debris, and plastic sheeting

The IDW will be properly containerized and temporarily stored at a location specified by Holloman AFB prior to disposal. Depending on the COCs, fencing or other special marking may be required. Acceptable waste containers include sealed, DOT-approved, steel 55-gallon drums; small dumping bins with lids; or roll-off boxes with liners and covers. The containers will be transported in such a manner as to prevent spillage or particulate loss to the atmosphere. When required, sampling of drums or roll-off boxes will be done in accordance with SOPs URS 2014c).

The IDW will be segregated at the site according to the specified categories. Each waste container will be properly labeled with site identification, matrix, date of generation, and other pertinent information for handling.

3.11 Site Restoration

Following delineation and remedial action activities at the former UST site, site conditions will be restored to similar states as initial conditions. Direct-push boreholes will be filled with appropriate materials, and the surfaces will be finished to match the surrounding area (e.g., soil, asphalt cold patch, concrete, etc.). Excavations will be backfilled with clean fill and compacted with a vibratory compactor, backhoe, or other appropriate methods. The area will be graded to maintain positive drainage to conform to site conditions. The ground covering will then be restored to surrounding site conditions or other covering as directed by Holloman AFB.

3.12 Surveying

Surveying of the locations (northing, easting, and elevation coordinates) of excavations, confirmation soil sampling locations, new and existing monitoring well locations, and other pertinent site features will be conducted by a State of New Mexico-licensed surveyor. Elevation data for monitoring wells will include the top of the PVC riser and ground surface elevation at the well locations. Surveying data will be provided in a spreadsheet format for import into the geographic information system (GIS), and the data will also be incorporated into the report figures.

Horizontal coordinates will be referenced to the New Mexico Central State Plane Coordinate System, and surveyed to an accuracy of ±1.0 ft. Vertical elevations will be referenced to North American Datum 1983 coordinate system to an accuracy of ±0.01 ft.

Geospatial information will also be submitted as a separate deliverable to the USAF. All applicable federal, U.S. Department of Defense, and USAF geospatial data standards will be followed. Spatial data will be compliant with the Spatial Data Standards for Facilities, Infrastructure, and Environment v2.6.

Each geospatial data set will be accompanied by metadata that conforms to the Spatial Data Facilities, Infrastructure, and Environment standards. The horizontal accuracy of any geospatial data created will be tested and reported in accordance with the National Standard for Spatial Data Accuracy, and the results will be recorded in the metadata.

3.13 Reporting

The details of reporting related to this IM Work Plan are discussed in **Section 4.0** (Interim Measures Report).

This page intentionally left blank

4.0 INTERIM MEASURES REPORT

Documentation of the project will be maintained, including field notes/forms, photographs, analytical, and survey data. An IM Report detailing the delineation and remedial action activities will be prepared and submitted to NMED for review. The IM Report will include the following elements:

- A description of IM implemented, including:
  - Purpose of the IM;
  - A summary of the delineation and remedial action activities conducted at the site as part of the overall IM;
  - Descriptions of field operations, including quantity of soil removed, quantity of soil backfilled, number of soil borings or monitoring wells installed, quantities of materials injected into the subsurface, and quantity of wastes generated;
  - Documentation of disposal volumes, manifests, and bills of lading;
  - Maps with surveyed excavation footprints and locations of surveyed confirmation samples, including monitoring wells; and
  - Photographs showing site conditions and/or typical operations.
- Summaries of results, including:
  - A discussion of the chemical sampling efforts, including the results of all delineation sampling, and associated maps and tables; and
  - Explanation of data validation efforts.
- Summaries of problems encountered, including:
  - Explanation and description of any modifications to the IM Work Plan, and why the modification was necessary.
- Summaries of accomplishments and/or effectiveness of IMs, including:
  - A discussion of the confirmation/compliance sample analytical results; and
  - Recommendations, as appropriate, for disposition of the site(s) under the Holloman AFB RCRA Part B Permit.
- Copies of relevant laboratory/monitoring data, etc., including:
  - Pertinent field data, sampling sheets, and laboratory results in appendices.

This page intentionally left blank

5.0 PROJECT SCHEDULE

A preliminary project schedule for the overall anticipated sequence of IM activities is presented in **Figure 5-1**. The schedule is dependent on many independent factors including, but not limited to, USAF and NMED review and comment, subcontractor availability, weather, and site conditions.

USAF and NMED will be notified 30 days prior to the start of IM field activities. Additionally, during IM implementation, brief daily status reports may be submitted to Environmental representatives at Holloman AFB by electronic mail. These reports will summarize the previous day's activities, the planned activities for the following day, and other pertinent information.

As a general rule, IM will proceed quickly from site delineation to remediation within the same mobilization, if feasible. The IM implementation schedule will allow for evaluation of screening-level data collected during delineation to formulate a more detailed remedial approach specific to the site. Following implementation of the site-specific IM remedy, compliance and confirmation sample collection will begin. Post-remedy groundwater sample collection (e.g., monthly or quarterly) may be conducted to monitor IM effectiveness at the site and augment the implemented remedial actions with additional remediation if deemed necessary to achieve the IM objectives.

Upon successful completion of the IM, the IM Report will be submitted for review and approval of CAC without controls status.

This page intentionally left blank

6.0 REFERENCES

Basabilvazo, G.T., Myers, R.G., and Nickerson, E.L. 1994. Geohydrology of the High Energy Laser System Test Facility Site, White Sands Missile Range, Tularosa Basin, south- central New Mexico: U.S. Geological Survey Water-Resources Investigations Report 93-4192, 59 p.

Derr, Phillip S. *Soil Survey of Otero Area, New Mexico, Parts of Otero, Eddy, and Chaves Counties.* Soil Conservation and Forest Service incooperation with the New Mexico State University Agricultural Experiment Station, 1981.

Foster Wheeler Environmental Corporation (Foster Wheeler). 2002. Draft Report for the Remedial Investigation of DP-63—Disposal Pit 63, Holloman Air Force Base, New Mexico. December.

NationView/Bhate JV III, LLC (NationView). 2011. Basewide Background Study Report, Holloman Air Force Base, New Mexico. Contract No. W9128F-07-D-0022. Task Order No. 0003. July.

New Mexico Administrative Code (NMAC). 2013a. Title 20 Environmental Protection. Chapter 6. Water Quality. Part 2. Ground and Surface Water Protection. 20.6.2. Standards for Ground Water of 10,000 mg/l TDS Concentration or Less.

NMAC. 2013b. Title 20 Environmental Protection. Chapter 4. Hazardous Waste. Part 1. Hazardous Waste Management Regulations. 20.4.1. Adoption of 40 CFR Part 260.

New Mexico Environment Department (NMED). 2001. Use of Low-Flow and Other Non-Traditional Sampling Techniques for RCRA Compliant Groundwater Monitoring. Hazardous Waste Bureau. Santa Fe, New Mexico. October.

NMED. 2004. Holloman Air Force Base RCRA Permit No. NM6572124422. February.

NMED. 2011a. "Partial Approval, Basewide Background Study Report, January 2009, Holloman Air Force Base, USEPA ID# NM6572124422, HWB-HAFB-09-004," letter to D. Scruggs, Chief, Environmental Restoration Program, Holloman Air Force Base from J.E. Kieling, Acting Chief, Hazardous Waste Bureau, New Mexico Environment Department, August 12.

NMED. 2011b. Monitoring Well Construction and Abandonment Guidelines. Ground Water Quality Bureau. Santa Fe, New Mexico. March.

NMED. 2012a. Notice of Public Comment Period and Intent to Approve a Class 3 Permit Modification to the Holloman Air Force Base hazardous Waste Facility Permit, October 29, 2012.

NMED. 2012b. Risk Assessment Guidance for Site Investigations and Remediation, Volume 1, Tier 1: Soil Screening Guidance Technical Background Document. Hazardous Waste Bureau and Ground Water Quality Bureau Voluntary Remediation Program. Santa Fe, New Mexico. February.

NMED. 2014. "Approval, Voluntary Corrective Measure Request Group 2, Five Former Underground Storage Tank Sites, Holloman Air Force Base, EPA ID# NM6572124422, HWB-HAFB-12-004," letter to D. Rothhaupt, Chief, Compliance and Restoration,

Holloman Air Force Base from J.E. Kieling, Chief, Hazardous Waste Bureau, New Mexico Environment Department, January 21.

New Mexico Statutes Unannotated (NMSA).1983. Chapter 74 Environmental Improvement. Article 4. Hazardous Wastes. 74-4-1. Hazardous Waste Act.

New Mexico Water Quality Control Commission (NMWQCC). 2006. 2004-2006 State of New Mexico Integrated Clean Water Act §303(D)/§305(B) Report.

Shaw Environmental & Infrastructure, Inc. (Shaw). 2011. Working Copy Voluntary Corrective Measures Request, Group 2 - Five Former Underground Storage Tank Sites, Holloman Air Force Base, Contract No. FA8903-09-D-8580, Task Order No. 0013, Project No. 144106, Rev. 0, December 2011.

Shaw. 2012. Final Voluntary Corrective Measures Request, Group 3 - Nine Former Underground Storage Tank Sites, Holloman Air Force Base, Contract No. FA8903-09-D-8580, Task Order No. 0013, Project No. 144106, Rev. 0, February 2012.

Shaw. 2013. *Sample Completion Report, Group 23 – Five Former UST Sites, Holloman Air Force Base, New Mexico*, Contract No. FA8903-09-D-8580, Task Order No. 0013, Project No. 144106, Rev. 0. March.

United States Air Force (USAF). 2013. Holloman Air Force Base official website. http://www.holloman.af.mil/. Accessed 12/3/2013.

United States Census Bureau (U.S. Census). 2010. Census 2010 using American FactFinder. http://factfinder2.census.gov. Accessed 12/3/2013.

U.S. Environmental Protection Agency (USEPA). 2013. USEPA Regional Screening Level (RSL) Chemical-specific Parameters Supporting Table. November. Accessed online at: http://www.epa.gov/region9/superfund/prg/.

USEPA. 2010. Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, SW-846. 3rd ed. Including all promulgated updates and new methods. July 2010.

USEPA. 1992. Resource Conservation and Recovery Act Ground-Water Monitoring. Technical Enforcement Guidance Document. November.

United States Geological Survey (USGS). 2003. Geologic map of New Mexico.

URS Group, Inc. (URS). 2009. Volume II, Final Evaluation Report, Holloman Air Force Base, Identification and Evaluation of Defense Environmental Restoration Account Eligibility. Contract No. W912QR-04-D-0025, Task Order DS03. September.

URS, 2013. Meeting Minutes: Project Kickoff with NMED. 16 December.

URS. 2014a. Draft Final Interim Measures Work Plan - Group 3 Former Underground Storage Tank Sites: AOC-UST-221 (TU503), AOC-UST-298 (TU508), AOC-UST-901 (TU506), and AOC-UST-7003 (TU518), Holloman Air Force Base, New Mexico. Contract No.: FA8903-13-C-0008. March 2014.

URS. 2014b. Meeting Minutes: Interim Measures at TU-Sites. 19 June.

URS. 2014c. Technical Memorandum – Interim Measures Supplemental Plan Documents For TU-Sites. Holloman Air Force Base, New Mexico. Contract No.: FA8903-13-C-0008. *{In Progress}*

Weir, Jr., James E. *Geology and Availability of Ground Water in the Northern Part of the White Sands Missile Range and Vicinity New Mexico.* U.S Geological Survey and U.S. Department of interior, 1965.

Western Regional Climate Center. 2013. Desert Research Institute State Narrative Web Page, http://www.wsmr.army.mil/paopage/Pages/WU%2360.htm. Accessed 12/3/2013.

This page intentionally left blank

Figures

Appendix A
Meeting Minutes
Interim Measures at TU-Sites. 19 June 2014