Final
MEC Investigation Work Plan
Parcel 11
Revision 1.0

Fort Wingate Depot Activity
McKinley County, New Mexico

June 6, 2025

Contract No.: W912PP22D0014
Task Order: W912PP23F0040

Prepared for:

U.S. Army Corps of Engineers
Albuquerque District
4101 Jefferson Plaza NE
Albuquerque, NM 87109-3435

Prepared by:
Parsons
999 18th St., Suite 1555N
Denver, CO 80202

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Parsons Government Services, Inc.
999 18th St., Suite 1555N
Denver, CO 80202

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United States Army Corps of Engineers, Albuquerque District
4101 Jefferson Plaza NE
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Project Manager: Alan Soicher, PG (CESPA)

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This MEC Investigation Work Plan describes additional investigation activities within Parcel 11 at Fort Wingate Depot Activity, McKinley County, New Mexico. This document has been prepared for submission to the New Mexico Environment Department (NMED) Hazardous Waste Bureau (HWB), as required by Section VII.F.1 of the Resource Conservation and Recovery Act (RCRA) Permit, No. NM6213820974

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Fort Wingate Depot Activity, McKinley County, NM

40 CFR 270.11

June 2025

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with 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.

Cheryl Frischkorn

Ms. Cheryl Frishkorn
Base Realignment and Closure Division (BRAC), Environmental Coordinator
Fort Wingate Depot Activity, BRAC Operations Branch
DCS G-9, Environmental Division

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Notes:

BIA	=	Bureau of Indian Affairs
BIA-NRO	=	Bureau of Indian Affairs – Navajo Regional Office
BRAC	=	U.S. Army Base Realignment and Closure Division
COR	=	Contracting Officer's Representative
EPA	=	U.S. Environmental Protection Agency
FWDA BEC	=	Fort Wingate Depot Activity Base Realignment and Closure Environmental Coordinator
NM	=	New Mexico
NMED HWB	=	New Mexico Environment Department, Hazardous Waste Bureau
NN	=	Navajo Nation
OH	=	Ohio
USACE	=	U.S. Army Corps of Engineers

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EXECUTIVE SUMMARY

ES.1 EXECUTIVE SUMMARY INTRODUCTION

This Munitions and Explosives of Concern (MEC) Investigation Work Plan was prepared by the Army for submission to the New Mexico Environment Department (NMED) Hazardous Waste Bureau (HWB), as required by Section VII.H.1.a of Resource Conservation and Recovery Act (RCRA) permit NM 6213820974 for the Fort Wingate Depot Activity (FWDA) (Permit) effective December 1, 2005, and last revised February 2015 (NMED, 2015).

ES.2 PURPOSE AND SCOPE

This MEC Investigation Work Plan contains investigative information for two areas in Parcel 11:

- Solid Waste Management Unit (SWMU) 10 – Sewage Treatment Plant (approximately 17.5 acres), and
- The Administration Area survey area (approximately 36.5 acres). The Administration Area survey covers areas in Parcel 11 where the storage or transport of munitions may have resulted in MEC contamination and includes the following SWMUs and Areas of Concern (AOCs):
    - SWMU 3 – Fenced Storage Yard (also known as the Former Storage Yard or Defense Reutilization and Marketing Office (DRMO) Area, or Extended Storage Yard, or Former Coal Storage Area),
    - SWMU 5 – Building 5 (Regimental Garage),
    - SWMU 6 – Former Building 11 (Former Locomotive Shop),
    - SWMU 23 – Building 8 (Paint Shop or Carpenter Shop) and Building 7 (Paint Shop and Paint Storage Warehouse),
    - SWMU 24 – Building 15 (Garage and Storage Building),
    - SWMU 37 – Building 9 (Machine Shop and Signal Shop),
    - SWMU 40 – South Administration Area (Building 10, Building 12, Building 13, Building 14, Former Building 29, and Structure 63)
    - SWMU 45 – Building 6 (Gas Station),
    - SWMU 50 – Former Structure 35 (Former UST No. 7 located near Building 45),
    - AOC 46 – Above ground storage tank (AST) located near Former Building 11,
    - AOC 47 – TPL, Incorporated (TPL) spill of photoflash powder west of Former Building 11,
    - AOC 48 – Building 34 (Fire Station),
    - AOC 49 – Structure 38 (End Loading Dock) and Structure 39 (Side Loading Dock),
    - AOC 51 – Structure 64 (Former UST near Former Building 11),
    - AOC 52 – Building 79 and Building 80 (Storage Vaults), and
    - AOC 75 – Former electrical transformer locations within Parcel 11.

The purpose of this MEC Investigation Work Plan is to describe the procedures to be followed to conduct a MEC investigation in Parcel 11 as recommended by the U.S. Army (the Army) in the Parcel 11 RCRA Facility Investigation (RFI) Report (USACE, 2014). The purpose and scope of the planned MEC investigation are to:

1. Confirm the presence of MEC within and adjacent to SWMU 10, define the vertical extent of contamination, and confirm that MEC contaminated areas have been fully surveyed;
2. Determine the presence/absence of MEC within the 36.5-acre Administration Area survey area and define the vertical extent of contamination, if present;
3. Determine if MEC have released munitions constituents (MC) into the soil;
4. Assess potential risks to human health;
5. Determine the necessity of future remedial action; and
6. Provide a dig list to be used in a future remedial action if action is deemed necessary.

ES.3 PROPOSED INVESTIGATIONS

Thousands of munitions debris (MD) items have been recovered from SWMU 10 and the surrounding area during previous investigations, and two MD items were found in an area adjacent to the buildings/structures that comprise SMWU 40 within the proposed Administration Area survey area. Following the MD recoveries, geophysical investigations were performed in and/or adjacent to both SWMUs in 2009, and numerous geophysical anomalies representing subsurface metal were identified in the collected data. None of the identified anomalies were investigated to determine their sources.

The 2009 surveys are now approximately 15 years old and were collected using an EM61-MK2 time domain metal detector (EM61), which was a standard sensor used for MEC surveys at the time. In addition to the limited applicability of data collected in 2009 for identifying targets for potential remedial actions over 15 years later, sensors developed since 2009 are more capable than the EM61 for resolving precise locations of subsurface sources, especially in high anomaly density areas. Newer sensors can also be used to classify subsurface sources as potential MEC or as non-hazardous clutter. Additionally, large geophysical anomalies potentially indicative of subsurface MEC appear to extend outside of the existing EM61 datasets. New geophysical data will be collected using an advanced geophysical classification (AGC) sensor, the UltraTEM Portable Classifier (UltraTEM), over the previous EM61 survey areas and over additional areas where digital geophysical data has not been collected yet.

UltraTEM data will be evaluated to identify locations of subsurface sources potentially representing MEC and dig lists will be compiled for the SWMU 10 and Administration Area surveys based on anomaly locations and classification decisions (i.e., potential MEC vs non-hazardous clutter). A subset of the recommended digs will be intrusively investigated to confirm the presence of MEC in and adjacent to SWMU 10 and to determine the presence/absence of MEC in the 36.5-acre Administration Area survey area. Because saturated response areas (SRAs; anomalies with areal extents > 10 square meters [m^2]) appear to extend past the boundary of the EM61 data collected adjacent to SWMU 10, the collected UltraTEM data will be evaluated to confirm that these areas are fully delineated by the new data. If SRAs extend past the added buffer area, the project team will determine the necessity of expanding the survey outside of the currently planned boundary. The 2009 geophysical surveys in the Administration Area survey area were limited to approximately 2.1 acres of non-contiguous area adjacent to SWMU 40 buildings and structures. The Parcel 11 MEC investigation will include approximately 36.5 acres of Parcel 11 area where the storage or transport of munitions may have resulted in MEC contamination, including the previous survey areas adjacent to SWMU 40.

If MEC is encountered a soil sample will be collected beneath the location of each MEC item to determine if MC has been released to soil.

The Army will conduct the RFI activities in accordance with this RFI Work Plan once approved by NMED and reflected in the RCRA permit (NMED, 2015). The RFI is divided into the following nine sections:

- **Section 1** is an introduction to this MEC Investigation Work Plan.
- **Section 2** provides background information for Parcel 11.
- **Sections 3 and 4** provide details from data obtained during previous investigations and summarize the proposed investigation activities for SWMU 10 and the Administration Area survey area.
- **Section 5** describes the investigation methods.
- **Section 6** describes the risk assessment process for the MEC Investigation Report.
- **Section 7** provides the Waste Management Plan
- **Section 8** provides the schedule.
- **Section 9** provides references for the documents cited in the text.

ES.4 RISK EVALUATION AND REPORTING

The results of the intrusive investigations will be used to perform a qualitative MEC exposure pathway risk assessment evaluating explosive hazards to human receptors. This baseline risk assessment will be performed consistent with the Office of the Secretary of Defense Memorandum dated 14 July 2023 and titled, *Military Munitions Response Program Risk Management Methodology*.

A MEC Investigation Report will be developed to document the findings of the MEC investigation, including the nature and extent of MEC contamination (or lack thereof) in SMWUs 10 and the Administration Area survey area and overall investigation conclusions. If MEC or significant quantities of MD are found, recommendations will be provided for additional activities to be conducted in the next phase of work. While intrusive investigation during this investigation will be limited relative to the number of expected anomalies, the locations of all anomalies representing potential subsurface MEC items within both survey areas will be available for any necessary subsequent investigation.

If MEC is encountered a soil sample will be collected beneath the location of each MEC item to determine if MC has been released to soil. If a release of MC from a MEC item is confirmed, either further evaluation to determine the extent of contamination and potential risk, or removal of contaminated soil will be recommended.

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ACRONYMS AND ABBREVIATIONS

°C	degree(s) Celsius
°F	Degrees Fahrenheit
µV/A	Microvolts per ampere
AGC	Advanced geophysical classification
AHA	Activity Hazard Analysis
AOC	Area of concern
APP	Accident Prevention Plan
Army	U.S. Army
AST	Above ground storage tank
atm-m3/mol	Atmospheres – cubic meter(s) per mol
AUF	area use factor
BEC	(FWDA) Base Realignment and Closure Environmental Coordinator
BIA	Bureau of Indian Affairs
BIA-NRO	Bureau of Indian Affairs – Navajo Regional Office
BRAC	Defense Base Realignment and Closure Act
BRACD	BRAC Division
CA	Corrective action
CAMU	Corrective Action Management Unit
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
cm	Centimeter(s)
cm bgs	Centimeter(s) below ground surface
COC	chain-of-custody
COPC	chemical of potential concern
COR	Contracting Officer's Representative
CSM	Conceptual site model
DAF	dilution attenuation factor
DDESB	Department of Defense Explosives Safety Board
DGM	Digital geophysical mapping
DI	deionized
DMM	Discarded military munitions
DoD	Department of Defense
DOI	U.S. Department of the Interior
DQO	Data quality objective
DRMO	Defense Reutilization and Marketing Office
DRO	diesel-range organics
DUA	Data usability assessment
EDD	electronic data delivery
EM61	EM61-MK2 time domain metal detector
EPC	exposure point concentration
ESP	Explosives Site Plan
FWDA	Fort Wingate Depot Activity
ft	Foot/feet
g/mol	gram(s) per mol
GIS	Geographic information system

ACRONYMS AND ABBREVIATIONS (Continued)

GPS	Global Positioning System
HE	High explosive
HI	hazard index
HQ	hazard quotient
HWB	Hazardous Waste Bureau
ID	Identification (number)
IDW	investigation-derived waste
ITS	Instrument test strip
ISO	Industry standard object
IVS	Instrument Verification Strip
LCS	laboratory control sample
LOQ	limit of quantitation
m	Meter(s)
m^2	square meter(s)
m/s	Meters per second
MC	Munitions constituents
MCL	maximum contaminant level
MD	Munitions debris
MDAS	Material documented as safe
MEC	Munitions and Explosives of Concern
MGFD	Munition with the greatest fragmentation distance
mL	milliliter
mm	Millimeter
MPC	Measurement performance criteria
MPPEH	Material potentially presenting an explosive hazard
MQO	Measurement quality objective
MS	matrix spike
MSD	matrix spike duplicate
MSD	Minimum separation distance
MSL	Mean Sea level
mV	Millivolt(s)
NEU	No evidence of use
NM	New Mexico
NMED	New Mexico Environment Department
NN	Navajo Nation
NOAEL	no adverse effect level
NRCS	Natural Resources Conservation Service
OB/OD	Open Burning/Open Detonation (Area)
OH	Ohio
OESS	Ordnance and Explosives Safety Expert
OSD	Office of the Secretary of Defense
OSHA	Occupational Safety and Health Administration
Permit	RCRA Permit NM 6213820974, effective December 1, 2005, Revised February 2015

ACRONYMS AND ABBREVIATIONS (Continued)

PPE	Personal protective equipment
QA	Quality assurance
QC	Quality control
QSM	Quality Systems Manual
RCA	Root cause analysis
RCRA	Resource Conservation and Recovery Act
RFI	RCRA Facility Investigation
RMM	Risk management methodology
RPD	relative percent difference
RRD	Range-related debris
RSL	Regional Screening Level
RTK	Real-time kinematic
SDG	sample delivery group
SEDD	Staged Electronic Data Deliverables
SLAM	Simultaneous localization and mapping
SLHQ	screening level hazard quotient
SL-SSL	soil leachate-based Soil Screening Level
SNR	Signal to noise ratio
SRA	Saturated response area
SRHI	Summary Report of Historical Information
SSHP	Site Safety and Health Plan
SSL	Soil Screening Level
STP	Sewage Treatment Plant
SUXOS	Senior UXO Supervisor
SWMU	Solid waste management unit
TAL	Target Analyte List
TEAD	Tooele Army Depot
TNT	Trinitrotoluene
TOI	Target of interest
TPL	TPL, Incorporated
TPMC	TerranearPMC
TP-T	Target practice – tracer
TRV	toxicity reference value
TSD	Team separation distance
UltraTEM	UltraTEM Portable Classifier
U.S.	United States
USACE	U.S. Army Corps of Engineers
USEPA	U.S. Environmental Protection Agency
UST	Underground storage tank
UXO	Unexploded ordnance
UXOSO/SSHO	UXO Safety Officer/Site Safety and Health Officer

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1.0 INTRODUCTION

This Munitions and Explosives of Concern (MEC) Investigation Work Plan describes investigation activities to be completed within Parcel 11 at Fort Wingate Depot Activity (FWDA), in McKinley County, New Mexico (**Figures 1.1 and 1.2**).

This MEC Investigation Work Plan has been prepared by the United States (U.S.) Army for submission to the New Mexico Environment Department (NMED) Hazardous Waste Bureau (HWB), as required by Section VII.H.1.a of the Resource Conservation and Recovery Act (RCRA) Permit (Permit) (NM 6213820974) for the FWDA, which became effective December 31, 2005, and was most recently modified in February 2015 (NMED, 2015).

This MEC Investigation Work Plan summarizes previous MEC investigations performed in Parcel 11 and describes the MEC investigation to be completed to determine the nature and extent of MEC contamination within the Parcel as recommended in the *Final RCRA Facility Investigation Report Parcel 11, Revision* 2.0, dated May 23, 2014 (U.S. Army Corps of Engineers [USACE], 2014).

1.1 PURPOSE AND SCOPE

The purpose of this MEC Investigation Work Plan is to describe the procedures to be followed to conduct a MEC investigation in and/or adjacent to Solid Waste Management Unit (SWMU) 10 and an approximately 36.5-acre area covering the non-SWMU 10 SWMUs and Areas of Concern (AOCs) in Parcel 11 as recommended by the Army in the Parcel 11 RCRA Facility Investigation (RFI) Report (USACE, 2014). Thousands of munitions debris (MD) items have been recovered in and adjacent to SWMU 10 during previous investigations, and two MD items were found adjacent to the buildings/structures that comprise SMWU 40 in the Administration Area survey area. Following the MD recoveries, geophysical investigations were performed in and/or adjacent to both SWMUs in 2009, and numerous geophysical anomalies representing subsurface metal were present in the collected data. None of the identified anomalies were investigated to determine their sources.

The 2009 surveys were performed using an EM61-MK2 time domain metal detector (EM61), which was a standard sensor used for MEC surveys at the time. However, sensors developed since 2009 are more capable of resolving precise locations of subsurface sources, especially in high anomaly density areas, and can be used to classify subsurface sources as potential MEC or as non-hazardous clutter. For this reason, they are referred to as advanced geophysical classification (AGC) sensors. Following any necessary vegetation clearance and a surface sweep, an AGC sensor, the UltraTEM Portable Classifier (UltraTEM), will be used to perform geophysical surveys in and/or adjacent to SMWU 10 and the 36.5-acre Administration Area survey area to update the geophysical record using a more advanced sensor than was used in 2009. Because areas of high anomaly density seemingly extended outside of the EM61 survey boundary in 2009, the SWMU 10 survey will cover a larger area than the 2009 survey to confirm that all saturated response areas (SRAs; anomalies with areal extents > 10 square meters [m^2]) that appear to be present in the 2009 data are fully delineated by the new data (see **Figure 3.1**). If SRAs extend past the added buffer area, the project team will determine the necessity of expanding the survey outside of the currently planned boundary. The 2009 geophysical surveys in the Administration Area survey area were limited to approximately 3.5 acres of non-contiguous area adjacent to SWMU 40 buildings and structures. The Parcel 11 MEC investigation will expand the survey area to cover approximately 36.5 acres of the Administration Area (see **Figure 4.1**).

Tables 1.1 and 1.2 include the list of known and suspected munitions for the SWMU 10 and Administration Area investigation areas, respectively. These are based on munitions recovered during previous investigations at SWMU 10 and during utility trenching adjacent to one of the SWMU 40 buildings in 1998. **Tables 1.1 and 1.2** also contain the UltraTEM expected detection depths for each munition listed.

Collected AGC data will be evaluated to identify the locations of subsurface sources potentially representing MEC. Dig lists will be compiled for SWMUs 10 and the Administration Area survey area in Parcel 11. A total of 600 digs is proposed for the MEC investigation with the intent to split digs between Parcel 11 and Parcel 22 as necessary to accomplish site characterization. It was determined that approximately 300 digs at each Parcel would be sufficient to determine the nature and extent of contamination. Items included on the dig list may include classified TOI, inconclusive sources, and sources representing potential MD that would be indicative of the types of munitions present.

A MEC Investigation Report will be developed to document the findings of the MEC investigation, including the nature and extent of MEC contamination (or lack thereof) in SMWU 10 and the Administration Area survey area, and overall investigation conclusions. If MEC is found, recommendations will be provided for additional activities to be conducted in the next phase of work. While intrusive investigation during this investigation will be limited relative to the number of expected anomalies, the locations of anomalies representing potential subsurface MEC items within both survey areas will be available for any necessary subsequent investigation.

If MEC is encountered a soil sample will be collected beneath the location of each MEC item to determine if MC has been released to soil. If a release of MC from a MEC item is confirmed, either further evaluation to determine the extent of contamination and potential risk, or removal of contaminated soil will be recommended.

To summarize, the purpose and scope of this MEC Investigation Work Plan are to:

- Describe the procedures to be followed to conduct a MEC investigation in Parcel 11 as recommended by the Army in the Parcel 11 RFI Report (USACE, 2014),
- Determine the presence/absence of MEC within Parcel 11 and define the horizontal and vertical extent of contamination, if present,
- Determine if MEC have released MC into soil,
- Assess potential risks to human health,
- Determine the necessity of future remedial action, and
- Provide a dig list to be used in any necessary future remedial action.

1.2 PARCEL 11 BACKGROUND INFORMATION

Complete background information regarding FWDA and Parcel 11 is provided in numerous documents previously submitted to NMED, including the following:

- *Summary Report of Historical Information (SRHI), Parcel 11, Fort Wingate Depot Activity* (TerranearPMC [TPMC], 2009a), which serves as a companion to the RFI Work Plan (TPMC, 2009b),
- *RCRA Facility Investigation Work Plan, Parcel 11, Final, Fort Wingate Depot Activity* (hereafter referred to as the RFI Work Plan, TPMC, 2009b),
- RFI Report, Revision 2.0 (USACE, 2014), and
- *Final RFI Phase 2 Work Plan for MEC, Parcel 11 SWMU 40 and SWMU 10 MEC Removal Action* (PIKA, 2016).

The SRHI provides a listing of site surveys, data compilation efforts, operational history, site or facility drawings, and environmental investigations that have been contained in previously completed reports and are pertinent to sites now considered to be within Parcel 11. Additionally, the SRHI summarizes findings and conclusions from the relevant historical site investigation efforts.

The FWDA installation has been divided into reuse parcels as part of the planned property transfer to the U.S. Department of the Interior (DOI). **Figure 1.2** presents a Parcel Location Map showing the location of Parcel 11, which contains the majority of buildings and structures that made up the Administration Area (see **Figure 1.3**). The Permit lists 10 SWMUs and seven AOCs within Parcel 11. These are:

- SWMU 3 – Fenced Storage Yard (also known as the Former Storage Yard or Defense Reutilization and Marketing Office (DRMO) Area, or Extended Storage Yard, or Former Coal Storage Area),
- SWMU 5 – Building 5 (Regimental Garage),
- SWMU 6 – Former Building 11 (Former Locomotive Shop),
- SWMU 10 – Sewage Treatment Plant
- SWMU 23 – Building 8 (Paint Shop or Carpenter Shop) and Building 7 (Paint Shop and Paint Storage Warehouse),
- SWMU 24 – Building 15 (Garage and Storage Building),
- SWMU 37 – Building 9 (Machine Shop and Signal Shop),
- SWMU 40 – South Administration Area (Building 10, Building 12, Building 13, Building 14, Former Building 29, Structure 63,
- SWMU 45 – Building 6 (Gas Station), and
- SWMU 50 – Former Structure 35 (Former UST No. 7 located near Building 45).
- AOC 46 – Above ground storage tank (AST) located near Former Building 11,
- AOC 47 – TPL, Incorporated (TPL) spill of photoflash powder west of Former Building 11,
- AOC 48 – Building 34 (Fire Station),
- AOC 49 – Structure 38 (End Loading Dock) and Structure 39 (Side Loading Dock),
- AOC 51 – Structure 64 (Former UST near Former Building 11),

- AOC 52 – Building 79 and Building 80 (Storage Vaults), and
- AOC 75 – Former electrical transformer locations within Parcel 11.

Although Parcel 11 only contains six of the 15 sub-sites included in SWMU 40 – South Administration Area (i.e., Building 10, Building 12, Building 13, Building 14, Former Building 29, and Structure 63), all of the planned survey areas adjacent to the buildings/structures that comprise SWMU 40 are within Parcel 11.

Characterization activities for the RFI were conducted in 2009 and 2010 in accordance with the NMED approved RFI Work Plan (TPMC, 2009b). Activities for the RFI were detailed in the Final RFI Report, Revision 1.0, dated March 29, 2013 (USACE, 2013b), which was approved with modifications in September 2013. The modified Final RFI Report, Revision 2.0, was issued May 23, 2014 (USACE, 2014). The MEC investigation activities described in this MEC Investigation Work Plan have been developed to address the Army recommendations contained in the RFI Report (USACE, 2014) as well as the comments received from NMED.

Based on the RFI Report (USACE, 2014), additional MEC investigation is required in areas in and adjacent to two SWMUs:

- SWMU 10 – Sewage Treatment Plant, and
- SWMU 40 – South Administration Area.

In addition to the areas surrounding the SWMU 40 buildings and structures, the 36.5-acre Administration Area survey area will cover additional area where the storage or transport of munitions may have resulted in MEC contamination.

2.0 BACKGROUND

This section summarizes historical information and previous investigations at Parcel 11 as documented in the approved *RCRA Facility Investigation Work Plan, Parcel 11, Final* (TPMC, 2009b), *Summary Report of Historical Information, Parcel 11* (TPMC, 2009a), and the *Final RCRA Facility Investigation Report, Parcel 11, Revision 2.0* (USACE, 2014).

2.1 GENERAL DESCRIPTION

The FWDA installation (the installation) is located approximately eight miles east of Gallup, New Mexico, and currently occupies approximately 15,277 acres of land in McKinley County, New Mexico. **Figure 1.1** presents a regional map showing the location of FWDA. The installation is mostly surrounded by federally owned or administered lands, including national forest and tribal lands. The installation can be divided into several sub areas based on location and historical land use. The major land use areas include the following:

- The Administration Area – encompassing approximately 800 acres in the northern portion of the installation, which contains former office facilities, housing, equipment maintenance facilities, warehouse buildings, and utility support facilities.
- The Workshop Area – which encompasses approximately 700 acres south of the Administration Area, consisted of an industrial area containing ammunition maintenance and renovation facilities, the trinitrotoluene (TNT) washout facility, and the TNT leach beds area. The buildings and other structures were demolished in 2010.
- Ten Munitions Storage Areas (Igloo Blocks A through H, J, and K) – encompassing approximately 7,400 acres in the central portion of the installation. This area has 732 earth-covered magazines (igloos), and 241 earthen revetments previously used for the storage of munitions.
- The Open Burning/Open Detonation (OB/OD) Area – encompassing approximately 1,800 acres in the west-central portion of the installation, which is separated into two sub areas based on the period of operation: the Closed OB/OD Area and the Current OB/OD Area (which is subject to active remediation).
- Protection and Buffer Areas – encompassing approximately 4,050 acres located adjacent to the eastern, western, and northern installation boundaries, which consists of buffer zones surrounding the former magazine and demolition areas.

The installation was originally established by the U.S. Army in 1862 at the southern edge of the Navajo territory. In 1918, the mission of FWDA changed from tribal activities to World War I related activities. Beginning in 1940, FWDA's mission was primarily to receive, store, maintain, and ship explosives and military munitions, as well as to disassemble and dispose of unserviceable or obsolete explosives and military munitions. In 1975, the installation came under the administrative command of Tooele Army Depot (TEAD), located near Salt Lake City, Utah.

In January 1993, the active mission of FWDA was ceased, and the installation was closed as a result of the Defense Base Realignment and Closure Act of 1990 (BRAC). Beginning in 2002, the Army reassigned many FWDA functions to the BRAC Division (BRACD), including caretaker duties, property transfer, and performance of environmental compliance and remediation activities. Command and control responsibilities were retained by TEAD until January 31, 2008, when these responsibilities were transferred to White Sands Missile Range (TPMC, 2009a).

The installation is currently undergoing environmental characterization and remediation activities prior to final property transfer and reuse. Since the 1980s, when FWDA became subject to Permit requirements, it has transferred 8,351 acres to the DOI.

2.2 SITE CONDITIONS

Site conditions described below are primarily obtained from the 2014 RFI Report (USACE, 2014).

2.2.1 Climate

FWDA is located within the southern portion of the Colorado Plateau, in the Northwestern Plateau climate division of New Mexico. This region overall has a semiarid continental climate, and alternates seasonally and topographically from hot and dry, to cool and wet. Average annual precipitation for Gallup, New Mexico, and the surrounding area is approximately 12 inches of rainfall; the average snowfall amount is 35 inches. According to U.S. climate data accessed in 2019, most precipitation occurs during monsoon season from July through October, with minimal precipitation in the spring and late fall.

Average seasonal temperatures vary by elevation and topographic features, with the hottest temperatures occurring in the lower elevations (northern area) in the spring and summer months, and the lowest temperatures occurring in the higher elevations in the winter. The maximum temperature in 2019 was recorded in August as 97 degrees Fahrenheit (°F), and the lowest temperature recorded in February as -12.8°F, giving an overall range across the year of 109.8°F. Temperature fluctuations within FWDA can also vary as much as 20°F from sunrise to sunset, particularly in the late winter to early spring months.

2.2.2 Topography

Topography and surface water features facility-wide are shown in **Figure 2.1**. Parcel 11 topography is shown in **Figure 2.2.**

Topographically, FWDA may be divided into three areas: (1) the rugged north-to-south trending Hogback along the western and the southwestern boundaries; (2) the northern hillslopes of the Zuni Mountain Range in the southern portion; and (3) the alluvial plains marked by bedrock remnants in the northern portion of the installation. The Hogback area is formed by interbedded Mesozoic sedimentary rocks dipping sharply to the west and is dissected by northeastern-trending intermittent streams. During rainfall and snowmelt events, streams transport sediment to low-lying areas in the northern part of the installation, creating an extensive alluvial deposit among remnants of bedrock. The streams eventually discharge to the South Fork of the Puerco River near the northern boundary of FWDA.

The elevation of FWDA ranges from approximately 8,200 feet above mean sea level (MSL) in the south to 6,660 feet above MSL in the north. Main drainages, following the topography, flow from south to north and discharge to the South Fork of the Puerco River. However, many tributaries follow the regional trend, flowing from southwest to northeast. Because of the nature of precipitation in this semi-arid region, the surface drainage is relatively shallow near headwaters.

Downward erosion intensifies as the stream moves downstream, resulting in a system of well-developed steep-walled arroyos. Arroyos form because of the erodibility of localized areas of silt- and clay-rich bedrock.

As shown in **Figure 2.2**, Parcel 11 is relatively flat. Surface runoff during rainfall /snowmelt events generally enters the Administration Area stormwater system and discharges via ditches to the Rio Puerco River located to the north of Parcel 11 or pools and infiltrates or evaporates in other areas. No surface water bodies or intermittent stream channels exist within Parcel 11.

2.2.3 Vegetation/Habitat

The vegetation cover types for Parcel 11 include moderate grasslands and sagebrush. Parcel 11 provides habitat for antelope, prairie dogs, rattlesnakes, field mice, various other insects, and animals, and occasionally mountain lions, elk, and bear. Wetland environments and aquatic habitats do not occur in Parcel 11.

2.2.4 Soils

The soils found on the installation are similar to those occurring in cool plateau and mountain regions of New Mexico. The major soil types at FWDA are variants/complexes of sands, loams, clays, and rocks. These soils are relatively thin, and the parent bedrock is either at or near the surface in more than a quarter of the installation. Natural Resources Conservation Service (NRCS) soils mapping for Parcel 11 was provided in the RFI Report (USACE, 2014) and is shown in **Figure 2.3**.

As shown in **Figure 2.3**, the primary soil type in the southern portion of Parcel 11 is the Aquima-Hawaikuh silt loams (soil map unit 225; 1 to 5 % slopes), and the primary soil type in the northern portion of Parcel 11 is the Rehobeth silty clay loam (soil map unit 212; 0 to 1 % slopes) (USACE, 2014). A small area of Zia sandy loam (soil map unit 352; 1 to 5 % slopes) is present in the western portion of the parcel, and a small area of Bamac extremely gravelly sandy loam (soil map unit 566; 5 to 50 % slopes) is present on the eastern portion of the parcel (USACE, 2014).

2.2.5 Geologic Summary

FWDA is underlain primarily by Triassic mudstone and sandstone layers that dip gently to the northwest. In the western and southern portions of the installation, however, Jurassic and Cretaceous sandstone and claystone layers are exposed along the Nutria Monocline (the Hogback), which is a steeply west dipping, north trending monoclinal fold. None of the referenced rock types are particularly iron rich, which would be the primary geologic concern for the proposed geophysical surveys. Additional detail on site-specific geology (stratigraphy, structural geology, and hydrogeologic conditions) can be found in the 2014 RFI Report (USACE, 2014).

2.3 PREVIOUS INVESTIGATION SUMMARY

The environmental remediation process has been underway for more than 30 years at FWDA. In 1980, the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) guidelines began to guide environmental remediation activities at FWDA other than those in the OB/OD Area, with the U.S. Environmental Protection Agency (USEPA) Region 6 as the lead regulatory agency. In 1996, the NMED was granted regulatory authority under RCRA and became the lead regulatory agency for the facility. Activities are currently performed under the Permit issued in 2005 and revised in February 2015 (NMED, 2015).

Available historical information from prior investigations for FWDA sites that lie within what is now identified as Parcel 11 have been compiled and summarized in an SRHI (TPMC, 2009a) that serves as a companion to the approved RFI Work Plan (TPMC, 2009b). The SRHI provides a listing of site surveys, data compilation efforts, operational history, site or facility drawings, and environmental investigations that have been contained in previously completed reports and that are pertinent to sites now considered to be within Parcel 11. Additionally, the SRHI summarizes findings and conclusions from the relevant historical site investigation efforts. Summaries of prior environmental investigations pertinent to the Parcel 11 sites are also provided in the individual sections for the Parcel 11 SWMUs and AOCs within the RFI Report (USACE, 2014).

The RFI field work began on October 12, 2009, and concluded on July 16, 2010, in accordance with the RFI Work Plan (TPMC, 2009b). The RFI Work Plan was approved by NMED in an Approval with Modifications dated August 28, 2009. The results were documented in the RFI Report (USACE, 2014).

The RFI Phase 2 Work Plan for MEC for Parcel 11 (PIKA, 2016) was prepared and submitted to NMED on May 26, 2016. The main scope of the proposed work was the intrusive investigation of geophysical anomalies identified in EM61 geophysical data collected in 2009. Although the work plan was approved, the proposed work was not completed. The Parcel 11 EM61 Geophysics Report is included in the Parcel 11 RFI Report (USACE, 2014) as Appendix L. However, the geophysical data itself is not available, and the locations of the anomalies that were to be excavated during the MEC investigation proposed in the 2016 Work Plan for MEC are also not available. The EM61 data collected in 2009 is now approximately 15 years old. Even if the data was available, it would not be considered acceptable for guiding a removal action in 2025. Finally, the 2009 EM61 data does not fully cover areas potentially containing subsurface MEC in and adjacent to SWMU 10. The fieldwork proposed under this MEC Investigation Work Plan uses a newer, more advanced geophysical sensor for data collection and will cover areas in SWMU 10 that are outside the previous survey boundary.

Site-specific information for previous investigations at SWMU 10 and the Administration Area survey area within Parcel 11 is provided in **Section 3** and **Section 4**, respectively.

3.0 SWMU 10 – SEWAGE TREATMENT PLANT

3.1 BACKGROUND

To the northwest of the Administration Area, within the STP area, is an incinerator reportedly used to destroy small munitions. During previous removal actions, 20 millimeter (mm), 37mm, and 40mm projectiles have been recovered adjacent to the incinerator. A geophysical survey performed on a 7-acre area east of the incinerator in 2009 indicated the presence of subsurface metal, with areas of relatively high anomaly density present on the edges of the survey area, indicating that the 2009 survey was not large enough. The intent of this current investigation is to refine the locations of subsurface sources potentially representing MEC items in and adjacent to SWMU 10, including delineating the outer edges of the high anomaly density areas apparent in the 2009 results. A subset of the subsurface sources identified will be excavated to help determine the presence/absence of MEC.

3.1.1 Location, Description, and Operational History

SWMU 10 is the FWDA STP. SWMU 10 and its current structures are shown in **Figure 3.1**. The list of facilities associated with SWMU 10 given in Permit Attachment 8 includes Building/Structures 22, T-37, 63, 69, 70, 71, 72, 73, 74a, 74b, 74c, 74d, 82, 83, 745, the document incinerator, drainage ditch, and septic system at the STP.

The document incinerator, Building 21, is located within the fenced portion of the STP, and is the only STP building/structure believed to be associated with MEC contamination. The designed use of this incinerator is unknown, but it was likely intended to be used to incinerate dried sewage sludge. It has also reportedly been used to incinerate classified documents and based on MEC survey and clearance efforts; it was also used to incinerate military munitions containing tracer elements. The last date the incinerator was used is unknown; it was listed as inactive in 1961 (TPMC, 2009a [Appendix E]).

3.1.2 Surface and Subsurface Conditions

SWMU 10 is characterized by a flat lying ground surface with several bermed settling ponds. The ground surface is generally gravel or soil covered. Remaining STP features, including buildings, settling ponds, and fences are present and will affect geophysical survey coverage as well as data collected near metallic features.

Geologically, the site conditions for geophysical investigations are good. Geophysical data collected during previous investigation efforts have not indicated unusual geophysical conditions or an unusual quantity of ferromagnetic rocks. No obvious subsurface utilities were identified in the 2009 geophysical survey, although some may be present west of the 2009 survey area within the STP fence.

3.1.3 Preliminary MEC Conceptual Site Model

The MEC conceptual site model (CSM) for SMWU 10 is presented in **Table 3.1**. **Figure 3.1** shows the proposed geophysical survey boundary, which is considered “the site” for the purposes of the MEC investigation.

3.2 PREVIOUS INVESTIGATIONS

According to the RFI Report for Parcel 11 (USACE, 2014), prior to 1993, the area around the incinerator was littered with munitions items that had apparently been burned to set off the tracer elements. A total of 7,930 20mm and 40mm target practice – tracer (TP-T) projectiles were reportedly removed from the ground surface around the incinerator as part of an unexploded ordnance (UXO) clearance in 1993. Another ordnance and explosive clearance was conducted to a reported depth of 4 feet in 1996, covering approximately 9 acres in and around the incinerator and STP. Additional 20mm and 37mm TP-T projectiles were recovered during this operation. No MEC was reported recovered during either the 1993 or 1996 operations. All recovered items were classified as scrap and disposed/recycled off-site. It is assumed that all the clearance operations performed in 1993 and 1996 were conducted using analog sensors. There is no available record showing any digital data or the specific locations of any recovered MD. The approximate boundary of the 1993 and 1996 clearance operations is shown in **Figure 3.1**.

In 2009, a digital geophysical mapping (DGM) survey was performed outside of the STP fence line immediately to the east of the STP, the incinerator, and most of the area covered by the 1993 and 1996 clearance projects. This survey was performed using an EM61 and covered approximately 7 acres. The EM61 survey boundary is shown in **Figure 3.1**. As shown in the figure, the southwest corner of the EM61 survey area covers the southeast corner of the 1993/1996 clearance area where there is a relatively large anomalous area in the EM61 data that appears to extend outside of the 2009 survey boundary (PIKA, 2016 [Figure 5-2]). Additionally, high anomaly density areas appear to be present in the northwest corner of the survey area, the southeast corner of the survey area, and along the eastern edge. While the anomalous area in the southwest corner appears to be real and caused by subsurface metal, the other higher anomaly density areas are less clear. It is possible that these anomalies may be related to sensor or external noise rather than subsurface metal, but the actual data is unavailable for review.

The last version of the Parcel 11 Phase 2 RFI Work Plan for MEC (PIKA, 2016) indicated that a surface and subsurface removal would be performed for metallic debris the size of a 20mm projectile or larger based on the EM61 survey (7 milliVolt [mV] or higher response on EM61 channel 2). If MEC items were recovered in the large anomalous area in the southwest corner of the EM61 survey, additional excavation would be performed to locate the boundary of this anomalous area and remove any associated MEC items. The proposed intrusive investigation was never performed.

3.3 MEC DATA QUALITY OBJECTIVES

3.3.1 Step 1: State the Problem

Evidence from previous investigations suggests that MEC that poses a threat to human health may be present in Parcel 11 SWMU 10 based on the parcel's previous use for the destruction of munitions. Prior investigations determined that MD is present in the SWMU. A geophysical investigation was performed in the field east of the SWMU boundary in 2009 to identify the locations of subsurface metal with the potential to be MEC. The SWMU 10 survey was performed using an EM61, a standard DGM sensor still used for some munitions work. In addition to the prior geophysical data being over a decade old, the EM61 has generally been replaced for removal actions by newer, more advanced geophysical sensors. The newer sensors locate subsurface sources with greater accuracy and can be used to classify subsurface sources as potential MEC or non-hazardous clutter depending on the configuration of those sources. Classification is possible for full rounds and larger components such as fuzes or rocket warheads/motors but is generally not possible for smaller components that comprise munition warheads (e.g., primers, burster tubes, booster cups).

Because there is still potential unacceptable risk adjacent to SWMU 10, further study is needed to:

- Characterize the type, nature, and distribution (horizontal and vertical) of remaining MEC;
- Assess baseline MEC risk; and
- Collect data to support a remedial action, if necessary.

Depending on the types and distribution of MEC potentially remaining at the property, remedial action may be required to mitigate risks to current or reasonably anticipated future receptors. Results of the investigation will be used to assess baseline risks and identify potential remediation goals.

3.3.2 Step 2: Identify the Project Goals

3.3.2.1 Principal Study Question for MEC

The following are the principal study questions:

- What is the nature and horizontal and vertical extent of potential explosive hazards from MEC at the site?
- What current and potential future threats may be posed to human health by MEC remaining at the site?
- Is a remedial action warranted?
- If a remedial action is warranted, are there remaining data gaps that would prevent full implementation of the remedial action using existing data?

3.3.2.2 How Data Will Be Used

The project team will collect geophysical data and conduct intrusive investigations to answer the following questions:

1. Have the horizontal boundaries of each area potentially contaminated with subsurface MEC been confirmed/defined?
2. Within the areas potentially contaminated with subsurface MEC, answer the following questions:
    a. What is the horizontal distribution of anomalies?
    b. What is the vertical distribution of sources?
3. What types of MEC, MD, and other metallic debris are/may be present in each area potentially contaminated with subsurface MEC?
4. For MEC potentially remaining at the site, what is the sensitivity, potential severity, and likelihood of reaction by explosives (e.g., detonation, deflagration, or burning)?

5. What is the nature, density, and condition of munitions and/or MD?
6. Has soil movement (e.g., scraping, filling, digging, or natural processes) occurred or will future soil movement occur naturally or be required in association with future use? If previous soil movement has occurred, what were the volume, methods, and fate?
7. How is land within the subject SWMU currently being used? What are the reasonably anticipated future land uses (if known)?
8. Who are the current and future potential receptors, where are they located, and what activities are they, or would they be, performing within the SMWU?
9. What access restrictions are present?
10. Are there access-challenged areas that may require innovative or alternative work processes, technologies, and/or safety measures to maximize MEC removal?
11. What endangered species, sensitive habitats, and/or historical/cultural resources are present?

3.3.2.3 Evaluate the Results of the MEC Investigation

The presence of MD has been previously confirmed adjacent to SWMU 10, and potential remedial action boundaries will be limited to the planned geophysical investigation boundaries unless SRAs potentially representative of burial pits or disposal areas are not fully defined by the completed surveys. The project team will conduct a site-specific MEC baseline risk assessment for the SWMU to evaluate whether potentially complete exposure pathways exist, and if so, to characterize the current and potential future threats to human health due to MEC. The two potential outcomes of the risk assessment are:

1. There is no unacceptable risk.
2. There is unacceptable risk, and a remedial action will be recommended to mitigate the unacceptable risk. If a remedial action is recommended, data from the MEC investigation and previous investigations, if applicable, will be reviewed to determine if the necessary remedial action could be completed using existing data (primarily the MEC investigation geophysical data), or if there are data gaps that would need to be filled prior to initiation of the remedial action.

3.3.3 Step 3: Identify Information Inputs

3.3.3.1 Information Needed to Establish Presence/Absence of MEC and Characterize the Potential Hazard

- Mapped inaccessible and obstructed areas (e.g., buildings, structures, paved roads, topography)
- Results of the surface sweep documented in the Surface Sweep Technical Memorandum
- Anticipated depth of reliable detection for munitions suspected to be present
- Geophysical data and analysis results:
    - Digital maps of areas covered

  - Single point anomaly locations, responses, and identification numbers (IDs)
  - Classification results, if applicable
  - SRA boundaries and IDs
  - Quality control (QC) results
  - Quality assurance (QA) results
  - Usability assessments
- Types of munitions on the site:
  - UXO vs discarded military munitions (DMM)
  - Caliber and type (e.g., mortars, bombs, projectiles)
  - Nature of explosive hazard (i.e., sensitivity of fuzing and ordnance)
  - Associated hazardous components

3.3.3.2 Additional Information to Establish Exposure

- Current and reasonably anticipated future land use
- Current and reasonably anticipated future receptors
- Potential exposure scenarios based upon current/future land use activities and receptors

3.3.3.3 Information Needed to Support a Remedial Action, if Necessary

- GIS database
  - MEC investigation boundaries
  - Identification and mapping of access limitations within the project area
  - Site characteristics
  - Land use
- Intrusive Results
  - Depth of recovery
  - Recovery depth vs reliable detection depth
  - Verified modeled and recovery depths (predicted vs actual)
  - Classification performance, if applicable (predicted vs actual and stop-dig threshold)
- Recommended dig lists following analysis of intrusive results and AGC data
  - Single point anomaly locations, responses, and IDs
  - SRA boundaries and IDs
- Final Data Usability Assessment (DUA)
  - Was the sampling design as implemented consistent with project objectives?
  - Did the data collected for the MEC investigation satisfy the data quality objectives (DQOs) and measurement performance criteria (MPCs)?

- Was the data considered usable for its intended purpose (i.e., determining the nature and extent of MEC contamination and development of a target list for a potential remedial action)?

3.3.4 Step 4: Define the Boundaries of the Project

3.3.4.1 Target Population

Several previous munitions-related investigations have been completed in and adjacent to SWMU 10, and extensive subsurface investigation has indicated that the only munitions potentially present are 20mm, 37mm, and 40mm projectiles. **Table 1.1** includes the list of known and suspected munitions, with expected maximum reliable detection depths for the UltraTEM to be used for geophysical data collection. This list is considered complete, and the expected detection depths are considered accurate based on modeling for a site with relatively benign background response. All the suspected munitions are included in the Department of Defense (DoD) classification library.

3.3.4.2 Spatial and Temporal Boundaries

This study is designed to detect targets of interest (TOI) exceeding the detection threshold and meeting measurement criteria within the established horizontal and vertical boundaries for the project. The detection threshold will be based on a response five times the site-specific background noise or 25 microvolts per ampere (µV/A) for the sum of all UltraTEM time gates between 0.25 and 0.5 milliseconds (ms), whichever is lower. Five times background is typically used as a target selection threshold to ensure a signal to noise ratio (SNR) high enough to limit target selections on background response; 25 µV/A is the lowest expected response for a 37mm projectile at a depth of 30 centimeters below the ground surface (cm bgs). For sites with relatively low background response, which is the expectation at FWDA, five times background is expected to be lower than 25 µV/A. The project/field geophysicist will evaluate geophysical data to ensure the project DQOs are being achieved. Geophysical data deliverables will be submitted weekly during the project, with task specific memoranda (e.g., Instrument Verification Strip [IVS] Memorandum, Classification Memorandum, DUAs) submitted as they are completed.

Spatial boundary considerations also include any areas that will be inaccessible to investigation for any reason (e.g., geophysical instrument interference caused by buildings or other structures, fence lines, overhead powerlines, steep slopes, sensitive habitats, cultural resources, or vegetation).

3.3.4.3 Horizontal Boundaries

The horizontal boundaries of the project are defined by the previous survey boundaries (including analog clearances performed prior to the geophysical surveys in 2009) plus a buffer added to ensure that SRAs noted in the previous surveys were completely covered by the MEC investigation survey. The buffer is a minimum of 75 feet from previous survey boundaries.

3.3.4.4 Vertical Boundaries

The vertical boundary for each confirmed or suspected munition that may be present is the munition-specific maximum reliable depth of detection based on the detection threshold discussed above and the maximum reliable depth of classification, which can be dependent on background conditions. Expected minimum detection and classification depths for the munitions suspected to be present in SWMU 10 are included in Table 1.1. Synthetic seeding, discussed in additional detail in Section 5.1.6.5, will be performed following data collection to determine detection and classification depths based on site-specific geophysical conditions.

It is considered unlikely that munitions are present deeper than the detection/classification depths indicated in Table 1.1 unless they were buried intentionally, in which case it is assumed that large quantities of buried munitions would produce a substantially greater response than a single munition. However, the depths at which munitions were previously recovered in SWMU 10 are unavailable, so maximum depths are presently unknown. If a MEC item or MD is recovered from deeper than the site-specific detection/classification depth for the associated munition during the intrusive investigation, or if the site-specific detection/classification depths are less than the depths indicated in Table 1.1, it is possible that explosive hazards would remain at the site. Site-specific detection/classification depths relative to the expected depths of munitions will be evaluated in the DUA and the MEC Investigation Report.

3.3.4.5 Temporal Boundaries

The temporal boundary for the project is the time it takes to conduct the detection and subsurface investigation. While weather/climate are not hard temporal limits on the project, the project team will adjust the project schedule to accommodate these conditions and conduct fieldwork accordingly (i.e., schedules will be adjusted to avoid monsoon rains and snow). Activities will be considered complete upon QA acceptance, which verifies the SWMU has been investigated.

3.3.5 Step 5: Develop the Project Data Collection and Analysis Approach

3.3.5.1 AGC Survey

A 100% coverage single-pass AGC survey will be performed across the SWMU 10 investigation area. Because the expected munitions are well known and there are numerous examples in the DoD classification library for the munitions potentially present, the sources identified in the dynamic AGC data will be classified to separate potential TOI from non-hazardous clutter. A subset of the sources considered to potentially be TOI will be excavated to determine the nature and vertical extent of contamination in the SWMU.

Parameters of interest: Geophysical anomalies exceeding the project-specific detection threshold and sources classified as either potential TOI or inconclusive.

Assumptions: The buffer added to the 2009 EM61 survey boundary will be sufficient to fully delineate MEC associated with SWMU 10.

Type of inference:

- Anomalies with areal extents > 10 m^2 will be considered SRAs where classification results are considered unreliable due to sensor limitations (i.e., the ability of the sensor to resolve all the sources present). If a remedial action is required, additional action (e.g., analog clearance) would need to be performed before resurvey to ensure adequate remediation of all potential MEC.
- The AGC results will be used to develop a dig list for SWMU 10 and the adjacent area. A subset of the dig list will be excavated as part of the MEC investigation, with the sources investigated to be determined in consultation with the project team. The remainder of the targets on the dig list will serve as the basis for a remedial action, if necessary.

Decision rules:

- If no SRAs extend past the survey area boundary, the survey area will be considered adequate to identify MEC potentially present at the site to the depths listed in **Table 1.1**.
- If SRAs are not fully delineated in the surveyed data and cannot be attributed to a known source (e.g., utility line, above-ground source), the project team will discuss the necessity of expanding the survey area.
- If AGC analyses meet any of the following criteria, the associated source will be placed on an ordered dig list: a) the polarizability decay curve matches that of an item in the site-specific TOI library, as defined in the Classification Technical Memorandum, b) estimates of the size, shape, symmetry, and wall thickness indicate the item is long, cylindrical or spherical, and thick-walled, c) there is a group (cluster) of unknown anomalies having similar polarizability decay curves that, after investigation, are discovered to be TOI, or d) the source is classified as inconclusive. The procedures for designating a cluster are described in **Section 5.1.6.4**.
- The horizontal boundaries of all SRAs that cannot be attributed to a known source will be defined for clearance as part of a remedial action, if necessary.

3.3.5.2 Baseline Risk Assessment

The project team will update the CSM using the MEC investigation results and conduct a baseline risk assessment in compliance with the Office of the Secretary of Defense (OSD) Memorandum dated 14 July 2023 and titled, *Military Munitions Response Program Risk Management Methodology* (2023). The risk assessment will consider the amount and type of MEC, likelihood a receptor will encounter MEC, likelihood a receptor will interact with MEC, and the risk of a harmful incident upon interaction.

Parameters of interest: Current and reasonably anticipated future land use, current and future receptors, site accessibility, MEC types, MEC density and distribution, and MEC characteristics.

Type of inference: Within each survey area, the presence of remaining MEC, material potentially presenting an explosive hazard (MPPEH), or significant MD will indicate a potential need for further action. Because significant quantities of MD have previously been identified in SWMU 10, no evidence of use (NEU) will not be considered. A decision will be made between the need for further action or no further action, which will be determined based on the risk scenarios identified through risk management methodology (RMM).

Decision rules:

RMM tables will be updated based on the results of the MEC investigation. The output of the RMM will be captured in Matrix 3, with two possible outcomes:

- There is no unacceptable risk at the site, in which case, the site will not be recommended for a future MEC removal; or
- There is unacceptable risk at the site, and the site will be recommended for a future MEC removal.

3.3.6 Step 6: Specify Project-Specific Measurement Performance Criteria

Geophysical and intrusive investigations shall achieve applicable MPCs as stated in **Section 5.2** and confirmed/modified by the IVS Technical Memorandum, unless MPC failures can be adequately explained or justified. Failure to achieve the MPCs may have an impact on end uses of the data, which will be addressed in the DUA.

3.3.7 Step 7: Survey Design and Project Workflow

The MPCs established during Step 6 of the DQO process (documented in **Section 5.2**) were used to develop the sample design, which is described in general in **Section 5.1** and more specifically for SWMU 10 below.

3.4 MC DATA QUALITY OBJECTIVES

3.4.1 Step 1: State the Problem

Evidence from previous investigations suggests that MEC that poses a threat to human health may be present in Parcel 11 SWMU 10 based on the parcel's previous use for the destruction of munitions. During the MEC Investigation it is possible that MEC will be encountered that warrant soil sampling to determine if MC has been released to soil within Parcel 11 SWMU 10. This includes collection of additional samples from the detonation crater if consolidated detonation is conducted. If MC contamination is present, it may pose a risk to human receptors.

3.4.2 Step 2: Identify the Project Goals

Is there evidence of a release of MC at concentrations greater than background levels and Human Health Screening Levels at locations where MEC items were encountered during the MEC investigations or where demolition operations were conducted? If so, what is the horizontal and vertical extent?

If MC contamination is present, is further evaluation needed to determine if concentrations pose unacceptable risks to human receptors at SWMU 10?

If MC contamination is established by the MEC Investigation, are further response actions required at SWMU 10?

3.4.3 Step 3: Identify Information Inputs

See **Section 3.3.3** as the information inputs for MEC investigation are also applicable to the MC investigation. Additionally, background soil sample metals concentrations will be used to determine if metals concentrations from soil samples exceed background.

3.4.4 Step 4: Define the Boundaries of the Project

3.4.4.1 Target Population

See **Section 3.3.4** as the temporal, horizontal, and vertical boundaries for the MEC investigation are also applicable to the MC investigation.

If no MEC items are found, then SWMU 10 will be determined to be free of MC contamination within the limits of the investigation and no MC samples will be collected.

If concentrations of MC in soil exceed Human Health Screening Levels, then step out samples will be collected at 10.0 foot intervals until lateral extent is defined, and subsurface soil samples will be collected at a depth of 1.5 to 2.0 feet bgs to define vertical extent.

3.4.5 Step 5: Develop the Project Data Collection and Analysis Approach

If a MEC item is encountered in Parcel 11 SWMU 10, a soil sample will be collected 0.5 feet below the item. If a MEC item cannot be moved and must be blown-in-place, a soil sample will be collected 0.5 feet below the surface of the detonation crater. Confirmation samples in SWMU 10 will be analyzed for explosives and TAL metals.

If concentrations in soil are less than or equal to Human Health Screening Levels (**Table 3.2**), then there is no evidence of a release, and no further analysis is required.

If analytes that are known to be MC of the MEC encountered during the MEC Investigation are present in soil at concentrations greater than Human Health Screening Levels (**Table 3.2**), then there is evidence of a release (i.e., COPCs are present), then either further evaluation to determine the extent of contamination and potential risk, or removal of contaminated soil will be recommended. Additional surface and/or subsurface samples may need to be collected to delineate extent of COPCs in soil and evaluate risk associated with potential exposure to MC in soil.

3.4.6 Step 6: Specify Project-specific Measurement Performance Criteria

All sampling and analysis will be performed in accordance with this MEC Work Plan (**Section 5.0**).

3.4.7 Step 7: Survey Design and Project Workflow

The MPCs established during Step 6 of the DQO process (documented in **Section 5.3**) were used to develop the sample design, which is described in general in **Section 5.1.9** and more specifically for SWMU 10 below.

As described in **Section 5.1.9**, discrete soil samples will be collected from soil beneath any MEC item encountered during the MEC investigation. If required, step out samples will continue until lateral and vertical extent is defined.

3.5 INVESTIGATION METHODS

General investigation methods for the vegetation removal, surface clearance, blind seeding, geophysical survey and data processing, intrusive investigation, MPPEH handling, and soil sampling are described in detail in **Section 5.1**. The QC procedures for the MEC and MC investigation are described in detail in **Section 5.2**.

3.6 SCOPE OF PROPOSED INVESTIGATION

The proposed UltraTEM survey area at SWMU 10 is shown in **Figure 3.1** As indicated in the figure, the survey area covers approximately 17 acres and includes all areas within the STP fence line and the field to the east of the fence that was covered by the 2009 EM61 survey. To ensure that the large anomalous area in the southwest corner of the 2009 EM61 survey (PIKA, 2016 [Figure 5-2]) is delineated sufficiently, a buffer of a minimum of 75 feet from the EM61 survey boundary has been added in the proposed survey area. However, if the boundary of this SRA or any of the other SRA not attributable to a known source are not adequately delineated, the project team will discuss the need to expand the survey area to define the SRA boundaries.

Dig lists will be compiled for the SWMU 10 and 40 investigations, and a total of approximately 200 sources will be identified for intrusive investigation, split between the two SWMUs. The sources will be selected from the list of potential TOI (and possibly inconclusive) targets in SWMU 10 and from the full source lists in SWMU 40. The list of sources to be investigated will be developed in consultation with the project team. Therefore, the exact number of sources to be investigated in SWMU 10 is to be determined.

If MEC is encountered, a soil sample will be collected beneath the item to determine if MC has been released to soil within Parcel 11 SWMU 10. A summary of the proposed samples, sample analysis, and QC sample counts are summarized in **Table 3.3.**

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4.0 ADMINISTRATION AREA

4.1 BACKGROUND

MD was recovered adjacent to the northwest corner of Building 12 during utilities trenching in 1998. It is unknown how deep the munitions were when they were found or why they were buried, if intentionally buried, but it was assumed that they were related to munitions transport between the storage yard to the west of Building 10 and a loading dock northeast of Building 10 where railcars were loaded with scrap from the storage yard. Because the source of the MD recovered in 1998 is uncertain, an approximately 36.5-acre survey is proposed to cover portions of the Administration Area where the storage and/or transport of munitions may have led to MEC contamination. The intent of this investigation is to refine the locations of subsurface sources potentially representing MEC items. A subset of the subsurface sources identified will be excavated to help determine the presence/absence and vertical extent of MEC.

4.1.1 Location, Description, and Operational History

The approximately 3.5-acre MEC investigation performed in 2009 was focused on areas adjacent buildings and structures associated with SWMU 40 based on the location of the MD recovered in 1998. SWMU 40 as listed in the Permit includes 14 buildings or structures, six of which are within Parcel 11 (**Figure 4.1**). The SWMU 40 structures related to the MEC investigation, all of which are within Parcel 11, include Buildings 10, 12 and 13, former Building 29, and Structure 63. These structures are described below:

- Building 10, the Salvage and Coal Test Building, is a single-story concrete block structure built in 1953, and is approximately 20 feet (ft) wide and 50 ft long. The building was used as a coal testing facility and was used as an office for the adjacent storage yard. Currently the building is unused. The storage yard was reportedly used to store munitions prior to transport.
- Structure 63 is a loading dock within the storage yard associated with Building 10. Based on historical aerials and drawings, the loading dock was built sometime after 1966 and appears to have been used for loading railcars and trucks at the storage yard.
- Buildings 12 and 13, Inert Storage Warehouses, are single-story brick structures built in 1941, and are approximately 68 ft wide and 202 ft long. These buildings feature elevated floors with exterior docks for both truck and railcar loading and unloading. Several potential MEC items (scrap 37 mm armor-piercing projectiles and scrap 75 mm projectiles) were unearthed near the northwest corner of Building 12 during installation of buried utilities in 1998. Because the items were scrap and located in an area where railcars were loaded with scrap from the storage yard, it is believed that these items were associated with operations at Building 10 and the storage yard rather than operations at Building 12.
- Former Building 29, Inert Storage Warehouse, was a single-story brick structure built in 1943, and was approximately 60 ft wide and 500 ft long. According to the 1961 Facilities Data report, Building 29 was originally the Ammunition, Linking, Belting, and Clipping Building. Herbicides and pesticides were stored in Building 29 for an unknown length of time prior to FWDA closure in 1993. Building 29 was demolished in 1999.

Due to uncertainty regarding the source of the MD recovered in 2009, the proposed 36.5-acre survey area (**Figure 4.1**) includes former storage yards, former building locations, and other areas adjacent to Administration Area buildings and structures near the SWMU 40 MD finds where the storage and/or transport of munitions might have taken place, leading to the potential for MEC contamination. This area includes the following SWMUs and AOCs, none of which are known to be specifically munitions related except for the AOC 47 photoflash powder spill:

- SWMU 3 – Fenced Storage Yard (also known as the Former Storage Yard or DRMO Area, or Extended Storage Yard, or Former Coal Storage Area),
- SWMU 5 – Building 5 (Regimental Garage),
- SWMU 6 – Former Building 11 (Former Locomotive Shop),
- SWMU 23 – Building 8 (Paint Shop or Carpenter Shop) and Building 7 (Paint Shop and Paint Storage Warehouse),
- SWMU 24 – Building 15 (Garage and Storage Building),
- SWMU 37 – Building 9 (Machine Shop and Signal Shop),
- SWMU 40 – South Administration Area (Building 10, Building 12, Building 13, Building 14, Former Building 29, and Structure 63),
- SWMU 45 – Building 6 (Gas Station),
- SWMU 50 – Former Structure 35 (Former UST No. 7 located near Building 45).
- AOC 46 – AST located near Former Building 11,
- AOC 47 – TPL spill of photoflash powder west of Former Building 11,
- AOC 48 – Building 34 (Fire Station),
- AOC 49 – Structure 38 (End Loading Dock) and Structure 39 (Side Loading Dock),
- AOC 51 – Structure 64 (Former UST near Former Building 11),
- AOC 52 – Building 79 and Building 80 (Storage Vaults), and
- AOC 75 – Former electrical transformer locations within Parcel 11.

4.1.2 Surface and Subsurface Conditions

The survey area is characterized by a flat lying ground surface. The unimproved ground surface within the survey boundary is generally gravel or soil covered, and unimproved areas or fully cleared areas are the only areas that will be surveyed. AGC data will not be collected over paved areas or the footprints of demolished buildings if the foundations are still present. Data will be collected over any former building footprints if the foundations have also been removed. Remaining features, including still-existing buildings and railroad tracks will affect geophysical data collected near metallic features.

Geologically, the site conditions for geophysical investigations are good. Geophysical data collected during previous investigation efforts have not indicated unusual geophysical conditions or an unusual quantity of ferromagnetic rocks. However, the results of the 2009 geophysical surveys indicate that subsurface utilities are likely present in the survey area. The 2009 EM61 geophysical data collected south of former Building 29 also contains large areas of saturated response, suggesting that the demolition of the building resulted in a significant amount of subsurface debris.

4.1.3 Preliminary MEC Conceptual Site Model

The MEC CSM for the 36.5-acre Administration Area survey area is presented in **Table 4.1**. **Figure 4.1** shows the proposed geophysical survey boundaries, which are considered "the site" for the purposes of the MEC investigation.

4.2 PREVIOUS INVESTIGATIONS

MD 37mm and 75mm projectiles were reportedly recovered near the northwest corner of Building 12 during utility installation work in 1998. They were near an area where railcars were loaded with scrap from the storage yard via a loading dock to the northeast of Building 10. In addition to the 37mm and 75mm projectiles recovered, 3.5-inch rocket and 155mm projectile parts and shipping containers have been observed in the storage yard. Approximately 3.5 acres of EM61 data were collected to the north/and west of Buildings 12 and 13 and to the south of Former Building 29 in 2009 to evaluate the potential presence of MEC (PIKA, 2016 [Figure 6-2]). The boundaries of the EM61 surveys are shown in **Figure 4.1**. Numerous geophysical anomalies large enough to represent potential MEC items were identified in the EM61 data.

The most recent version of the Parcel 11 Phase 2 RFI Work Plan for MEC (PIKA, 2016) indicated that a subsurface removal would be performed for a subset of the anomalies identified in the EM61 data to statistically prove that 95% of the anomalies were not related to MEC with +/- 5% sampling error. It was determined that this would require the excavation of 254 of the 748 anomalies identified in the EM61 data (7 mV or higher response on EM61 channel 2). The proposed intrusive investigation was never performed.

4.3 MEC DATA QUALITY OBJECTIVES

4.3.1 Step 1: State the Problem

Evidence from previous investigations suggests that MEC that poses a threat to human health may be present in areas adjacent to Administration Area buildings/structures based previous storage of munitions or transport of munitions through these areas. MD in the form of 37mm and 75mm projectiles has previously been recovered at the site. Geophysical investigations were performed in 2009 to identify the locations of subsurface metal with the potential to be MEC. The surveys were performed using an EM61, a standard DGM sensor still used for some munitions work. In addition to the prior geophysical data being over a decade old, the EM61 has generally been replaced for removal actions by newer, more advanced geophysical sensors. The newer sensors locate subsurface sources with greater accuracy and can be used to classify subsurface sources as potential MEC or non-hazardous clutter depending on the configuration of those sources. Classification is possible for full rounds and larger components such as fuzes or rocket warheads/motors but is generally not possible for smaller components that comprise munition warheads (e.g., primers, burster tubes, booster cups, etc.).

Because there is still potential unacceptable risk at the site, further study is needed to:

- Characterize the type, nature, and distribution (horizontal and vertical) of remaining MEC;
- Assess baseline MEC risk; and

- Collect data to support a remedial action, if necessary.

Depending on the types and distribution of MEC potentially remaining at the property, remedial action may be required to mitigate risks to current or reasonably anticipated future receptors. Results of the investigation will be used to assess baseline risks and identify potential remediation goals.

4.3.2 Step 2: Identify the Project Goals

4.3.2.1 Principal Study Question for MEC

The following are the principal study questions:

- What are the nature and vertical extent of potential explosive hazards from MEC at the site?
- What current and potential future threats may be posed to human health by MEC remaining at the site?
- Is a remedial action warranted?
- If a remedial action is warranted, are there any remaining data gaps that would prevent full implementation of the remedial action using existing data?

4.3.2.2 How Data Will Be Used

The project team will collect geophysical data and conduct intrusive investigations to answer the following questions:

1. Have the horizontal boundaries of each area potentially contaminated with subsurface MEC been confirmed/defined?
2. Within the areas potentially contaminated with subsurface MEC, answer the following questions:
    a. What is the horizontal distribution of anomalies?
    b. What is the vertical distribution of sources?
3. What types of MEC, MD, and other metallic debris are/may be present in each area potentially contaminated with subsurface MEC?
4. For MEC potentially remaining at the site, what is the sensitivity, potential severity, and likelihood of reaction by explosives (e.g., detonation, deflagration, or burning)?
5. What is the nature, density, and condition of munitions and/or MD?
6. Has soil movement (e.g., scraping, filling, digging, or natural processes) occurred or will future soil movement occur naturally or be required in association with future use? If previous soil movement has occurred, what were the volume, methods, and fate?
7. How is land within the site currently being used? What are the reasonably anticipated future land uses (if known)?

8. Who are the current and future potential receptors, where are they located, and what activities are they, or would they be, performing within the site?
9. What access restrictions are present?
10. Are there access-challenged areas that may require innovative or alternative work processes, technologies, and/or safety measures to maximize MEC removal?
11. What endangered species, sensitive habitats, and/or historical/cultural resources are present?

4.3.2.3 Evaluate the Results of the MEC Investigation

The presence of MD has been confirmed within the site, and potential remedial action boundaries will be limited to the planned geophysical investigation boundaries unless SRAs potentially representative of burial pits or disposal areas are not fully defined by the completed surveys. The project team will conduct a site-specific MEC baseline risk assessment to evaluate whether potentially complete exposure pathways exist, and if so, to characterize the current and potential future threats to human health due to MEC. The two potential outcomes of the risk assessment are:

1. There is no unacceptable risk.
2. There is unacceptable risk, and a remedial action will be recommended to mitigate the unacceptable risk. If a remedial action is recommended, data from the MEC investigation and previous investigations, if applicable, will be reviewed to determine if the necessary remedial action could be completed using existing data (primarily the MEC investigation geophysical data), or if there are data gaps that would need to be filled prior to initiation of the remedial action.

4.3.3 Step 3: Identify Information Inputs

4.3.3.1 Information Needed to Establish Presence/Absence of MEC and Characterize the Potential Hazard

- Mapped inaccessible and obstructed areas (e.g., buildings, structures, paved roads, topography)
- Results of the surface sweep documented in the *Surface Sweep Technical Memorandum*
- Anticipated depth of reliable detection for munitions suspected to be present
- Geophysical data and analysis results:
  - Digital maps of areas covered
  - Single point anomaly locations, responses, and IDs
  - Classification results, if applicable
  - SRA boundaries and IDs
  - QC results
  - QA results
  - Usability assessments
- Types of munitions on the site:

    - UXO vs DMM
    - Caliber and type (e.g., mortars, bombs, projectiles)
    - Nature of explosive hazard (i.e., sensitivity of fuzing and ordnance)
    - Associated hazardous components

4.3.3.2 Additional Information to Establish Exposure

- Current and reasonably anticipated future land use
- Current and reasonably anticipated future receptors
- Potential exposure scenarios based upon current/future land use activities and receptors

4.3.3.3 Information Needed to Support a Remedial Action, if Necessary

- GIS database
    - MEC investigation boundaries
    - Identification and mapping of all limitations within the project area
    - Site characteristics
    - Land use
- Intrusive Results
    - Depth of recovery
    - Recovery depth vs reliable detection depth
    - Verified modeled and recovery depths (predicted vs actual)
    - Classification performance, if applicable (predicted vs actual and stop-dig threshold)
- Recommended dig lists following analysis of intrusive results and AGC data
    - Single point anomaly locations, responses, and IDs
    - SRA boundaries and IDs
- Final DUA
    - Was the sampling design as implemented consistent with project objectives?
    - Did the data collected for the MEC investigation satisfy the DQOs and MPCs?
    - Was the data considered usable for its intended purpose (i.e., determining the nature and extent of MEC contamination and development of a target list for a potential remedial action)?

4.3.4 Step 4: Define the Boundaries of the Project

4.3.4.1 Target Population

The investigation is based on the recovery of 37mm and 75mm projectiles during utility trenching in 1998. There is concern that any munition, or partial munition, stored in within the survey area and transported or loaded/unloaded in this area may have ended up on the ground and been buried in the same manner as the projectiles recovered in 1998. **Table 1.2** contains the list of the MD recovered adjacent to SWMU 40 Building 12.

The target populations also include MD, which serves as an indicator of potential MEC hazards.

4.3.4.2 Spatial and Temporal Boundaries

This study is designed to detect TOI exceeding the detection threshold and meeting measurement criteria within the established horizontal and vertical boundaries for the project. The detection threshold will be based on a response five times the site-specific background noise or 25 µV/A for the sum of all UltraTEM time gates between 0.25 and 0.5 ms, whichever is lower. Five times background is typically used as a target selection threshold to ensure SNR high enough to limit target selections on background response; 25 µV/A is the lowest expected response for a 37mm projectile at a depth of 30 cm bgs. For sites with relatively low background response, which is the expectation at FWDA, five times background is expected to be lower than 25 µV/A. The project/field geophysicist will evaluate all geophysical data to ensure the project DQOs are being achieved. Geophysical data deliverables will be submitted weekly during the project, with task specific memoranda (e.g., IVS Memorandum, Classification Memorandum, DUAs) submitted as they are completed.

Spatial boundary considerations also include any areas that will be inaccessible to investigation for any reason (e.g., geophysical instrument interference caused by buildings or other structures, railroad tracks, fence lines, overhead powerlines, steep slopes, sensitive habitats, cultural resources, or vegetation).

4.3.4.3 Horizontal Boundaries

The horizontal boundaries of the project are defined by the locations of two storage yards and adjacent buildings and structures in Parcel 11. One of the storage yards is SWMU 3, and the buildings and structures include most of the non-SWMU 10 SWMUs and AOCs in Parcel 11. The 36.5-acre survey area encompasses all areas in Parcel 11, other than SMWU 10, where it is considered possible that the storage or transport of munitions could have resulted in MEC contamination.

4.3.4.4 Vertical Boundaries

The vertical boundary for each confirmed or suspected munition that may be present is the munition-specific maximum reliable depth of detection based on the detection threshold discussed above. Expected minimum detection and classification depths for the munitions suspected to be present in the survey area are included in **Table 1.2**. However, because classification will not be used to separate TOI from non-TOI at this site (see **Section 4.3.5.1**), the classification depths are relatively unimportant. Synthetic seeding, discussed in additional detail in **Section 5.1.6.5**, will be performed following data collection to determine detection depths based on site-specific geophysical conditions.

It is considered unlikely that munitions are present deeper than the detection/classification depths indicated in **Table 1.2** unless they were buried intentionally, in which case it is assumed that large quantities of buried munitions would produce a substantially greater response than a single munition. However, the depths at which munitions were previously recovered in SWMU 40 are unavailable, so maximum depths are presently unknown. If a MEC item or MD is recovered from deeper than the site-specific detection depth for the associated munition during the intrusive investigation, or if the site-specific detection depths are less than the depths indicated in **Table 1.2**, it is possible that explosive hazards would remain at the site. Site-specific detection/classification depths relative to the expected depths of munitions will be evaluated in the DUA and the MEC Investigation Report.

4.3.4.5 Temporal Boundaries

The temporal boundary for the project is the time it takes to conduct the detection and subsurface investigation. While weather/climate are not hard temporal limits on the project, the project team will adjust the project schedule to accommodate these conditions and conduct fieldwork accordingly (i.e., field schedules will be adjusted to avoid monsoon rains and snow). Activities will be considered complete upon QA acceptance, which verifies the site has been investigated.

4.3.5 Step 5: Develop the Project Data Collection and Analysis Approach

4.3.5.1 AGC Survey

A 100% coverage single-pass AGC survey will be performed across the 36.5-acre Administration Area investigation area. In the survey area, where the full list of munitions potentially present is not well defined and where munitions components not included in the DoD classification library could be present, modeled sources will be compared to the full DoD classification library, but no library match threshold will be applied to separate potential TOI from non-TOI. All sources identified using the project detection threshold of five times site-specific background will be considered potential TOI unless they are confirmed to be caused by a non-TOI source (e.g., surface source, utility line). A subset of the sources considered to potentially be TOI will be excavated to determine the nature and vertical extent of contamination.

Parameters of interest: Geophysical anomalies exceeding the project-specific detection threshold; sources with high matches to DoD library munitions to guide the intrusive investigation.

Assumptions: The 36.5-acre survey boundary will be sufficient to fully delineate MEC associated with munitions storage in and/or transport through the Administration Area.

Type of inference:

- Anomalies with areal extents > 10 m^2 will be considered SRAs where classification results are considered unreliable. If a remedial action is required, additional action (e.g., analog clearance) would need to be performed before resurvey to ensure adequate remediation of all potential MEC.
- The AGC results will be used to develop a dig list for the Administration Area survey area. A subset of targets on the dig list will be excavated as part of the MEC investigation, with the exact sources investigated to be determined in consultation with the project team. The remainder of the targets on the dig list will serve as the basis for any remedial actions determined to be necessary.

Decision rules:

- If no SRAs extend past the survey area boundary, the survey area will be considered adequate to identify all MEC potentially present at the site to the depths listed in **Table 1.1**.
- If SRAs are not fully delineated in the surveyed data and cannot be attributed to a known source (e.g., utility line, above ground source), the project team will discuss the necessity of expanding the survey area.

- Dynamic survey anomalies with response amplitude greater than the target selection threshold will be considered potential MEC. Source locations for these anomalies will be modeled, and the modeled source locations will be added to the dig list.
- The horizontal boundaries of all SRAs that cannot be attributed to a known source will be defined for clearance as part of a remedial action, if necessary.

4.3.5.2 Baseline Risk Assessment

The project team will update the CSM using the MEC investigation results and conduct a baseline risk assessment in compliance with the OSD Memorandum dated 14 July 2023 and titled, *Military Munitions Response Program Risk Management Methodology*. The risk assessment will consider the amount and type of MEC, likelihood a receptor will encounter MEC, likelihood a receptor will interact with MEC, and the risk of a harmful incident upon interaction.

<u>Parameters of interest</u>: Current and reasonably anticipated future land use, current and future receptors, site accessibility, MEC types, MEC density and distribution, and MEC characteristics.

<u>Type of inference</u>: Within the survey area, the presence of MEC, MPPEH or significant MD will indicate a potential need for further action. Because MD has previously been identified in within the survey area, it is considered unlikely that NEU will be considered, although this option may be considered if no evidence of munitions use is identified during the surface sweep or intrusive investigation. The more likely decision will be between the need for further action or no further action, which will be determined based on the risk scenarios identified through RMM.

<u>Decision rules</u>:

RMM tables will be updated based on the results of the MEC investigation. The output of the RMM will be captured in Matrix 3, with two possible outcomes:

- There is no unacceptable risk at the site, in which case, the site will not be recommended for a future MEC removal; or
- There is unacceptable risk at the site, and the site will be recommended for a future MEC removal.

As discussed above, if NEU is identified, then the site will be presumed to have no unacceptable risk and will not be evaluated using the RMM.

4.3.6 Step 6: Specify Project-specific Measurement Performance Criteria

Geophysical and intrusive investigations shall achieve applicable MPCs as stated in **Section 5.2** and confirmed/modified by the IVS Technical Memorandum, unless MPC failures can be adequately explained or justified. Failure to achieve the MPCs may have an impact on end uses of the data, which will be addressed in the DUA.

4.3.7 Step 7: Survey Design and Project Workflow

The MPCs established during Step 6 of the DQO process (documented in **Section 5.2**) were used to develop the sample design, which is described in general in **Section 5.1** and more specifically for the site below.

4.4 MC DATA QUALITY OBJECTIVES

4.4.1 Step 1: State the Problem

Evidence from previous investigations suggests that MEC that poses a threat to human health may be present in portions of the Administration Area where the storage and/or transport of munitions occurred historically. During the MEC Investigation it is possible that MEC will be encountered that warrant additional sampling to determine if MC has been released to soil within the Administration Area. This includes collection of additional samples from the detonation crater if consolidated detonation is conducted. If MC contamination is present, it may pose a risk to human receptors.

4.4.2 Step 2: Identify the Project Goals

Is there evidence of a release of MC at concentrations greater than background levels and Human Health Screening Levels at locations where MEC items were encountered during the MEC investigations or where demolition operations were conducted? If so, what is the horizontal and vertical extent?

If MC contamination is present, is further evaluation needed to determine if concentrations pose unacceptable risks to human receptors at the Administration Area?

Based on the nature and extent of MC contamination established by the MEC Investigation are further response actions required at the Administration Area?

4.4.3 Step 3: Identify Information Inputs

See **Section 4.3.3** as the information inputs for MEC investigation are also applicable to the MC investigation. Additionally, background soil sample metals concentrations will be used to determine if metals concentrations from soil samples exceed background.

4.4.4 Step 4: Define the Boundaries of the Project

4.4.4.1 Target Population

See **Section 4.3.4** as the temporal, horizontal, and vertical boundaries for the MEC investigation are also applicable to the MC investigation.

If no MEC items are found, then the Administration Area will be determined to be free of MC contamination within the limits of the investigation and no MC samples will be collected.

If concentrations of MC in soil exceed Human Health Screening Levels then step out samples will be collected at 10.0 foot intervals until lateral extent is defined, and subsurface soil samples will be collected at a depth of 1.5 to 2.0 feet bgs to define vertical extent.

4.4.5 Step 5: Develop the Project Data Collection and Analysis Approach

If a MEC item is encountered in the Administration Area, a soil sample will be collected 0.5 feet below the item. If a MEC item cannot be moved and must be blown-in-place, a soil sample will be collected 0.5 feet below the surface of the detonation crater. Confirmation samples in the Administration Area will be analyzed for explosives and TAL metals.

If concentrations in soil are less than or equal to Human Health Screening Levels (**Table 3.2**), then there is no evidence of a release and no further analysis is required.

If analytes that are known to be MC of the MEC encountered during the MEC Investigation are present in soil at concentrations greater than Human Health Screening Levels (**Table 3.2**), then there is evidence of a release (i.e., COPCs are present), then either further evaluation to determine the extent of contamination and potential risk, or removal of contaminated soil will be recommended. Additional surface and/or subsurface samples may need to be collected to delineate extent of COPCs in soil and evaluate risk associated with potential exposure to MC in soil.

4.4.6 Step 6: Specify Project-specific Measurement Performance Criteria

All sampling and analysis will be performed in accordance with this MEC Work Plan (**Section 5.0**).

4.4.7 Step 7: Survey Design and Project Workflow

The MPCs established during Step 6 of the DQO process (documented in **Section 5.3**) were used to develop the sample design, which is described in general in **Section 5.1.9** and more specifically for Administration Area below.

As described in **Section 5.1.9**, discrete soil samples will be collected from soil beneath any MEC item encountered during the MEC Investigation. If required, step out samples will continue until lateral and vertical extent is defined.

4.5 INVESTIGATION METHODS

General investigation methods for the vegetation removal, surface clearance, blind seeding, geophysical survey and data processing, intrusive investigation, MPPEH handling, and soil sampling are described in detail in **Section 5.1**. The QC procedures for the MEC and MC investigation are described in detail in **Section 5.2**.

4.6 SCOPE OF PROPOSED INVESTIGATION

The proposed 36.5-acre UltraTEM survey area is shown in **Figure 4.1**. The 2009 3.5-acre survey area was based on the location of the 37mm and 75mm projectiles recovered during utility work and the location of a loading dock relative to the storage yard to the west of Building 10. The larger proposed survey area covers two storage yards in the vicinity of the 1998 MD finds and all adjacent buildings and structures where it is considered possible that the storage and/or transport of munitions may have resulted in MEC contamination. The survey area includes the 2009 survey area and most of the Parcel 11 SWMUs and AOCs except for SMWU 10, which is discussed in **Section 3**.

Dig lists will be compiled for the SWMU 10 and Administration Area investigations as described in **Section 3.5**. The Administration Area dig list will likely be compiled from sources with the best library matches to items in the full DoD library because these will present the best opportunity to determine the presence/absence of MEC. The list of sources to be investigated will be developed in consultation with the project team. Therefore, the exact number of sources to be investigated in the 36.5-acre survey area is to be determined.

If MEC is encountered a soil sample will be collected beneath the item to determine if MC has been released to soil within the 36.5-acre Administration Area. A summary of the proposed samples, sample analysis, and QC sample counts are summarized in **Table 4.2.**

5.0 DESCRIPTION OF INVESTIGATION METHODS

This section provides general information regarding the planned field activities to be completed as part of this MEC Investigation Work Plan. Information specific to individual investigation areas is presented in **Section 3** and **Section 4**.

5.1 PLANNED ACTIVITIES

5.1.1 Site Safety and Awareness

All work will be accomplished in accordance with Army safety measures. A project-specific Accident Prevention Plan (APP)/Site Safety and Health Plan (SSHP) has been developed for the MEC investigations at FWDA. The APP/SSHP defines the roles and responsibilities of site personnel, establishes proper levels of personal protective equipment (PPE), and describes emergency response and contingency procedures. The associated Activity Hazard Analyses (AHAs) define hazards associated with each type of work activity and how those hazards will be mitigated. The APP/SSHP will be reviewed by site personnel prior to performing any site work. In addition, task-specific AHAs will be reviewed before any new tasks are performed and periodically during daily tailgate safety meetings.

All work will be completed by a supervisor, operators, and technicians that have successfully completed 40-hour Hazardous Waste Operations and Emergency Response training in accordance with 29 U.S. Code of Federal Regulations 1910.120. An Unexploded Ordnance Safety Officer (UXOSO)/Site Safety and Health Officer (SSHO) will be on site for all field operations. The UXOSO/SSHO will be responsible for conducting site-specific training, daily tailgate safety meetings, and periodic safety inspections. The UXOSO/SSHO will also be responsible for ensuring site monitoring, worker training, and effective selection and use of PPE. The UXOSO/SSHO will have completed the Occupational Safety and Health Administration (OSHA) 30-hour Construction Safety Course prior to being tasked to fill the position.

5.1.2 Geophysical Surveys and Intrusive Investigation

This section provides general information regarding the methods that will be employed to accomplish the geophysical surveys and intrusive investigations in Parcel 11. The following sections provide details regarding vegetation clearance, surface clearance, blind seeding, geophysical survey, intrusive investigation, and QC.

5.1.3 Vegetation Removal

UXO Technicians will perform vegetation removal prior to the surface clearance, as necessary, to allow for access to the investigation areas by both the surface clearance and geophysical data collection teams. The vegetation removal team will use either a brush hog or hand tools to clear vegetation to a height of no higher than six inches above the ground surface. The UXOSO/SSHO will perform an instrument-aided surface sweep ahead of any mechanized brush cutting equipment using analog ML-3 or Schonstedt metal detectors to confirm that the areas intended for clearance are free of surface MEC. Any identified surface MEC or MD identified by the UXOSO/SSHO or any other team member during vegetation removal will be dealt with as described in **Section 5.1.8**. Root systems will not be disturbed as part of the vegetation removal operation. Cut vegetation will be removed from the immediate work area, placed outside of the area, and allowed to degrade naturally at the project site. The UXOSO/SSHO will coordinate with FWDA personnel to determine the optimal location(s) to place the vegetation removed from the clearance areas.

5.1.4 Surface Clearance

A visual and analog detector-aided surface clearance will be conducted across the geophysical survey areas to remove metallic surface items measuring at least two inches in any one dimension. The surface clearance will be completed by five UXO Technicians, including a UXO Technician III Team Lead, two UXO Technician IIs, and two UXO Technician Is. A Senior UXO Supervisor (SUXOS) and the UXOSO will also be present on site during the surface clearance.

Handheld sensors and operators will be tested daily to determine functionality. An instrument test strip (ITS) will be constructed for daily analog sensor QC, with three small ISOs buried horizontally at 30 cm depth in the cross-track orientation. Each team member will be responsible for performing tests on the ITS to verify their sensor is in proper working condition at least each morning and evening and any other time the instrument is turned on.

Grids will be established across each area to be surface cleared using a real-time kinematic (RTK) Global Positioning System (GPS) capable of sub-centimeter level accuracy. All location data for geophysical surveys will be in World Geodetic System 1984, Universal Transverse Mercator Zone 12 North, meters (m). Grids will be at most 200 ft by 200 ft, although they may be smaller depending on the shape of the survey area. The team leader will assemble team members in a line at approximately 5-ft intervals. The "open" end of the line will be marked by placing pin flags or other visual markers at intervals along the way. The team will work systematically to travel through the grid, ensuring no areas are uninvestigated. Team members will locate and remove surface metallic items as necessary to reduce interference with the geophysical surveys. Metallic items recovered in each grid will be laid out and photographed to maintain a record of recovered items, particularly MEC or identifiable MD items. The total weight of recovered objects grouped by type (e.g., MD, other debris) will also be recorded. The locations of MEC items recovered will be recorded using RTK GPS. All recovered MEC or MD will be dealt with as described in **Section 5.1.8** and the Waste Management Plan (**Section 7**).

5.1.5 Blind Seeding

Blind seed items will be placed within the geophysical survey areas to test the ongoing functionality of the UltraTEM and positioning sensors used for data collection, the data collection procedures employed by the collection team, and the procedures employed during data processing and analysis. The seeds will be bolts or pipe sections, referred to as industry standard objects (ISOs), that have been identified as having a similar geophysical response to some relatively common munitions items (e.g., 20mm projectiles, 37mm projectiles, 60/81mm mortars, and 105mm projectiles). Blind seed items will be selected to represent the munitions potentially present in each survey area and will be placed within the expected depth range for those munitions.

The QC Geophysicist will prepare a QC Seed Plan that will describe the type, frequency, and distribution of blind seeds to be placed in the geophysical survey areas. While the specific number of seed items to be placed will only be described in the QC Seed Plan, seeds will be placed at a rate of one to three seeds per system per expected day of geophysical survey. The QC Seed Plan will be submitted to the Army to review conformance with Munitions Response Quality Assurance Project Plan Toolkit Module 1 (Intergovernmental Data Quality Task Force, 2020) and

Engineering Manual 200-1-15 (Department of the Army, 2018). It will contain a list of the seeds to be buried, including ID, type, and proposed location, depth, and orientation.

Following approval of the QC Seed Plan, a seed team will place seeds within geophysical survey areas as described in the plan. Members of the designated seed team will not be involved in production data collection or excavation of anomalies. The seed team will include a UXO Escort, who will check a 1-m radius around each proposed seed location for the presence of subsurface anomalies using an analog metal detector. The seed team may move seeds as necessary to avoid placement within 1 m of existing anomalies. The UXO Escort will dig a hole to the appropriate depth to bury the seed item as described on the list provided by the QC Geophysicist. While the seed team has latitude to change the location of the seed items to avoid preexisting anomalies, they will attempt to bury the items described on the list at the intended depth and orientation. If an excavation encounters bedrock or another condition precluding further excavation, the hole will be used for placing a shallower-planned seed item. If all shallower seed item burials have been completed, the item will be placed at the achieved depth, or another location will be excavated to place the seed item at the depth proposed in the QC Seed Plan. After a seed item has been placed in the hole, the Seed Team Leader will record the location of the center of the seed item using RTK GPS, measure the depth to the seed item center of mass from a straight edge placed over the open hole, and photograph the seed in the hole. After the required information has been recorded, the UXO Escort will replace the dirt in the hole as completely as possible. They will level the location and, if possible, replace any grass or vegetation plug over the burial location to restore the location to its original appearance to the extent practical.

QC seed item information will be delivered in the Production Area QC Seeding Report. The QC Geophysicist will compare the AGC dig lists and intrusive results to the known locations of blind seeds to confirm that the work meets the expected measurement performance criteria MPCs and measurement quality objectives (MQOs) listed in **Section 5.2.1**. In addition to evaluating the final dig lists and intrusive results, the QC Geophysicist will also evaluate daily datasets promptly to identify seed item detection problems quickly.

5.1.6 Geophysical Surveys

5.1.6.1 Instrument Verification Strip

In addition to the blind seeds described in **Section 5.1.5**, an IVS will be used to test the daily functionality of the UltraTEM and positioning sensors used for geophysical data collection. It is expected that one IVS will be constructed in Parcel 11, although multiple IVSs may be constructed if multiple locations are more expedient that one relatively central location. A background survey will be performed with the UltraTEM in an area that is easily accessible, not prone to flooding and other weather-related phenomena, and is expected to be relatively free of subsurface metal objects. The data from the background survey will be processed and evaluated before test items are buried to confirm that there are few existing anomalies in the area and to ensure that IVS test items are not buried near existing anomalies. Data processing will be performed as described in **Section 5.1.6.4.**

The IVS(s) will include a seed line containing one small schedule 80 ISO and one medium schedule 40 ISO and a noise line containing no seeds. The noise line will be used to confirm that unexpected UltraTEM response is not present in data that should be noise-free on a day-to-day basis. IVS seeds will be emplaced using shovels to dig holes to the appropriate depths of burial.

MEC avoidance will be performed as necessary based on the location of the IVS (i.e. inside or outside the hazard area[s]) and the results of the background survey. Both ISOs will be buried at approximately four to five times their inner diameters (i.e., 15 centimeters [cm] for the small ISO and 25 cm for the medium ISO) in horizontal orientations, with depth measurements made to the center of mass of each item. Items in the IVS will be separated by at least 3 m and from any preexisting anomalies by at least 1.5 m. Holes will be backfilled once the appropriate data have been recorded.

5.1.6.2 Instrument Assembly and Initial IVS Testing

The UltraTEM will be assembled per manufacturer instructions. To test the UltraTEM and verify that it is functioning correctly, initial IVS surveys will be performed, to include an initial function test of the UltraTEM and the RTK GPS and simultaneous localization and mapping (SLAM) sensors to be used for positioning (SLAM only as necessary) and survey of the IVS seeded and noise lines. The initial function test involves data collection using a standard test object to confirm that the UltraTEM response to that object is within 20% of the expected response, which is a known value for the test object. Survey of the IVS seed line will confirm that the two buried seeds are detectable and classifiable and that the positing system (i.e., RTK GPS or SLAM) is correctly locating the UltraTEM data. Survey of the noise line will establish a baseline value of expected response for this location during the project (standard deviation of response over the line). The response threshold for the project may also be based on five times the site-specific noise measured over the IVS noise line, unless modified based on site conditions (e.g., if data collected in the survey areas exhibit significantly higher noise levels than the location selected for the IVS). IVS data processing will be performed as described in **Section 5.1.6.4.**

After performance of the initial IVS testing, an IVS Technical Memorandum will be prepared detailing the IVS setup, surveys, and results, including documentation of compliance with the initial IVS MQOs provided in **Section 5.2.1**. The IVS Technical Memorandum will be provided to the project team for review and concurrence.

5.1.6.3 Conduct AGC Surveys

AGC data will be collected using a person portable UltraTEM in cart or litter mode with positioning information provided by a RTK GPS or a SLAM sensor if overhead canopy or structures limit the effectiveness of the GPS. Data collection will be performed at 1.6-m line spacing across 100% of the specified survey areas except for areas obstructed by buildings or other cultural features preventing access to the sensor (e.g., fence lines, debris piles, uncut vegetation). The 1.6-m line spacing is intended to provide overlap between adjacent lines using the 1.8-m wide UltraTEM to reduce the necessity of gap fills for minor drift between adjacent lines. Care will be taken to maintain a constant speed and to avoid sharp turns. The ideal collection speed for the UltraTEM is 0.75 meters per second (m/s) and speed should be maintained below 1.25 m/s. Circling obstructions and deviating from a straight path to avoid obstructions is acceptable. All avoided obstacles will be recorded in the project geographic information system (GIS) database for comparison with areas where 100% coverage was not achieved. During data processing (**Section 5.1.6.4**), the analyst will identify gaps within the collected geophysical data. If these are not in areas identified as obstacles, the data analyst will supply the UltraTEM team with a file containing the locations of gaps that must be filled before the AGC survey in each survey area is considered complete.

Surface MEC or MD observed while performing AGC surveys will be recorded. Specifically, coordinates for MEC will be recorded with a GPS and photographs taken of the item(s) by the UXO Escort (prior to arrangements for disposition). Locations of significant MD (or surface metal or other interference sources) will also be recorded with GPS and photographed to assist with interpretation of the AGC data.

5.1.6.4 Process AGC Data, Pick Targets, Perform Classification, and Data Validation

UltraTEM data will be imported into BTField for processing. Upon import, the data analyst will assess it against the data collection MPCs and MQOs provided in **Section 5.2.1** (i.e., daily IVS results, transmit current, in-line measurement spacing, coverage, spacing between sensors). A median or equivalent filter will be applied to the raw data to derive an estimate of the background model, then that model will be subtracted from the raw data to provide a background removed or 'leveled' data set. The leveled response amplitude data will then be evaluated by gridding and mapping the Z-component data for the data channel to be used for target selection, which will be discussed in the Target Selection Technical Memorandum. Complete coverage of each survey area, or subset area for which target selection will be performed, will be confirmed before target selection is performed.

UltraTEM targets will be selected using a response threshold based on five times the site-specific noise measured at the IVS, unless modified based on site conditions. Response amplitude targets may be screened based on measured geophysical size and/or decay to reject sources too small or too quickly decaying to be a potential TOI from the target list. Final target selection criteria, including any screening performed, will be detailed in the Target Selection Technical Memorandum.

Once targets have been selected, BTField will be used to perform 1-, 2-, and 3-dipole inversions to determine extrinsic (location and orientation) and intrinsic parameters (principal axis polarizabilities) for the source(s) causing the UltraTEM anomaly at each target location. The intrinsic parameters, otherwise known as polarizabilities, are related to the size, shape, and wall thickness of the source object(s) and are consistent for similar sources (e.g., munitions items). A library of known polarizabilities for standard munitions items is maintained by the DoD, and modeled polarizabilities can be compared to the polarizabilities in the DoD library to determine the degree of match between the in-ground source and munitions in the library. BTField uses a misfit metric to determine the degree of match, with a lower number indicative of a better match.

For the SWMU 10 investigation, the types of munitions potentially present (**Table 1.1**) are well defined, the munitions list is limited, and there are examples of each of the potential munitions in the DoD TOI library. Sources modeled using the SMWU 10 AGC data will be compared to a site-specific TOI library to generate a potential TOI list. Prior to AGC data collection, the Project Geophysicist will prepare the site-specific TOI library for the SWMU 10 investigation based on the DoD TOI library (single source models only). The site-specific library will be sub-selected from the DoD TOI library to contain only the confirmed or suspected MEC items listed in **Table 1.1** and ISOs that will be used for seeding. The preliminary site-specific library will be provided to the UXOQCS and Ordnance and Explosives Safety Expert (OESS) for review. The UXOQCS and OESS will verify that the expected items listed in **Table 1.1** are included in the site-specific library, or that items similar in size and shape are included. The Project Geophysicist will provide the site-specific library to the QA Geophysicist prior to beginning UltraTEM data collection. The SWMU 10 site-specific library may be modified during the project if unexpected items are found on the surface or if AGC data or intrusive results indicate items should be added to or removed from the library.

UltraTEM data collected in and adjacent to SWMU 10 will be inverted to identify potential anomaly sources and the polarizabilities of those sources. Polarizabilities for each potential anomaly source will be compared to the site-specific library to develop a misfit metric based on the degree of match between the inverted polarizabilities and the best library match. A threshold (to be detailed in the Classification Technical Memorandum) will be applied to the calculated decision statistic, and sources with a decision metric above the threshold will be classified as potential TOI. Sources not classified as TOI will be classified as either inconclusive (i.e., potentially poor data) or likely clutter (non-TOI).

While the DoD classification library that is typically sub-selected to generate a site-specific library does contain some examples of munitions components, mostly warheads and fuzes, it does not contain examples of others such as primers, burster tubes, or booster cups. Without definitive knowledge about the munitions potentially present in the 36.5-acre Administration Area MEC investigation area, it is possible that complete munitions or munitions components for which there are no examples in the DoD library may be present. Sources modeled from the UltraTEM data collected in this area will be compared to the full list of munitions in the DoD library. While this comparison will be performed, it is not necessarily expected to successfully classify all TOI correctly. Although they will not be usable as the basis for a final dig list, the classification results will be used to determine the shapes (e.g., cylindrical, plate-like, spherical, etc.) and relative sizes (e.g., smaller than a 20mm projectile, larger than 5-in rocket) of subsurface sources. They may also be used to guide the selection of sources for excavation (e.g., digging a subset of the best matches to munitions in the library) and comparisons between AGC-predicted sources and items recovered during the intrusive investigation.

Cluster analysis, which groups anomalies with similar polarizabilities will also be performed following inversion. Any group of four or more self-similar sources will be examined by the analyst. For each identified cluster, a representative sample may be included on the dig list at the discretion of the analyst to determine if the group of similar polarizabilities are MEC related. Clusters will generally not be investigated if the sources in the cluster are identified as noise or background by the analyst. The polarizabilities for cluster dig sources that are confirmed to be TOI will be added to the site-specific library and classification re-run following the library update.

Parameters and criteria used for classification will be documented in the Classification Technical Memorandum. The Classification Technical Memorandum will be revised, as necessary, if site conditions require modifications to the classification process, parameters, or criteria. Following target selection and classification, a full list of results for the UltraTEM data will be compiled for the SWMUs 10 and the Administration Area investigations. A dig list containing approximately 300 intrusive locations, to be split between the two investigation areas, will be developed in consultation with the project team. Items included on the dig list may include classified TOI, inconclusive sources, and sources representing potential MD that would be indicative of the types of munitions present. It is assumed that the SWMU 10 dig list will trend toward classified TOI because the expected munitions are well known (i.e., 20mm, 37mm, and 40mm projectiles). Given the uncertainty regarding munitions expected in the 36.5-acre Administration Area survey area, the dig list may contain a mix of sources matching munitions in the full DoD library and potential MD sources that are not necessarily TOI-level matches to library munitions. Investigation of inconclusive sources is expected to be limited in both SWMUs.

5.1.6.5 Synthetic Seeding and Analysis

After dynamic AGC data collection is complete, synthetic seeding methods will be used to verify that the expected munitions, as listed in **Tables 1.1 and 1.2**, are detectable and classifiable (as applicable) to the detection/classification depths listed in the tables given site-specific noise conditions. Synthetic seeding is a non-invasive process where artificial, software-generated responses from forward-modeled polarizabilities of TOIs are superimposed into AGC data to monitor the quality of the data and to provide confidence that the data are usable for their intended purpose. Using BTField, synthetic seeds will be modeled in the data at depths between 75 and 125 percent of their respective expected depths of detection/classification. Any noted effects on detection and/or classification depths, either positive (i.e., deeper than the depths noted in the tables) or negative (i.e., shallower than the depths in the tables) based on the synthetic seed results will be discussed in the DUA and the MEC Investigation Report. Synthetic seeding will be in addition to the actual physical seeds to be placed as discussed in **Section 5.1.5**.

5.1.7 Intrusive Investigation

AGC sources identified for excavation will be reacquired (i.e., located) and marked in the field using either RTK GPS or SLAM, dependent on overhead canopy or buildings restricting GPS coverage. Intrusive investigations will be performed using an EM61 for excavation clearance, and an RTK GPS or SLAM for source location. An analog metal detector may be used to pinpoint source locations within open holes.

The minimum separation distances (MSDs) presented in the approved Explosives Site Plan (ESP, PIKA-Pirnie Joint Venture, LLC [PIKA-Pirnie], 2015) will be enforced during intrusive MEC operations. If multiple teams are working in proximity to one another, the team separation distance (TSD) specified in the approved ESP will be maintained during intrusive activities. MSDs will be based on the appropriate munition with the greatest fragmentation distance (MGFD), which is also presented in the approved ESP.

It is anticipated that selected sources will be intrusively investigated by UXO-qualified personnel using hand digging. Although not expected, if warranted, mechanical methods (e.g., mini excavator) may be used to access large or deep anomalies. Personnel excavating an anomaly will initially remove approximately 6 inches of soil at the anomaly location. Excavations using heavy equipment will be conducted offset laterally from the suspected MEC item or anomaly being investigated. Following initial excavation, the excavation team will conduct a visual and instrument-assisted examination of the excavation. This process will be repeated until the audible signal from the handheld magnetometer indicates the anomaly source is close to the current floor of the excavation. Once this determination has been made, additional soil will be removed using hand tools or by hand until the anomaly is located.

Dig lists provided to the intrusive team will include the AGC-determined best match from either the site-specific library (SMWU 10) or the full DoD library (Administration Area survey area) and the misfit metric associated with that match. The type of match (e.g., 20mm projectile, 60mm mortar, 105mm projectile) will provide a relative size for the expected source, and the misfit metric will be an indication of the likelihood that the source will be the same general shape as the library munition/seed item. Excavations will continue until the anomaly source is resolved, both with regard to the degree of match with the AGC-predicted source and remaining response per the EM61. The source of any remaining EM61 response unrelated to the source (e.g., above-ground structure, adjacent anomaly not on the dig list) will be noted by the dig team.

For each recovered source, the Team Leader will record the location using RTK GPS or SLAM, depth, length, and a brief description if the item can be identified (e.g., 4.2-inch mortar base plate, aluminum can, large bolt, nail). A whiteboard photograph will be taken of all sources recovered at each dig location, to include a scale to show the item(s) dimensions. MPPEH, MEC, and DMM encountered during intrusive activities will be handled and disposed of as described in **Section 5.1.8** and the Waste Management Plan (**Section 7**). Once the source of an anomaly has been identified, confirmation samples have been collected, and necessary MEC operations have been completed, the excavation will be filled in and tamped to the approximate consistency and grade of the surrounding soil. To the extent possible, the excavation site will be restored to its original condition.

The Project Geophysicist will review intrusive investigation dig results. The comparison will include an evaluation of position, depth, approximate size, and item shape. Significant mismatches between the predicted and actual item location (horizontal and/or vertical) or size will require re-analysis of the advanced sensor data. The Project Geophysicist or their designated representative will review polarizability curves for mismatches. If that review indicates the mismatch was possibly caused by the intrusive team not properly clearing the dig location, it will be marked to be rechecked. If a review of the polarizability curves indicates the mismatch was caused by geophysical noise or geologic response matching a library object, the mismatch will be considered acceptable. For any other mismatch between prediction and observations the Project Geophysicist will examine the anomaly location, the analysis, or both and use professional judgment to determine the cause of the mismatch.

5.1.8 Handle, Certify and Dispose of MPPEH/MEC

5.1.8.1 MPPEH/MEC Identification

If the source of an excavated anomaly is MPPEH, it will be uncovered sufficiently to obtain a positive identification of the item. It will be inspected by a UXO Technician II or higher, who will determine if it is MEC, material documented as safe (MDAS), or range-related debris (RRD). The item will then be shown to the Team Leader (UXO Technician III), who will verify the classification, and immediately report the condition of the item(s) to the SUXOS and UXOSO. No MPPEH/MEC will be moved without positive identification of the item(s) and an evaluation of its condition by the SUXOS and UXOSO. MPPEH that cannot be verified to be free of explosive hazards or is suspected to present an explosive hazard, will be handled as MEC (see below).

MEC encountered during the project will be clearly marked and its position will be recorded by GPS. Data regarding such factors as type, size, depth, condition, and location of MEC located during the MEC investigation will be recorded, and all MEC encountered will be photographed.

5.1.8.2 Storage and Disposal of MEC/MPPEH

5.1.8.2.1 MEC/MPPEH Storage

If an item is identified as MEC or if a determination cannot be made, it will subsequently be decided whether that item is acceptable to move. MEC/MPPEH deemed acceptable to move may, in accordance with the approved ESP (PIKA-Pirnie, 2015), be moved for consolidation. Acceptable to move MEC/MPPEH items will be stored in an earth covered magazine in Explosive

Storage Block B for later consolidated disposal in the Corrective Action Management Unit (CAMU).

5.1.8.2.2 MEC/MPPEH Disposal

Acceptable to move items will be disposed of by Parsons in the CAMU in accordance with the ESP and the CAMU Management Plan. Items that cannot be moved will ideally be blown in place the day they are discovered in accordance with the ESP. If an unacceptable to move MEC item cannot be detonated on the day it is found, the item will be guarded until the item(s) can be detonated. If a MEC item cannot be safely blown in place under the existing conditions, the PM, SUXOS, and UXOSO will be notified, and a determination will be made of how to resolve the situation safely.

5.1.8.3 Material Documented as Safe

MPPEH that is inspected, verified, and certified to be free of explosive hazards will be classified as MDAS. MDAS generated during the project will be stored in a secure area inside locked containers. Once the field investigation is complete, the sealed containers will be shipped off-site for proper disposal in accordance with the Waste Management Plan (**Section 7**).

5.1.8.4 Other

If munitions are recovered during the investigation that are not addressed in the approved ESP (PIKA-Pirnie, 2015) and/or the above sections on MEC disposal, the SUXOS shall inform the USACE OESS, and the Parsons and USACE PMs so appropriate measures can be discussed, developed, and implemented for dealing with those item(s).

5.1.9 Soil Sampling and Analysis

This section provides general information regarding the methods that will be employed for soil sampling activities to be completed during the MEC investigation. A summary of analytical methods, sample containers, preservatives, and holding times is provided in **Table 5.5**. The following sections provide details regarding sample collection and management, QA, and QC.

5.1.9.1 Surface Soil Sampling

A discrete soil sample will be collected 0.5 foot below each MEC item encountered or after each consolidated detonation from the detonation crater. If any of the sample results encounter obvious contamination (visible material, staining or odors, or the results are above direct contact Human Health Screening Levels (**Table 3.2**), step-out locations will be advanced. Discrete step-out soil samples will be collected ten feet from the original sample location in at least four directions to define the nature and lateral extent of contamination (unless indicated otherwise). The step-out locations will be placed at 10-foot intervals stepping out until the lateral extent of contamination is defined. If additional step-out samples are collected, these samples will be collected from the outermost boring in that direction, and additional QC samples will be collected as needed. Samples will be collected using a decontaminated stainless-steel spoon or disposable plastic trowel.

5.1.9.2 Subsurface Soil Sampling

Subsurface soil sampling will be conducted if the results of the surface soil samples indicate that vertical extent has not been defined. The condition of all sampling and support equipment used for subsurface soil sampling associated with each specific MEC investigation area and the equipment cleaning procedures will be the same as defined in **Section 5.1.9.3**. Subsurface samples will be collected using a decontaminated hand auger.

5.1.9.2.1 Hand Auger Method for Subsurface Soil

This section provides procedures for subsurface soil sampling using a hand auger.

The Sampling Team shall complete the following steps to collect soil samples:

1. Spread clean plastic sheeting on the ground or table at each sampling location to keep sampling equipment clean and prevent cross-contamination.
2. Advance the hand auger to the desired sample depth.
3. Collect the sample using an approved sampling tool (e.g., stainless steel or disposable spoon, trowel, or scoop) and scoop the soil from the auger bucket starting at representative depth ranges as detailed in the work plan. Use a new, clean auger bucket once the top of the sampling depth is reached.
4. Transfer the sample from the auger bucket or trowel into a large disposable or stainless-steel bowl and mix the combined soil thoroughly to ensure a representative sample.
5. Collect suitable quantities with the approved sampling tool and transfer directly into the laboratory supplied clean containers with a moisture-tight lid (or a re-sealable plastic bag for grain size samples).
6. Repeat these steps as necessary to obtain sufficient sample volume.
7. When sample containers are filled, secure the caps tightly on the containers. Lids will be sealed by labels or custody seals to prevent tampering. The sample containers will then be placed into a cooler with ice and cooled to less than or equal to 6 degrees Celsius (≤ 6°C).
8. After sampling is completed, backfill the hole with remaining soil to return the site to as close to original condition as possible.

5.1.9.3 Decontamination Procedures

Equipment used to collect soil samples during the investigation will be decontaminated within a temporary decontamination pad constructed at Parcel 11. The decontamination pad will be designed so that all decontamination liquids are contained from the surrounding environment and can be recovered for disposal as investigation-derived waste (IDW). Equipment will be decontaminated after each sample is completed. The decontamination procedure for sampling equipment is as follows:

1. Remove caked soil material from the exterior of the equipment using a rod and/or brush.
2. Steam clean the equipment interior and exterior with approved water using a brush where steam cleaning is not sufficient to remove all soil material.
3. Rinse thoroughly with approved potable water.
4. Allow equipment to air dry as long as possible on clean, dry plastic sheeting.
5. Place equipment on clean plastic if it will be used immediately or wrap in plastic to prevent contamination if storage is required.

Non-dedicated sampling equipment will be decontaminated after each use during sampling. The procedure for decontamination of sampling equipment will be as follows:

1. Wash with approved water and phosphate-free detergent using brushes required to remove particulate matter and surface films.
2. Rinse thoroughly with approved potable water.
3. If analyzing for metals and expecting high levels of contamination, rinse thoroughly with hydrochloric acid (2% solution) or nitric acid (10% solution).
4. Rinse thoroughly with ASTM Type I or equivalent deionized/distilled water with analytical certification.
5. If analyzing for organics and expecting high levels of contamination, rinse thoroughly with solvent-pesticide grade isopropanol, acetone, or methanol, depending on analytes of interest.
6. Rinse thoroughly with ASTM Type I or equivalent deionized/distilled water with analytical certification.
7. Allow equipment to air dry as long as possible on clean, dry plastic sheeting.
8. Place equipment on clean plastic if immediate use is anticipated or wrap in aluminum foil to prevent contamination if storage is required.

A final decontamination inspection of any equipment leaving the site at the end of field activities will be conducted to ensure proper decontamination.

5.2 MEC QUALITY CONTROL

5.2.1 Measurement Performance Criteria and Measurement Quality Objectives

In order to attain data of sufficient quality to support DQOs (**Section 3.3 and Section 4.3**), specific procedures are required to allow evaluation of data quality. MPCs and MQOs have been developed for the project per the requirements in the Munitions Response Quality Assurance Project Plan Toolkit Module 1 (Intergovernmental Data Quality Task Force, 2020) and Engineering Manual 200-1-15 (Department of the Army, 2018). The MPCs (**Table 5.1**) are the minimum performance specifications that the investigation must meet to ensure that collected data will satisfy the DQOs. The MQOs (**Tables 5.2 through 5.4)** include procedures for testing, inspection, and quality control for all field data activities. MQO failures may be acceptable, but the failure response must include a root cause analysis (RCA) to determine the appropriate corrective action (CA) for the failure. Corrective actions will be applied, as necessary, before the data will be considered acceptable.

MQO results will be tracked via a Microsoft Access QC database that will be delivered to the USACE weekly during field operations. The MPCs are more general requirements that do not require daily evaluation, so applicable MPCs will be evaluated at the conclusion of the two major stages of the field project (i.e., following AGC data collection, processing, and submittal of the digs list and following the intrusive investigation). An MPC and MQO Results Report will be generated for each stage of the project and delivered with the final QC database to detail the results of the MPC/MQO evaluation.

5.2.2 Data Usability Assessments

A DUA is an evaluation based on the results of data verification and validation in the context of the overall project decisions or objectives. The assessment determines whether the project execution and resulting data meet the project DQOs (**Sections 3.3 and 4.3**) and MPCs (**Table 5.1**). All types of data (e.g., surface sweep, AGC, intrusive) will be considered with the goal of assessing whether the final, qualified results support the decisions to be made with the data. The process determines whether the collected data are of the right type, quality, and quantity to support the environmental decision-making for the project and describes how data quality issues will be addressed and how limitations of the use of the data will be handled.

Data gaps may be present if: (1) data are not collected, (2) data are not evaluated with regard to the necessary parameters, or (3) data are determined to be unusable. The need for further investigation or corrective action will be determined on a case-by-case basis, depending on whether data can be recovered, extrapolated from other data, and/or whether the missing data are needed based on the results of other recorded data. The project-specific DQOs (**Sections 3.3 and 4.3**), MPCs (**Table 5.1**), and MQOs (**Tables 5.2 through 5.4**) for MEC-related tasks define the various standards project data must achieve to ultimately be considered usable.

DUAs will be completed at two stages during the project: (1) following the dynamic survey and (2) following the completion of the intrusive investigation. DUAs may be completed for batches of data (i.e., more than one DUA for dynamic data may be completed). The completed DUAs will be included in the final report.

Each DUA will follow a four-step process:

1. Review the project objectives and sampling design:
    a. Review the DQOs. Are underlying assumptions still valid?
    b. Review the sampling design as implemented for consistency with stated objectives. Were assumptions representative of actual site conditions? Consider sources of uncertainty.
    c. Summarize any deviations from the planned sampling design and describe their impacts on DQOs.
2. Review the data verification/validation outputs and evaluate conformance to the MPCs:
    a. Review available QA/QC results. Evaluate the implications of unacceptable results. For any non-conformances, was the RCA/CA effective? Summarize the impacts of non-conformances on data usability.
    b. Evaluate conformance to the MPCs.
    c. Evaluate data completeness, identify data gaps, and summarize their impacts on the DQOs.
3. Document data usability, update the CSM, and draw conclusions:
    a. Assess the performance of the sampling design and identify any limitations on data use. Considering the implications of any deviations and data gaps, can the data be used as intended? Are the data sufficient to answer the study questions?
    b. Apply decision rules and draw conclusions.

    c. Update the CSM.

4. Document lessons learned and made recommendations:
    a. Summarize lessons learned.
5. Make recommendations for changes to the DQOs or sampling design for future delivery units.

5.3 MC QUALITY CONTROL

In order to attain data of sufficient quality to support project objectives, specific procedures are required to allow evaluation of data quality. The QA/QC procedures and requirements for their evaluation will comply with the RCRA Permit, Attachment 3, Sections 3.1.10 and 3.1.11 (NMED, 2015) and U.S. DoD Quality Systems Manual (QSM), Version 5.4 (U.S. DoD, 2021).

5.3.1 Field and Laboratory Quality Control Samples

Evaluation of field sampling procedures and laboratory equipment accuracy and precision requires the collection and evaluation of field and laboratory QC samples. **Table 5.6** summarizes the planned QC samples for this project. A description of each QC sample type is provided in the following sections.

5.3.1.1 Quality Control Analyses Originated by the Field Team

Field QC samples will be collected to determine the accuracy and precision of the analytical results. The QC sample frequencies are stated in the following sections.

Equipment Blank

Equipment blanks will be collected to monitor the cleanliness of sampling equipment and the effectiveness of decontamination procedures. Contamination from the sampling equipment can bias the analytical results high or lead to false positive results being reported. Equipment blanks will be prepared by filling sample containers with laboratory-grade contaminant free water that has been passed through non-disposable sampling equipment from driller tools and sampler hand tools. The required QC limits for equipment blank concentrations are to be less than the method's reporting limit.

Equipment blanks will be collected at a frequency of 10% per sampling apparatus. Samples associated with equipment blanks that have detected target compounds will be assessed during the data validation process. The usability of the associated analytical data will be documented and affected data will be appropriately qualified. Field corrective action to improve equipment decontamination procedures may also be implemented by the Field Lead at the request of the project chemist.

Field Duplicate

Field duplicates are collected in the field from a single aliquot of the sample to determine the precision and accuracy of the field team's sampling procedures. Field duplicates will be collected and analyzed at a frequency of 10% (i.e., one field duplicate sample will be collected for every ten samples collected) per mobilization. Field duplicates are indicated on **Table 3.3** and **Table 4.2.**

5.3.1.2 Quality Control Analyses/Parameters Originated by the Laboratory

Method Blank

Method blanks are used to monitor each preparation or analytical batch for interference and/or contamination from glassware, reagents, and other potential sources within the laboratory. A method blank is a contaminant-free matrix (laboratory reagent water for aqueous samples or Ottawa sand, sodium sulfate, or glass beads [metals] for soil samples) to which all reagents are added in the same amount or proportions as are added to the samples. It is processed through the entire sample preparation and analytical procedures along with the samples in the batch.

There will be at least one method blank per preparation or analytical batch. If a target compound is found at a concentration that exceeds one-half the reporting limit, corrective action must be performed in an attempt to identify and, if possible, eliminate the contamination source. If sufficient sample volume remains in the sample container, samples associated with the blank contamination should be reprocessed and reanalyzed after the contamination source has been eliminated.

Laboratory Control Sample

The laboratory control sample (LCS) will consist of a contaminant-free matrix such as laboratory reagent water for aqueous samples or Ottawa sand, sodium sulfate, or glass beads (metals) for soil samples spiked with known amounts of compounds that come from a source different than that used for calibration standards. Target compounds will be spiked into the LCS. The spike levels will be less than or equal to the midpoint of the calibration range. If LCS results are outside the specified control limits, corrective action must be taken, including sample re-preparation and re-analysis, if appropriate. If more than one LCS is analyzed in a preparation or analytical batch, the results for each LCS must be reported. Any LCS recovery outside QC limits affects the accuracy for the entire batch and requires corrective action.

Matrix Spike/Matrix Spike Duplicate

A sample matrix fortified with known quantities of specific compounds is called a MS. It is subjected to the same preparation and analytical procedures as the native sample. For this project, all target compounds will be spiked into the MS sample. Sample MS recoveries are used to evaluate the effect of the sample matrix on the recovery of the analytes of interest. A MSD is a second aliquot of the MS sample, fortified at the same concentration as the MS. The relative percent difference (RPD) between the results of the MS duplicates measures the precision of sample results.

Project-specific samples will be used by the laboratory for the MS/MSD samples, which will be designated on the chain-of-custody (COC) form. The spike levels will be less than or equal to the midpoint of the calibration range. Pairs of MS/MSDs will be collected at a frequency of 5%. MS/MSDs are required in every analytical batch regardless of the rate of collection and how samples are received at the laboratory.

5.3.2 Data Precision, Accuracy, Representativeness, Comparability and Completeness

Field QA/QC samples and laboratory internal QA/QC samples are collected and analyzed to assess the data’s quality and usability. The following sections discuss the parameters that are used to assess the data quality.

Precision

The precision of laboratory analysis will be assessed by comparing the analytical results between MS/MSD and laboratory duplicate samples. The precision of the field sampling procedures will be assessed by reviewing field duplicate sample results. The RPD will be calculated for the duplicate samples using the equation:

$$\%RPD = \{(S - D)/[(S + D)/2]\} \times 100$$

where:

S = first sample value (original value)
D = second sample value (duplicate value)

The precision criteria for the duplicate samples will be plus or minus (±) 50% in soil samples.

Accuracy

Accuracy of laboratory results will be assessed for compliance with the established QC criteria using the analytical results of method blanks, reagent/ preparation blanks, LCS and MS/MSD samples and surrogate results, where applicable. Laboratory accuracy will be assessed for compliance with the established QC criteria listed in Appendix C of the QSM (U.S. DoD, 2021). The percent recovery (%R) of LCSs will be calculated using the equation:

$$\%R = (A/B) \times 100$$

where:

A = the analyte concentration determined experimentally from the LCS

B = the known amount of concentration in the sample

Completeness

The data completeness of laboratory analyses results will be assessed for compliance with the amount of data required for decision making. Complete data are data that are not rejected. Data with qualifiers such as “J” or “UJ” are deemed acceptable and can be used to make project decisions as qualified. Data qualifiers are listed in **Table 5.7**. The completeness of the analytical data is calculated using the equation:

$$\%Completeness = [(\text{complete data obtained})/(\text{total data planned})] \times 100$$

The percent completeness goal for this sampling event is 90% for each analytical method.

Representativeness

Representativeness is the degree to which sampling data accurately and precisely represent site conditions and is dependent on sampling and analytical variability and the variability of environmental media at the site. Representativeness is a qualitative “measure” of data quality.

Achieving representative data in the field starts with a properly designed and executed sampling program that carefully considers the project’s overall objectives. Proper location controls and sample handling are critical to obtaining representative samples.

The goal of achieving representative data in the laboratory is measured by assessing accuracy and precision. The laboratory will provide representative data when the analytical systems are in control. Therefore, representativeness is a redundant objective for laboratory systems if sample

COC and sample preservation are properly documented, analytical procedures are followed and holding times are met.

Comparability

Comparability is the degree of confidence to which one data set can be compared to another Comparability is a qualitative "measure" of data quality.

Achieving comparable data in the field starts with a properly designed and executed sampling program that carefully considers the project's overall objectives. Proper location controls and sample handling are critical to obtaining comparable samples.

The goal of achieving comparable data in the laboratory is measured by assessing accuracy and precision. The laboratory will provide comparable data when analytical systems are in control. Therefore, comparability is a redundant QC objective for laboratory systems if proper analytical procedures are followed and holding times are met.

Sensitivity

Sensitivity is the ability of the method or instrument to detect the contaminant of concern and other target compounds at the level of interest. Appropriate sampling and analytical methods will be selected that have QC acceptance limits that support the achievement of established performance criteria. Elevated sensitivities due to dilutions caused by matrix interference will be communicated in the case narrative of the laboratory report. If necessary, clean-up methods such as sulfuric acid, florisil cartridge, and copper clean-up for parameters such as pesticides and PCBs will be employed to get rid of interferences.

For this project, the performance criteria are the Soil Screening Levels (SSLs) presented in the NMED Risk Assessment Guidance for Site Investigations and Remediation (NMED, 2022). The NMED SSLs will be used to evaluate contaminant concentrations in soil samples. For human receptors, if NMED does not have a published SSL, then a USEPA Regional Screening Level (RSL) will be used if one is published (USEPA, 2024). Assessment of analytical sensitivity will require thorough data validation. NMED SSLs (or USEPA RSLs) are provided in **Table 3.2**. A comparison of the NMED SSLs (or USEPA RSLs) to laboratory quantitation limits is provided in **Table 5.8**, which includes an evaluation of analytes with limits of quantitation (LOQs) that are greater than lowest NMED SSLs (or USEPA RSLs). There are no analytes with LOQs greater than the lowest direct contact human health screening levels.

5.3.3 Data Verification and Data Review Procedures

Personnel involved in data validation will be independent of any data generation effort. The project chemist will be responsible for the oversight of data verification, review, and validation. Data verification and review will be performed when the data packages are received from the laboratory. Verification will be performed on an analytical-batch basis using the summary results of calibration and laboratory QC, as well as those of the associated field samples. There are five stages of review defined in the DoD General Data Validation Guidelines (DoD, 2019):

1. Stage 1: Verification and validation based only on completeness and compliance of sample receipt condition checks.
2. Stage 2A: Verification and validation based on completeness and compliance checks of sample receipt conditions and ONLY sample-related QC results.

3. Stage 2B: Verification and validation based on completeness and compliance checks of sample receipt conditions and BOTH sample-related and instrument-related QC results.
4. Stage 3: Verification and validation based on completeness and compliance checks of sample receipt conditions, both sample-related and instrument-related QC results, AND recalculation checks.
5. Stage 4: Verification and validation based on completeness and compliance checks of sample receipt conditions, both sample-related and instrument-related QC results, recalculation checks, AND the review of actual instrument outputs.

For this project, 100% of the data packages will undergo data verification and data review, 100% to Stage 2B, and 10% to Stage 4 in accordance with DoD General Data Validation Guidelines and DoD published data validation modules. Data validation will be performed by Parsons using automated data review software and/or manual data validation. The laboratory will submit the following data deliverables, a Stage 4 data package in PDF format as described in the DoD General Data Validation Guidelines and an electronic data deliverable (EDD) using the Staged Electronic Data Deliverables (SEDD) format in accordance with the most recently published version (SEDD Specification Document 5.2, Revision 1.1, October 2019).

Documentation of all laboratory Quality Control activities performed specifically in conjunction with this project will be furnished along with sample results. Copies of all raw data, chromatograms, standard curves etc. will be provided upon completion of the laboratory's work. The laboratory shall provide a case narrative of the analyses that includes any QC or sample analyses run deviations for each sample delivery group (SDG) and will include this at the front of any laboratory report deliverables. Data validation must, at a minimum, be Stage 2 with a 10% (100% for any manual integrations) back check to Stage 4.

Analytical data in the MEC Investigation Report will be provided as Stage II data in digital format with searchable electronic data tables.

5.3.4 Data Assessment

Limitations on data usability will be assigned, if appropriate, as a result of the validation process described earlier. The results of the data validation will be discussed in a separate report so that overall data quality can be verified through the precision, accuracy, representativeness, comparability, and completeness of sample results.

5.4 CHAIN OF CUSTODY

For each sample, COC forms will be completed and will accompany each sample at all times. Data on the COC form will include the sample ID (as described in **Section 5.9**), depth interval, date sampled, time sampled, project name, project number, and signatures of those in possession of the sample. The COC forms will accompany those samples shipped to the designated laboratory so that sample possession information can be maintained. The field team will retain a separate copy of the COC form at the field office. Additionally, the sample ID, date and time collected, collection location, and analysis requested will be documented in the field logbook as discussed in **Section 5.6**.

5.5 PACKAGING AND SHIPPING PROCEDURES

All samples will be shipped by overnight air freight to the laboratory or hand delivered. Unless otherwise indicated, samples will be treated as environmental samples, shipped in heavy duty coolers, packed in materials to prevent breakage (such as bubble wrap), and preserved with ice in sealed plastic bags. Each shipment will include the appropriate field QC samples (i.e., trip blanks, duplicates, and rinsates).

Corresponding COC forms will be placed in waterproof bags and taped to the inside of the cooler lids. Each cooler shipped from the laboratory containing aqueous sample bottles for VOC analyses will contain a trip blank. The trip blank will stay with the cooler until the cooler is returned to the analytical laboratory. All coolers will be taped shut and a custody seal will be placed over the tape to prevent tampering.

5.6 SAMPLE DOCUMENTATION

5.6.1 Field Logbook

All information pertinent to on-site environmental task activities, including field instrument calibration data, will be recorded in field logbooks or on field forms. A typed, formatted blank boring log will be prepared before sampling begins.

All logbooks or field forms will be completed in accordance with instruction defined in Appendix F of the *Requirements for the Preparation of Sampling and Analysis Plans* (USACE, 2001). The logbooks will be bound, and the pages will be consecutively numbered. Field forms, which are a project-specific collection of forms, will be bound by a three-ring binder, comb-binding, or equivalent or contained in electronic format (i.e., field sheet on a tablet computer) and will capture specific field data, similarly to a field logbook. Logbooks and field forms should be produced on waterproof paper when possible. Entries in the logbooks or forms will be made in black waterproof ink and must be clear, objective, and legible. Entries will include, at a minimum, a description of each day's activities, individuals involved in environmental task activities, date and time of drilling or sampling, weather conditions, any problems encountered, significant events, and all field measurements. Dates are recorded in the month/date/year format; time is recorded in the 24-hour military clock format. Changes will be made by striking through the original entry in a manner that does not obliterate the original entry. The person making the change will initial and date the change.

Calibration logs will include instrument name, serial number, calibration data, and date of calibration. Lot numbers, manufacturer name, and expiration dates of standard solutions used for field instrument calibration also will be recorded.

Sufficient information will be recorded in the logbooks to permit reconstruction of all environmental task activities conducted. Information recorded on other project documents (e.g., boring logs, well construction diagrams, well development records, electronic records) will not be repeated in the logbooks except in summary form where determined necessary. All field logbooks will be kept in the possession of field personnel responsible for completing the logbooks, or in a secure place when not being used during fieldwork. All electronic forms of data collection will be backed-up a minimum of once per day. All logbooks will have a distinct project ID number and an inventory will be maintained. Upon completion of the field activities, all logbooks will become part of the project evidence file. The title page of each logbook will be labeled with the following information:

- Logbook title;
- Project name;
- Logbook inventory ID number;
- USACE, Louisville District/other U.S. Army contract number and project delivery order number;
- Start date for field activities; and
- End date for field activities.

Logbook and field form entries will be a compilation of relevant, factual events as they occur. Entries recorded in logbooks can include, but not be limited to, the following information:

- Name and title of author, date, and times of arrival at and departure from the work site;
- Purpose of the drilling, sampling and/or remedial activity;
- Name and contact information of the field manager;
- Names and responsibilities of field crew members;
- Names and titles of any visitors;
- Weather and site conditions;
- Field observations;
- Sample collection or task accomplishment method;
- Amount of materials used or removed;
- Number and volume of sample(s) collected;
- Sample ID number(s);
- Date and time of sample collection, and name of collector;
- Sampling type and methodology;
- Sample preservation methods;
- Details of the sampling location, including a sketch map illustrating the sampling location;
- Location, description, and log of sampling point photographs;
- References for all maps and photographs of the sampling site(s);
- Information regarding drilling decisions not recorded on the boring log;
- Types of field instruments used and the purpose of use, including calibration methods and results;
- Any field measurements made (e.g., pH, conductivity, and static water level);
- Sample documentation information, including

  - COC record numbers; and
  - Number of shipping containers packaged (including contained chain-of-custody records) and the shipping method employed (noting applicable tracking numbers).
- Sample distribution and transportation (e.g., name and address of the laboratory and courier);
- Name and address of the U.S. Army QA laboratory for the project and the associated project Laboratory Information Management System number, where applicable;
- Information from containers, labels of reagents used, deionized and organic-free water used;
- Decontamination procedures;
- Type, matrix, and containerization method for IDW generated;
- IDW documentation information, including:
  - Types of containers/drums;
  - Contents, type, and approximate volume of waste;
  - Type of contamination and predicted level of contamination based on available information (i.e., generator knowledge);
  - Weekly visual inspection information.
- Summary of daily task (including costs where appropriate) and documentation on any cost or scope or work changes required by field conditions;
- Information regarding sampling changes, scheduling modifications, and change orders;
- Information regarding access agreements, if applicable;
- Signature and date of personnel responsible for recorded observations; and
- Signature and date of personnel responsible for verifying the QC review of the logbook and/or field form, including but not limited to, accuracy, completeness, legibility, consistency, and clarity.

Copies of the field logbooks will be included in the final report.

5.6.2 Photographs

Representative photographs will be taken of the investigative activities, soil borings, and any significant observations made during the field effort.

5.7 FIELD INSTRUMENT CALIBRATION

All field instruments will be calibrated following manufacturer recommended calibration procedures and frequencies. Field instruments may include, but are not limited to, air quality meters such as PIDs and multi-gas meters. Field instrument calibrations will be recorded in a designated portion of the field logbook at the time of the calibration. Adverse trends in instrument calibration behavior will be corrected.

5.8 SURVEY OF SAMPLE LOCATIONS

The location of each sample collected will be surveyed using appropriate instrumentation and procedures to obtain horizontal accuracy of less than 0.1 foot. A Trimble Total Station Global Positioning System (GPS), Trimble Static GPS, or equivalent, will be utilized to document each soil sample location. A North American Datum 1983 Northing and Easting in U.S. Survey Feet will be established for all surveyed points and recorded in a dedicated field notebook. Survey data will be supplied in the Final Report in New Mexico State Plane and Universal Transverse Mercator Index coordinates.

5.9 SAMPLE IDENTIFICATION

During sampling, unique sample ID numbers will be assigned to each sample or subsample. Each sample ID number will consist of a combination of the Parcel number, SWMU/AOC number, additional site identifier, source of sample, increment or boring number, type of sample, and depth of sample collection in accordance with the latest version of the FWDA *Environmental Information Management Plan* (USACE, 2009). Following is an example sample number and a description of the sample identifiers to be used during implementation of this MEC Investigation Work Plan.

Example Sample ID: 1110MECSB01-0.5-1.0D-SO

Parcel: 11

SWMU or AOC: in this case SWMU 10

Additional Site Identifier: in this case MEC

Source of Sample: in this case SB (soil boring)

Increment Number: Samples collected within each MEC Investigation area (SWMU 10 and the Administration Area) will be assigned sequential 2-digit or 3-digit numbers (in this case 01)

Depth Range: In feet (in this case 0.5 to 1.0 foot)

Type of Sample: D (discrete)

Matrix: SO (Soil)

QA/QC samples will carry the same sample nomenclature as the parent sample with a unique suffix and numeral (if required) to distinguish individual samples. Equipment rinsate blanks, trip blanks, and field blanks will carry the sample location identifier with an additional designation of TBXX or EBXX (where XX represents the sequence number of the sample). Each blank will have a unique tracking number.

5.10 INVESTIGATION-DERIVED WASTE

Three types of IDW may be generated during the sampling of environmental media during the Parcel 11 MEC Investigation activities: residual soil volume, decontamination fluids, and disposable sampling equipment/PPE. Proper management of this IDW is required to ensure compliance with federal, state, and Army regulations applicable to the collection, storage, transport, and disposal of potentially hazardous materials. Required IDW management measures for FWDA investigations or remedial activities will be waste segregation, containerization and labeling, temporary storage, waste characterization, and disposal. IDW will be managed in accordance with **Section 7.0**.

6.0 RISK ASSESSMENT AND REPORTING

A qualitative risk assessment will be conducted to evaluate explosive hazards to human receptors. The purpose of the risk assessment is to determine the potential hazards associated with interaction with MEC present in environmental media. A MEC hazard assessment is a procedure used to qualitatively evaluate the potential explosive hazards presented to human receptors associated with complete MEC exposure pathways at a site. The qualitative risk assessment technique presented here follows the OSD Memorandum dated 14 July 2023 and titled, *Military Munitions Response Program Risk Management Methodology* (OSD, 2023). RMM is a tool used to assess risks at MEC contaminated sites and can serve as the baseline risk assessment and facilitate communication about risk. A baseline risk assessment is prepared and serves as the basis for evaluating risk posed from exposure to contamination if no remediation or institutional controls are applied. The RMM is one factor to be considered when determining whether additional actions are required at a MEC-contaminated site. Successful implementation of the decision-making process is highly dependent on receiving stakeholder input and concurrence.

If MEC is encountered and MC soil samples are collected, then a summary of the analytical data, including a comparison of the results to the appropriate screening levels, will be included in the MEC Investigation Report.

6.1 EXPLOSIVE HAZARDS AND RISK ASSESSMENT

Explosive hazards exist at a site if there is a potentially complete MEC exposure pathway, consisting of a receptor that can come near or into contact with MEC and interact with the item in a manner that might result in its detonation. For this reason, the potential hazard depends upon the presence of three critical elements, all of which must be present for explosive hazards to exist (i.e., there is no risk if any one of these three elements are absent). These three critical elements are:

- *A source* of MEC (i.e., an explosively hazardous item);
- *A receptor* (i.e., a person); and
- *The potential for harmful interaction between the MEC source and the receptor* (i.e., the possibility a receptor encounters the MEC item and causes energy to be imparted on it resulting in an unintentional detonation).

The RMM provides an assessment of the explosive hazards associated with MEC at a site by evaluating site-specific conditions and human issues that affect the likelihood that a MEC accident will occur. The method uses input data based on historical documentation, field observations, and results of previous studies and removal actions. Most importantly, the RMM provides a means to evaluate site-specific factors regarding explosive hazards at a site and differentiate acceptable versus unacceptable conditions.

The risk assessment will be conducted to evaluate the baseline conditions for the Parcel 11 sites regarding explosive hazards. This baseline risk assessment will determine whether further action is necessary to address unacceptable explosive hazards and provides the basis for the evaluation and implementation of effective management response alternatives for mitigating unacceptable risks. The risk assessment also supports hazard communication among stakeholders by organizing site information in a consistent manner for the hazard management decision-making process.

6.2 ADDRESSING MULTIPLE RISK SCENARIOS

The RMM will be applied to SWMUs surveyed as part of the MEC investigation. There are two areas to be investigated at Parcel 11, SWMU 10 and the 36.5-acre Administration Area survey area. The MEC-related characteristics of discrete investigation areas may differ regarding the munitions types and quantities, land uses, receptors, and other factors. If these factors differ significantly, the qualitative explosive hazards in the discrete areas are also likely to vary. For example, the incinerator in Parcel 11 SWMU 10 was confirmed to be used for MEC disposal, and a significant quantity of MD was recovered during previous investigations, while the only potential MEC/MD source in the Administration Area survey area was the storage and/or transport of MEC/MD through the area. Additionally, the current and future conditions for each investigation area may differ, which might also affect the qualitative risks associated with explosive hazards. Finally, different levels of risk may also result in different response alternatives being appropriate for these discrete areas. Therefore, RMM will be applied to each SMWU individually.

If multiple possible risk scenarios (e.g., different munition types, significantly different munition quantities, or differing present/future conditions) are identified within a single survey area during the field investigation, it may be appropriate to evaluate them separately. In these cases, two or more distinct risk scenarios may be identified, each of which will be the subject of a separate application of the RMM.

6.3 OVERVIEW OF INPUT FACTORS FOR DECISION LOGIC TO ASSESS RISKS FROM EXPLOSIVE HAZARDS

The RMM (OSD, 2023) uses three matrices (Matrices 1 through 3) to support the assessment of each risk scenario. To complete the baseline risk assessment for explosive hazards under each risk scenario, input factors for the three matrices are reviewed and suitable categories are selected based on historical documentation, stakeholder input, and the results of the MEC investigation. These matrices are related to the three critical elements noted previously and are:

- **Matrix 1: Likelihood of Encounter**, which is based on the input factors:
    - *Likelihood of MEC Presence* (i.e., how much MEC is there at the site?)
    - *Extent of Exposure* (i.e., what is the degree to which receptors traverse or conduct activities on the assessment area annually?)
- **Matrix 2: Likelihood of Interaction**, which is based on the input factors:
    - *Likelihood of Encounter* (see first bullet above; output of Matrix 1)
    - *Frequency of Activities in the Interaction Zone* (i.e., how often do receptors spend in the interaction zone for each identified risk scenario?)
- **Matrix 3: Risk of Harmful Incident**, which is based on the input factors:
    - *Likelihood of Interaction* (see second bullet above; output of Matrix 2)
    - *Munition MEC Code* (selected from DoD-developed list that contains “MEC Codes” for most common munitions items)

The output of Matrix 3 is a recommendation of either acceptable or unacceptable risk.

The three risk matrices and the input factors required to complete the risk assessment are described below, though more complete details and explanations are provided in the RMM (OSD, 2023).

Matrix 1, Likelihood of Encounter**:** This is dependent on two input factors, the *likelihood of MEC presence* known or suspected to exist, and *extent of exposure* (e.g., accessibility and frequency of use). "Amount of MEC" is determined using site specific characterization data or anticipated or completed results of a remedial action. Although the scale emphasizes the results of distribution, the selection may also include consideration of available historical information, such as former uses. "Extent of Exposure" are selected based on considerations of the access and frequency of use for the MRS. The selection considers the degree to which receptors traverse and/or conduct activities within the assessment area annually. Matrix 1 is shown in **Table 6.1**.

Matrix 2, Likelihood of Interaction**:** This factor relates "Likelihood of Encounter" from Matrix 1 (**Table 6.1**) to the frequency of activities in the interaction zone. An interaction is defined as the receptor imparting energy to a MEC item, either intentionally or unintentionally, upon an encounter. Matrix 2 is shown in **Table 6.2**.

Matrix 3, Risk of Harmful Incident**:** This factor is to help the project team evaluate the likelihood of an explosive incident and relates the "Likelihood of Interaction" from Matrix 2 (**Table 6.2**) to a "MEC Code" developed by the DoD. An *explosive incident* occurs when a receptor interacts with a MEC item and causes it to function or otherwise release energy, resulting in harm to one of more receptors. The MEC Codes were developed for most common munitions and are generally based on the likelihood of an interaction causing an explosive incident and harm the incident may cause to the receptor. Factors considered in the MEC Codes include the fuzing, size, and filler of the MEC items. Matrix 3 is shown in **Table 6.3**. If a munition is not included in the MEC Codes, the following are the general criteria for each MEC Code:

- **MEC Code 3** – MEC that will likely cause the death of one or more individuals if they function because of an interaction. *Example: Most munitions with high explosive (HE) fill*.
- **MEC Code 2** – MEC that will likely cause major injury to, and in extreme cases could cause the death of, one or more individuals if they function because of an interaction. *Example: Most pyrotechnics and propellants*.
- **MEC Code 1** – MEC that will likely cause minor injury to, and in extreme cases could cause major injury to or the death of, one or more individuals if they function because of an interaction. *Example: Most practice munitions*.
- **MEC Code 0** – Munitions that present no explosive hazard.

The result from Matrix 3 is used to identify potentially unacceptable from potentially acceptable risk conditions for each exposure scenario. If an acceptable risk scenario is identified in Matrix 3, those results will be presented to the project team and stakeholders. If the project team and stakeholders concur that there is an acceptable risk, then it may be possible to recommend no further action. Leaving known MEC items in place will not be considered acceptable. Where an unacceptable risk scenario is identified, a remedial response is required to address risks from explosive hazards. In these situations, the matrices can be used to identify remedial responses that will ultimately achieve acceptable conditions.

6.4 SITE-SPECIFIC BASELINE MUNITIONS AND EXPLOSIVES OF CONCERN HAZARD EVALUATIONS

A qualitative baseline risk assessment of potential explosive hazards will be developed for each exposure scenario. The qualitative baseline evaluation will be conducted by reviewing each of the input factors for the RMM described in **Section 6.3** above and determining results appropriately. **Tables 6.4 and 6.5** list the matrix categories based on the current known land use. The risk evaluation will also comply with the requirements of Section 7.2 of Attachment 7 of the RCRA permit (NMED, 2015), which includes evaluating residential land use. Therefore, **Tables 6.6 and 6.7** list the matrix categories based on potential future residential land use. The data collected during the field investigation and the historical data available from prior surveys will be used to determine the appropriate categories for each of the remaining input factors or to adjust the assumptions in the CSM as new information is gained. Finally, the outputs from Matrices 1 through 3 will be used to evaluate whether conditions are considered acceptable or unacceptable with respect to risks from explosive hazards. This process and the justification(s) for the selection of each factor and the final result will be documented and explained in the MEC Investigation Report for Parcel 11.

Parsons will prepare and submit a MEC Investigation Report for Parcel 11 documenting the activities performed and summarizing the results. The MEC Investigation Report will include analysis and summary of the investigations conducted within each investigation area and their results, including photographs, and maps depicting relevant features including selected anomaly locations, classified TOI, as applicable, intrusive investigation locations and the types and extents of munitions related contamination identified.

6.5 HUMAN HEALTH RISK ASSESSMENT

The general steps for conducting the human health screening risk assessment per Section 1.3 of the *NMED Risk Assessment Guidance for Site Investigations and Remediation, Volume I, Soil Screening Guidance for Human Health Risk Assessments* (NMED, 2022) are as follows:

Step 1: Determine COPCs (further discussed in **Section 6.5.4.1**). This includes conducting a site attribution analysis and elimination of some constituents through comparison of site concentrations to background levels (**Section 6.5.4.2**).

Step 2: Compare maximum detected site concentrations for COPCs to the direct contact SSLs for applicable receptors (**Table 3.2**). If a chemical presents both carcinogenic and noncarcinogenic health toxicity, then compare to both screening levels, if available.

- If the resulting Hazard Index (HI) (sum of all hazard quotients, HQs) is less than 1.0, stop; no additional assessment for noncarcinogens is needed.
- If resulting cancer risk (sum of all cancer risks) is less than 1E-05, stop; no additional assessment for carcinogens is required.

Risks/hazards across all applicable pathways will be included in the comparison to NMED target levels of 1 and 1E-05 (**Section 6.5.4.3**). Any risk/hazard from other site-specific pathways will be added to the summed risk/hazard calculated using the SSLs (**Section 6.5.4.3**). The beef ingestion pathway will be addressed in the Uncertainty Section of the MEC Investigation Report.

If Step 2 results in adverse risk/hazard, then either further evaluation to determine the extent of contamination and potential risk, or removal of contaminated soil will be recommended. Additional surface and/or subsurface samples may need to be collected to delineate extent of COPCs in soil and evaluate risk associated with potential exposure to MC in soil. No further evaluation will be conducted as part of the MEC Investigation Report.

These steps are further discussed in **Section 6.5.4**.

6.5.1 Define NMED Target Risk Thresholds

The NMED risk guidance for human health (NMED, 2022; Section 1.2.3 and Section 5) identifies two target risk thresholds that are used to evaluate if cancer risks and noncancer hazards are acceptable. According to NMED, adverse health impacts are unlikely when the cancer risk is less than $1x10^{-5}$ for carcinogenic analytes, and when the HI is less than 1.0 for noncarcinogenic analytes. These are the target risk thresholds that will be used in the human health risk evaluation for Parcel 11.

6.5.2 Selection of Screening Levels

Soil is the only medium that will be evaluated for Parcel 11, through use of screening levels selected to reflect the requirements of the Permit (NMED, 2015; Attachment 7, Section 7.2) and the NMED risk guidance (NMED, 2022). For human receptors, if NMED does not have a published SSL, then a USEPA Regional Screening Level (RSL) will be used if one is published (USEPA, 2024). Assessment of analytical sensitivity will require thorough data validation. NMED SSLs (or USEPA RSLs) are provided in **Table 3.2**.

6.5.3 Preliminary Exposure Pathway Evaluation

The NMED risk guidance (NMED, 2022) requires the evaluation of four types of exposure to COPCs in soil: 1) direct contact, 2) ingestion of beef that has bioaccumulated COPCs through grazing, 3) inhalation of volatile COPCs that have migrated from the soil to indoor air, and 4) exposure to COPCs in soil that migrate to groundwater that is subsequently used as a potable water source. [Note: Groundwater in Parcel 11 is being evaluated as part of the Northern Area Groundwater RFI and will not be evaluated further here.] The NMED risk guidance (NMED, 2022) also requires evaluation of exposure to COPCs in tap water from domestic use. The exposure pathways are discussed in the following sections.

6.5.3.1 Direct Contact

The NMED risk guidance (NMED, 2022) identifies three receptor types that may potentially be exposed through direct contact with soil: 1) residential receptors, 2) commercial/industrial workers, and 3) construction workers. These three receptors could be exposed to site-related COPCs in soil via dermal contact, incidental ingestion, and inhalation of dust/volatiles in ambient air. All three receptors will be evaluated.

6.5.3.2 Beef Ingestion

The beef ingestion pathway will be addressed in a qualitative assessment in the Uncertainties Section of the risk assessment in the MEC Investigation Report. Lines of evidence to characterize potential risks may include the following:

- Percent of acreage impacted by site contamination is less than two acres in size resulting in only a fraction of the cow's diet (grass only, forage, silage, grain) being potentially contaminated;
- Levels of contamination are below residential screening levels;
- No significant ecological risks for the larger game receptors; and
- Beef ingestion rates (or percentage of beef in diets) for the potential receptors for the region/area.

SWMU 10 is approximately 5 acres and the Administration Area is approximately 36.5 acres. Therefore, the beef consumption pathway is potentially complete for SWMU 10 and the Administration Area. A qualitative evaluation for the beef ingestion pathway will be included in the Uncertainty section of the MEC Investigation Report for SWMU 10 and the Administration Area because they are greater than 2 acres.

6.5.3.3 Vapor Intrusion

The NMED risk guidance for human health (NMED, 2022) requires an evaluation of VI from subsurface media to indoor air when volatile analytes are detected. As defined by NMED, volatile analytes are those having a molecular weight of 200 grams per mole (g/mol) or less, having a Henry's law constant exceeding 1×10^{-5} atmospheres – cubic meter per mole (atm-m^3/mol), and that are identified as toxic through the inhalation pathway. None of the MC evaluated in this investigation (explosives and metals) are generally considered volatile or to pose a risk through vapor intrusion.

The NMED risk guidance (NMED, 2022) requires that the VI pathway be identified with one of the following designations:

1. Incomplete pathway and no action required,
2. Potentially complete pathway and a qualitative evaluation required, or
3. Complete pathway and quantitative evaluation required.

At SWMU 10 or the Administration Area, the VI pathway will be considered incomplete and no action is required.

6.5.4 Approach for Evaluating Human Health Risks

The potential for unacceptable health risks from exposure to MC-related contamination will be evaluated for potentially complete pathways as defined by the exposure pathway analysis for each MEC Investigation area (SWMU 10 and the Administration area). The steps of the human health risk assessment are presented below.

6.5.4.1 Identification of Chemicals of Potential Concern (Step 1, Part 1)

Analytes detected in one or more samples from the data set for each MEC Investigation area (SWMU 10 and the Administration area) will be identified as preliminary COPCs. Site specific COPCs will be determined by comparing the maximum detected concentrations of preliminary COPCs to the most protective direct contact SSLs (or USEPA RSL if an SSL is not available). The lowest direct contact screening level is shown in **Table 3.2.** If the maximum detected concentrations of preliminary COPCs are above the direct contact SSLs (or USEPA RSL if an SSL is not available), these analytes will be retained as site-specific COPCs and carried forward into the MC risk assessment.

6.5.4.2 Evaluation of Metals Background Levels (Step 1, Part 2)

As allowed by NMED risk guidance (NMED, 2022; Section 2.8.3.2), the risk evaluation process may incorporate a comparison to background concentrations before evaluating MC risks. This is consistent with Attachment 7 (Section 7.6) of the Permit (NMED, 2015), which indicates that the screening level for naturally occurring (i.e., background) constituents can be set at the background level if a background level is approved by NMED. This section provides a summary of the background studies completed at the site, and the evaluation to be performed to determine if metals should be retained as COPCs.

Summary of Metals Background Studies

At FWDA, site-specific background concentrations for metals in soil were established through the completion of a background study conducted in 2009 and documented in a report titled Soil Background Study and Data Evaluation Report (Shaw Environmental, 2010). The study included collection of 124 samples from areas of FWDA in Parcels 1, 2, 5A, 8, 14, 15, 17, 19, and 20 believed to be unimpacted by historical operations. The background value selected for each metal in soil included in the study is provided in Table 8.1 of the Shaw Environmental (2010) report. A supplemental background study was conducted in 2012 and documented in a report titled Final Phase 2 Soil Background Report (USACE, 2013a). The purpose of the supplemental investigation was to refine the background levels for arsenic and antimony. The study resulted in a revised background value of 0.23 mg/kg for antimony, which is the 95% upper tolerance limit (UTL) from soil unit 350ss, as presented in Table 4.1 of the Final Phase 2 Soil Background Report (USACE, 2013a), but arsenic concentrations at investigation areas without known arsenic sources still continued to exceed the background level.

In 2013, NMED issued a letter titled The Evaluation of Background Levels for Arsenic in Soil (NMED, 2013). This letter provides a summary of the background evaluations and provides a refined arsenic background value and guidance on how to use that value to assess investigation results. Specifically, the NMED letter states that if the maximum arsenic concentration is less than 5.6 mg/kg, then arsenic may be considered representative of background and no further action for arsenic is required. If the maximum arsenic concentration is greater than 5.6 mg/kg, then the range of arsenic concentrations in the sample data set is to be compared to the range of arsenic concentrations in the site-specific background data set (0.2 mg/kg to 11.2 mg/kg). If the range of arsenic concentrations in the sample data set is consistent with the range of concentrations in the site-specific background data set, then the arsenic concentrations can be considered representative of background and no further action for arsenic is required. If the range of arsenic concentrations in the sample dataset are not consistent with the range of concentrations in the background data set, then additional investigation or corrective action may be required.

The background values for soil that will be used to evaluate sample results are presented in **Table 3.2.**

Evaluate the Maximum Concentration

The NMED risk guidance (NMED, 2022; Section 2.8.3.2) indicates that metals can be eliminated from further consideration when the maximum detected concentration is less than or equal to its background level. The background levels for metals in soil described above will be used in the evaluation. In the case of arsenic, the range of arsenic concentrations may also be considered in the background evaluation. Metals detected in soil at concentrations less than background levels will not be retained as COPCs and are not evaluated further. Metals detected in soil at concentrations greater than background levels or that are considered essential nutrients will be further evaluated.

6.5.4.3 Comparison of MC Concentrations to SSLs (Step 2)

The MC risk evaluation assesses if there are potential health risks from simultaneous exposure to multiple MC analytes. The MC risk evaluation incorporates the results of the metals background evaluation and proceeds to evaluate potential health risks based on the maximum detected concentrations of each analyte. Both carcinogenic and noncarcinogenic endpoints are evaluated for those analytes exhibiting both types of effect. Subsequent refinements may be incorporated into the MC risk evaluation if an unacceptable cancer risk or noncancer hazard is identified in the initial MC risk evaluation. The MC risk evaluation to evaluate potential health risks, is described below.

<u>Initial MC Risk Evaluation (Step 2)</u>

The initial MC risk evaluation provides an assessment of potential health risks from exposure to COPCs in soil for the worst-case exposure. The maximum detected concentration in the sample data set for each COPC is used to evaluate the complete exposure pathways identified by the exposure pathway analysis. Cumulative MC cancer risks and MC noncancer hazards will be calculated for soil using the following steps:

- Select the maximum concentration for each detected COPC. Exclude compounds not detected in any sample for that MEC investigation area. Also exclude metals determined to be present at background levels and essential nutrients found at concentrations below screening levels based on dietary intake.
- Divide the maximum concentration by the screening level to calculate a risk ratio. Multiply the ratio for carcinogenic analytes by $1x10^{-5}$. Multiply the ratio for noncarcinogenic analytes by 1.0.
- Sum the risk ratios for carcinogenic analytes to calculate the cumulative MC cancer risk. Sum the risk ratios for noncarcinogenic analytes to calculate the HI.
- Evaluation for lead is conducted separately through comparison to the NMED SSL because its health effects are not correlated with the typical carcinogenic or noncarcinogenic dose-based toxicity values that characterize other chemicals. Instead, the screening level for lead is based on a modeled concentration in soil that results in an acceptable blood lead level protective of adverse developmental health effects, or that is the action level identified by USEPA for groundwater.
- Evaluation of essential nutrients may be conducted separately from the MC risk evaluation, per Section 5.3 of the NMED risk guidance (NMED, 2022). The metals and other inorganics classified as essential nutrients are calcium, chloride, magnesium, phosphorous, potassium, and sodium. The SSLs for essential nutrients developed by NMED are based on dietary guidelines developed by the Institute of Medicine and the National Academy of

Sciences. The maximum concentration will be compared to the SSL. Essential nutrients with maximum concentrations less than the SSL will not be retained as COPCs and are not evaluated further. Essential nutrients with maximum concentrations greater than the essential nutrient SSLs will be further evaluated. Like noncarcinogens, a HQ or HI above 1.0 indicates excess risk may be present and additional evaluation may be required.

If the initial MC cancer risks and noncancer hazards for soil are less than NMED target risk thresholds, and the maximum concentrations of lead are less than their respective screening levels, then the predicted health risks will be considered acceptable, and the MC risk evaluation is complete. No further investigation or removal action is required. If initial cumulative MC cancer risks or noncancer MC hazards exceed the target risk thresholds, or if the maximum concentration of lead exceeds its respective screening level, then either further evaluation to determine the extent of contamination and potential risk (i.e. Steps 3-7 as outlined in Section 1.3 of the *NMED Risk Assessment Guidance for Site Investigations and Remediation, Volume I, Soil Screening Guidance for Human Health Risk Assessments* [NMED, 2022]), or removal of contaminated soil will be recommended.

The results of the MC risk evaluation will be presented in the MEC Investigation Report and will include tables showing the MC risk calculations and appendices presenting the relevant backup documentation.

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7.0 WASTE MANAGEMENT PLAN

7.1 INTRODUCTION

This Waste Management Plan has been developed for the management of wastes generated during the MEC investigation. Other than MDAS, three types of IDW may be generated during the sampling of environmental media during the Parcel 11 MEC Investigation activities: residual soil volume, decontamination fluids, and disposable sampling equipment/PPE. Proper management of this IDW is required to ensure compliance with federal, state, and Army regulations applicable to the collection, storage, transport, and disposal of potentially hazardous materials. Required IDW management measures for FWDA investigations or remedial activities will be waste segregation, containerization and labeling, temporary storage, waste characterization, and disposal. All waste disposal operations shall be conducted in accordance with the Waste Management Plan.

7.2 MATERIAL DOCUMENTED AS SAFE

7.2.1 Recovered Item Processing

Prior to items being loaded onto a vehicle for transport to the debris processing/storage area, the senior UXO technician present, a minimum of a UXO Technician III, will re-inspect each item as it is placed on the vehicle, maintaining segregation between MEC, MDAS, and RRD, to ensure that no items were improperly identified or co-mingled with another material type. Those items that are either considered hazardous or undetermined will be turned over to the Army and disposed of in accordance with established policies and procedures. Those items considered non-hazardous will be transported to the debris processing/storage area.

Upon arrival at the debris processing/storage area, the items will be inspected for a for hazardous components again and then segregated by debris type: MDAS and MD in one container and RRD and other debris in another. Items may be further segregated by metal type if there is a large volume of material. The most common metal types are steel, aluminum, copper, brass, and mixed metals. In some instances, the volume of recovered items does not support segregation; therefore, all the recovered items would be placed in the same container. If a hazardous item is encountered, it will be placed in a predetermined, secure location within the processing/storage and turned over to the Army.

7.2.2 Debris Containerization

Non-MEC recovered items will be placed in either segregated metal lockable containers or all-metals lockable containers. Container choice will be based on the volume and variety of metals and the handling capabilities of the site and end recipient. The only constant is the requirement to be able to lock and/or seal the container to ensure chain-of-custody from initial inspection to final disposition. Regardless of the type of container selected, the container will be closed and locked and/or sealed when not in use. If the container is not capable of being locked, a seal can be used as long as it will be broken in the act of opening the container. If a lock is used, the UXOQCS will be responsible for securing the key(s) and ensuring the container(s) are properly locked and/or sealed prior to departing the site after the day's activities. In addition, the UXOQCS will inspect the container(s) each workday morning to ensure their integrity. If a seal is used either in conjunction with a lock or separately, the number on the seal, or other form of identification, of the container(s), will be recorded or checked as above. If one of the containers has been tampered with, or the seal numbers don't match the log, it will be immediately reported to the site manager/SUXOS. The UXOQCS, in conjunction with the Government onsite safety representative, will determine if it will be necessary to re-inspect the entire contents of the container(s).

Containers will be clearly labeled outside with a unique identification number and the following information: USACE district, installation or site name, Parsons, unique identification number commencing with 0001, seal identification number; and material type (e.g., mixed metals, steel, aluminum, etc.).

7.2.3 Documentation

All shipments of debris, other than MD, shall have a DD Form 1348-1A completed as the certification/verification document. It must clearly show the typed or printed names of the certifier (Site manager/SUXOS) and verifier (UXOQCS or a similarly trained individual). In addition, the DD Form 1348-1A shall indicate the following: basic material content (brass, copper, steel etc.), estimated weight, unique identification of the containers, location where contents were recovered, and seal identification number relating to the container identification.

Each DD Form 1348-1A will also contain ONE of the following statements (depending on whether the form is addressing MD only, or MD and RRD) and be signed by the certifying and verifying individuals:

- For a DD Form 1348-1A addressing MD only: *"The material listed on this form has been inspected, processed by DoD Explosives Safety Board (DDESB)-approved means, or undergone the application of expert knowledge, in compliance with DoD policy, and to the best of my knowledge and belief, does not pose an explosive hazard."*
- For a DD Form 1348-1A addressing both MD and RRD: *"This certifies and verifies that the material listed has been 100% properly inspected and, to the best of our knowledge and belief, is free of explosives hazards, engine fluids, illuminating dials and other visible liquid HTRW materials."*

7.2.4 MDAS Seal Log

The UXOQCS, with support from the SUXOS, shall maintain an MDAS Seal Log for the project. The MDAS Seal Log will include the following information: barrel number, seal number, date, and material type (e.g., mixed metals, steel, aluminum, etc.).

7.2.5 Chain-of-Custody

Throughout the debris handling process, a chain-of-custody procedure will be used to ensure that there is no accidental or deliberate cross contamination of the containers. While the material remains onsite, it is the responsibility of the site manager/SUXOS and the UXOQCS to maintain control of the containers. When the containers are being shipped to a receiving facility, the driver, regardless of his affiliation, will sign for the containers and will likewise obtain the signature of the receiving individual at each delivery location. Signed copies of the DD Form 1348-1A and the chain-of-custody form shall be included in the final report.

If the chain of custody is broken while the material is still under DoD control, the explosives-safety-status documentation is no longer valid, and the affected material is subsequently considered MPPEH. To re-establish the explosives safety status as MDAS, the affected material must be re-inspected (i.e., a 100 percent visual inspection and an independent 100 percent re-inspection), re-processed using a DDESB-approved method with appropriate post-processing inspection, or DoD component-approved expert knowledge must be re-applied.

7.2.6 Transportation

The transport of the certified/verified containers does not require any special permits, placards, or precautions since the contents are classified as scrap metal. Likewise, the transport of the debris to the processing yard does not require any special transport requirements since it has been inspected twice prior to being loaded onto a vehicle.

7.2.7 Final Disposition

Upon receipt of the containers by the recipient(s), they will prepare a statement on company letterhead stating: "*the contents of these sealed containers will not be sold, traded, or otherwise given to another party until the contents have been melted, smelted, cut, or deformed and are only identifiable by their basic content*" This statement will also be included in the final report.

7.3 DISPOSABLE SAMPLING EQUIPMENT

Any used disposable sampling equipment will be treated as IDW per **Section 7.1**.

7.4 SOIL

All soil moved during the intrusive investigation will be used as backfill and returned to the original location after confirmation sampling is complete.

7.5 DECONTAMINATION WATER

Decontamination fluids will be containerized and transported and disposed of at the evaporation tank located at the site of former Building 542 in Parcel 6.

7.6 OTHER SOLID WASTE

Non-hazardous solid waste (e.g., plastic water bottles, paper trash, food trash, etc.) will be consolidated and containerized on site for daily disposal at an authorized offsite location (e.g., municipal dumpster or landfill). No generation of hazardous waste is anticipated during this project.

7.7 WASTE MINIMIZATION

The objective of waste minimization is to reduce the amount of waste generated during project activities, including minimizing the amount of paper used during preparation of plans and reports, minimizing the amount of municipal solid waste generated during field work, reusing wooden stakes and pin flags to the extent practical, field staff use of reusable water/liquid containers versus single use water bottles when practical, and optimizing the recycling of materials throughout project tasks.

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8.0 SCHEDULE

The approximate schedule for conducting the investigation activities at Parcel 11 is summarized below. **Table 8.1** contains a list of deliverables for the project and the schedule for delivery.

1. MEC Investigation Work Plan delivered to NMED – October 15, 2024

1. Field Work – initiates 90 days subsequent to NMED approval of the MEC Investigation Work Plan

2. Final MEC Investigation Report to NMED – provided to NMED 120 days subsequent to completion of investigation activities including acceptance of the Final DUA

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9.0 REFERENCES

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TABLES

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Table 1.1 – Target Population and Estimated Detection/Classification Depths – SWMU 10

Confirmed/Suspected Munition (1)	Item Dimensions (approximate width x length)	Estimated UltraTEM Detection/Classification Depth (cm bgs) (2)
20mm projectile, M55A3B1 TP	20mm x 75mm	20/15
37mm projectile, M74 AP-T	37mm x 115mm	40/30
40mm projectile, M918 TP	40mm x 86mm	45/35

Notes:

(1) Specific munition listed is the least detectable variant (i.e., shallowest detection depth) included in the DoD classification library. It is not necessarily present on site, or if present, is not the only variant potentially present on site.

(2) Detection/classification depths listed above are for intact items in worst-case orientation and maximum horizontal offset from sensor. Items closer to the sensor and in vertical orientations will be detectable deeper than the listed depths. These are conservative detection depths and assume the background noise level will be ≤ 1.0 µV/A for the sum of all time gates between 0.25 and 0.5 ms (i.e., 1/5th of the expected selection threshold for the UltraTEM).

Table 1.2 – Target Population and Estimated Detection/Classification Depths – Administration Area

Confirmed/Suspected Munition (1)	Item Dimensions (approximate width x length)	Estimated UltraTEM Detection/Classification Depth (cm bgs) (2)
37mm projectile, M74 AP-T	37mm x 115mm	40/30
75mm projectile, Mk I shrapnel	75mm x 211mm	100/85
155mm projectile, M107	155mm x 675mm	160/140
3.5-in rocket, M301A1 WP	89mm x 340mm (warhead only)	100/84

Notes:

(1) Specific munition listed is the least detectable variant (i.e., shallowest detection depth) included in the DoD classification library. It is not necessarily present on site, or if present, is not the only variant potentially present on site. Confirmed/Suspected Munitions are not considered a complete list of the munitions potentially present in the SWMU 40 investigation area, as definitive records regarding exactly which munitions or munitions components were transported through SMWU 40 are unavailable.

(2) Detection/classification depths listed are for intact items in worst-case orientation and maximum horizontal offset from sensor. Items closer to the sensor and in vertical orientations will be detectable deeper than the listed depths. These are conservative detection depths based on UltraTEM modeling and assume the background noise level will be ≤ 1.0 µV/A for the sum of all time gates between 0.25 and 0.5 ms (i.e., 1/5th of the expected selection threshold for the UltraTEM).

Table 3.1 – Overview of Preliminary MEC Conceptual Site Model, SWMU 10

Site Details	Potential/Suspected Location and Distribution of MEC	Known/ Suspected Munitions	Exposure Medium	Current and Future Receptors	Exposure Pathways
Name: SWMU 10 **Boundaries and acreage:** 17.5-acre survey area, see Figure 3.1 for boundary **Known/suspected past DoD activities (release mechanisms):** STP, includes incinerator used to demilitarize small projectiles **Current land use:** FWDA is in BRAC caretaker status undergoing environmental investigation and remediation **Future land use:** After environmental remediation, the land will be transferred to Department of the Interior for further transfer to the Navajo Nation and/or the Zuni Tribe	MD has reportedly been found throughout SWMU 10 during previous investigations and clearances. Because several clearances have been performed, the remaining distribution of subsurface sources is unknown. At least one SRA appears to be present in the southwest portion of the 2009 EM61 data. This SRA appears to extend outside of the 2009 survey area	Projectile, 20mm Projectile, 37mm Projectile, 40mm	Surface soil and subsurface soil	- Commercial/ industrial workers - Construction workers - Residents	Potentially complete exposure to surface and/or subsurface MEC

Table 3.2 – Direct Contact Human Health Screening Levels in Soil

Analyte	Screening Level Surrogate	Analytical Method [1]	CASRN	Units	Background Value [2]	NMED Table A-1 and Table 6-2 Human Health Screening Levels Direct Contact [3]						EPA-RSL Table Human Health Screening Levels Direct Contact [4]				Lowest Human Health Screening Level Direct Contact [5]	Lowest Human Health Screening Level Direct Contact Source [5]
						Residential		Industrial/ Occupational		Construction Worker		Residential		Industrial			
						cancer	noncancer	cancer	noncancer	cancer	noncancer	cancer adj to $1x10^{-5}$	noncancer HQ=1	cancer adj to $1x10^{-5}$	noncancer HQ=1		
TAL Metals																	
Aluminum	-	SW6020B	7429-90-5	mg/kg	23,340	NS	78000	NS	1290000	NS	41400	-	-	-	-	41400	NMED SSL
Antimony	-	SW6020B	7440-36-0	mg/kg	0.23	NS	31.3	NS	519	NS	142	-	-	-	-	31.3	NMED SSL
Arsenic	-	SW6020B	7440-38-2	mg/kg	5.60	7.07	13.0	35.9	208	216	41.2	-	-	-	-	7.07	NMED SSL
Barium	-	SW6020B	7440-39-3	mg/kg	482	NS	15600	NS	255000	NS	4390	-	-	-	-	4390	NMED SSL
Beryllium	-	SW6020B	7440-41-7	mg/kg	1.49	64400	156	313000	2580	2710	148	-	-	-	-	148	NMED SSL
Cadmium	-	SW6020B	7440-43-9	mg/kg	0.224	85900	70.5	417000	1110	3610	72.1	-	-	-	-	70.5	NMED SSL
Calcium	-	SW6020B	7440-70-2	mg/kg	91,760	NS	13000000	NS	32400000	NS	8850000	-	-	-	-	8850000	NMED SSL
Cobalt	-	SW6020B	7440-48-4	mg/kg	6.82	17200	23.4	83400	388	722	36.7	-	-	-	-	23.4	NMED SSL
Copper	-	SW6020B	7440-50-8	mg/kg	18.4	NS	3130	NS	51900	NS	14200	-	-	-	-	3130	NMED SSL
Iron	-	SW6020B	7439-89-6	mg/kg	22,660	NS	54800	NS	908000	NS	248000	-	-	-	-	54800	NMED SSL
Lead [6]	-	SW6020B	7439-92-1	mg/kg	12.4	NS	NS	NS	NS	NS	NS	NS	200	NS	800	200	EPA RSL
Magnesium [7]	-	SW6020B	7439-95-4	mg/kg	8,170	NS	15600000	NS	5680000	NS	1550000	-	-	-	-	1550000	NMED SSL
Manganese	-	SW6020B	7439-96-5	mg/kg	1,058	NS	10500	NS	160000	NS	464	-	-	-	-	464	NMED SSL
Mercury	-	SW7471B	7439-97-6	mg/kg	0.0300	NS	23.8	NS	112	NS	20.7	-	-	-	-	20.7	NMED SSL
Nickel	-	SW6020B	7440-02-0	mg/kg	19.5	595000	1560	2890000	25700	25000	753	-	-	-	-	753	NMED SSL
Potassium	-	SW6020B	7440-09-7	mg/kg	3,950	NS	15600000	NS	76200000	NS	20800000	-	-	-	-	15600000	NMED SSL
Selenium	-	SW6020B	7782-49-2	mg/kg	0.513	NS	391	NS	6490	NS	1750	-	-	-	-	391	NMED SSL
Silver	-	SW6020B	7440-22-4	mg/kg	0.130	NS	391	NS	6490	NS	1770	-	-	-	-	391	NMED SSL
Sodium	-	SW6020B	7440-23-5	mg/kg	2,526	NS	7820000	NS	37300000	NS	10200000	-	-	-	-	7820000	NMED SSL
Thallium	-	SW6020B	7440-28-0	mg/kg	0.213	NS	0.782	NS	13.0	NS	3.54	-	-	-	-	0.782	NMED SSL
Total Chromium	-	SW6020B	7440-47-3	mg/kg	18.1	96.6	45200	505	314000	468	134	-	-	-	-	96.6	NMED SSL
Vanadium	-	SW6020B	7440-62-2	mg/kg	27.2	NS	394	NS	6530	NS	614	-	-	-	-	394	NMED SSL
Zinc	-	SW6020B	7440-66-6	mg/kg	49.2	NS	23500	NS	389000	NS	106000	-	-	-	-	23500	NMED SSL
Explosives																	
1,3,5-Trinitrobenzene	-	SW8330B	99-35-4	mg/kg	N/A	NS	NS	NS	NS	NS	NS	NS	2200	NS	32000	2200	EPA RSL
1,3-Dinitrobenzene	-	SW8330B	99-65-0	mg/kg	N/A	NS	NS	NS	NS	NS	NS	NS	6.3	NS	82	6.30	EPA RSL
2,4-Dinitrotoluene	-	SW8330B	121-14-2	mg/kg	N/A	17.1	123	82.3	1820	600	536	-	-	-	-	17.1	NMED SSL
2,6-Dinitrotoluene	-	SW8330B	606-20-2	mg/kg	N/A	3.56	18.5	17.2	276	165	80.9	-	-	-	-	3.56	NMED SSL
2,4,6-Trinitrotoluene (TNT)	-	SW8330B	118-96-7	mg/kg	N/A	211	36.0	1070	573	7500	161	-	-	-	-	36.0	NMED SSL
2-Amino-4,6-Dinitrotoluene	-	SW8330B	35572-78-2	mg/kg	N/A	NS	7.70	NS	127	NS	17.3	-	-	-	-	7.70	NMED SSL
2-Nitrotoluene	-	SW8330B	88-72-2	mg/kg	N/A	31.6	70.4	165	1170	1130	319	-	-	-	-	31.6	NMED SSL
3-Nitrotoluene	-	SW8330B	99-08-1	mg/kg	N/A	NS	6.16	NS	91.6	NS	26.9	-	-	-	-	6.16	NMED SSL
4-Amino-2,6-Dinitrotoluene	-	SW8330B	19406-51-0	mg/kg	N/A	NS	7.64	NS	125	NS	17.3	-	-	-	-	7.64	NMED SSL
4-Nitrotoluene	-	SW8330B	99-99-0	mg/kg	N/A	333	247	1600	3670	11800	1080	-	-	-	-	247	NMED SSL
Hexahydro-1,3,5-trinitro-1,3,5-triazine (RDX)	-	SW8330B	121-82-4	mg/kg	N/A	83.1	301	428	4890	2960	1350	-	-	-	-	83.1	NMED SSL
Methyl-2,4,6-trinitrophenylnitramine (Tetryl)	-	SW8330B	479-45-8	mg/kg	N/A	NS	156	NS	2590	NS	706	-	-	-	-	156	NMED SSL
Nitrobenzene	-	SW8330B	98-95-3	mg/kg	N/A	60.4	131	293	1540	1350	353	-	-	-	-	60.4	NMED SSL

Table 3.2 – Direct Contact Human Health Screening Levels in Soil

Analyte	Screening Level Surrogate	Analytical Method (1)	CASRN	Units	Background Value (2)	NMED Table A-1 and Table 6-2 Human Health Screening Levels Direct Contact (3)						EPA-RSL Table Human Health Screening Levels Direct Contact (4)				Lowest Human Health Screening Level Direct Contact (5)	Lowest Human Health Screening Level Direct Contact Source (5)
						Residential		Industrial/ Occupational		Construction Worker		Residential		Industrial			
						cancer	noncancer	cancer	noncancer	cancer	noncancer	cancer adj to $1x10^{-5}$	noncancer HQ=1	cancer adj to $1x10^{-5}$	noncancer HQ=1		
Explosives (Continued)																	
Nitroglycerin	-	SW8330B	55-63-0	mg/kg	N/A	313	6.16	1510	91.6	11100	26.9	-	-	-	-	6.16	NMED SSL
Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine (HMX)	-	SW8330B	2691-41-0	mg/kg	N/A	NS	3850	NS	63300	NS	17400	-	-	-	-	3850	NMED SSL
Pentaerythritol Tetranitrate (PETN)	-	SW8330B	78-11-5	mg/kg	N/A	NS	NS	NS	NS	NS	NS	1300	570	5300	7400	570	EPA RSL

Notes:
1. Analytical Method - EPA Test Methods for Evaluating Solid Waste latest edition (the most current version of each method the laboratory is accredited to will be used).
2. Selected FWDA background values are presented in Table 8-1 from *Soil Background Study and Data Evaluation Report* (Shaw, 2010), except arsenic and antimony:
- The arsenic background reference value is 5.6 mg/kg per Evaluation of Background Levels for Arsenic in Soil (NMED, 2013b). If the maximum arsenic concentration is greater than 5.6 mg/kg, then the range of arsenic concentrations in the sample data set is to be compared to the range of arsenic concentrations in the site-specific background data set (0.2 mg/kg to 11.2 mg/kg).
- The antimony background level of 0.23 mg/kg is from soil unit 350ss as presented in Table 4-1 of the *Phase 2 Soil Background Report* (USACE, 2013).
3. NMED *Risk Assessment Guidance for Site Investigations and Remediation* , November 2022 Revised (Appendix A, Table A-1, residential, commercial/industrial, construction worker).
4. USEPA RSL Summary Table (TR=1E-06, HQ=1), November 2024 (resident soil and industrial soil). The RSLs for carcinogenic analytes are adjusted to a TR=1E-05. Provided for analytes without a NMED SSL. Residential RSL for lead was changed to 200 mg/kg following USEPA's January 17, 2024, memorandum *Updated Residential Soil Lead Guidance for CERCLA Sites and RCRA Corrective Action Facilities (USEPA, 2024).*
5. The lesser of the NMED screening levels for residents, industrial/occupational workers, and construction workers (or EPA RSL (target excess cancer risk level of 1 x 10-5) if there is no NMED screening level. The most recent screening levels published by NMED and USEPA at the time the risk evaluation is conducted will be used in the risk evaluation.
6. Lead human health screening levels appear in the non-cancer column, but the health effects of lead are not correlated with the typical carcinogenic or non-carcinogenic dose-based toxicity values that characterize other chemicals. Instead, the screening level for lead is based on a modeled concentration in soil that results in an acceptable blood lead level protective of adverse developmental health effects (USEPA, 2024).
7. The background value for manganese is greater than the NMED human health screening level for direct contact.

Acronyms and Abbreviations:
CASRN = Chemical Abstracts Service Registry Number
EPA = United States Environmental Protection Agency
FWDA = Fort Wingate Depot Activity
HQ = Hazard quotient
MCL = Maximum contaminant level
mg/kg = Milligram per kilogram
N/A = Not applicable
NMED = New Mexico Environment Department
NS = No standard
RSL = Regional screening level
SSL = Soil screening level
TAL = Target analyte list

Table 3.3 – Proposed MEC Investigation Soil Samples, SWMU 10 Sewage Treatment Plant

Proposed Sample ID	Sample Depth (feet)	Sample Analyses	Regulatory Requirement
1110MEC [*Location ID*]SB01-[*Beginning Depth*]-[*Ending Depth*] D-SO*	To be determined.	Explosives (SW8330B), and TAL metals (SW6020B/ 7471B)	NMED HWB Comments 4, 12, and 13 (NMED, 2025)
QC Samples to be Collected			
Number of Primary Explosives Samples = TBD			
Number of MS/MSD Explosives Samples = (5%)			
Number of Field Duplicate Explosives Samples = (10%)			
Number of Primary TAL Metals Samples = TBD			
Number of MS/MSD TAL Metals Samples = (5%)			
Number of Field Duplicate TAL Metals Samples = (10%)			

Notes:
* Indicates that a Field Duplicate sample will also be collected.
% = percent
HWB = Hazardous Waste Bureau
ID = identification
MS/MSD = Matrix Spike/Matrix Spike Duplicate
NMED = New Mexico Environment Department
QC = quality control
TAL = target analyte list

Table 4.1 – Overview of Preliminary MEC Conceptual Site Model, Administration Area

Site Details	Potential/Suspected Location and Distribution of MEC	Known/Suspected Munitions	Exposure Medium	Current and Future Receptors	Exposure Pathways
Name: Administration Area **Boundaries and acreage:** Total of 36.5 acres of survey area, see Figure 4.1 for boundaries **Known/suspected past DoD activities (release mechanisms):** Munitions and/or MD potentially stored in storage yards; munitions transported to/from the storage yards through the Administration Area **Current land use:** FWDA is in BRAC caretaker status undergoing environmental investigation and remediation **Future land use:** After environmental remediation, the land will be transferred to Department of the Interior for further transfer to the Navajo Nation and/or the Zuni Tribe	MD was found near the northeast corner of Building 12 during utility trenching in 1998. There are many obvious anomalies in the 2009 geophysical data, most of which are likely caused by sources associated with the Administration Area, including utility lines and debris from the demolition of Building 29. Significant quantities of Administration Area-related anomalies are expected throughout this area, but there is little evidence suggesting that MEC contamination will be significant.	Projectile, 37mm Projectile, 75mm Projectile, 155mm Rocket, 3.5-in The full list of munitions and munitions components stored in or transported through this area is unknown, and this list is not considered comprehensive	Surface soil and subsurface soil	- Commercial/ industrial workers - Construction workers - Residents	Potentially complete exposure to surface and/or subsurface MEC

Table 4.2 – Proposed MEC Investigation Soil Samples, Administration Area

Proposed Sample ID	Sample Depth (feet)	Sample Analyses	Regulatory Requirement
11AAMEC [*Location ID*]SB01-[*Beginning Depth*]-[*Ending Depth*] D-SO	To be determined.	Explosives (SW8330B) and TAL metals (SW6020B/ 7471B)	NMED HWB Comments 4, 12, and 13 (NMED, 2025)
QC Samples to be Collected			
Number of Primary Explosives Samples = TBD			
Number of MS/MSD Explosives Samples = (5%)			
Number of Field Duplicate Explosives Samples = (10%)			
Number of Primary TAL Metals Samples = TBD			
Number of MS/MSD TAL Metals Samples = (5%)			
Number of Field Duplicate TAL Metals Samples = (10%)			

Notes:
* Indicates that a Field Duplicate sample will also be collected.
% = percent
HWB = Hazardous Waste Bureau
ID = identification
MS/MSD = Matrix Spike/Matrix Spike Duplicate
NMED = New Mexico Environment Department
QC = quality control
TAL = target analyte list

Table 5.1 – Measurement Performance Criteria for MEC-Related Tasks

Measurement	Data Quality Indicator	Specification	Activity Used to Assess Performance
Site Preparation			
1. Accessibility	Completeness	All areas inaccessible to investigation or inaccessible to use of proposed geophysical systems are identified in a GIS or the geophysical database	Lead organization will visually inspect the site and/or review the GIS/geophysical database
Sampling Design			
2. Detection threshold	Sensitivity	A detection threshold of 5 times background noise will be used for the UltraTEM Portable Classifier	1) Review of sampling design 2) Initial verification at IVS 3) Background analysis prior to VSP analysis 4) Target Selection Technical Memorandum describes all thresholds to be used and criteria for use
Data Acquisition			
3. Positioning requirement (full coverage grid mapping and reacquisition)	Accuracy	Recorded measurement positions must be within 0.1m of actual positions	Review of sampling design Initial verification at IVS
4. Survey Coverage	Accuracy/ Completeness	100% of specified acreage is sampled at a line spacing of ≤ 1.8 m	Data validation
5. QC seeding (AGC)	Accuracy/ Completeness	Contractors will place blind QC seeds at the rate of 1-3 seeds/system/day. Planning documents must describe the blind seed firewall	Lead agency verifies all QC seed failures are explained and corrective action implemented

Table 5.1 – Measurement Performance Criteria for MEC-Related Tasks

Measurement	Data Quality Indicator	Specification	Activity Used to Assess Performance
Anomaly Resolution/Classification			
6. Anomaly resolution (AGC sensor)	Completeness	All items within 0.25m laterally must be recovered for each flag	QC Geophysicist (or designee) verifies
7. Anomaly resolution (AGC sensor)	Accuracy/ Representative-ness	Excavation of anomalies will be performed where necessary to fill data gaps in the CSM. Inversion results correctly predict one or more physical properties (e.g., size, symmetry, or wall thickness) of the recovered items	Qualitative examination and documentation of recovered items
8. Anomaly classification (AGC sensor with classification)	Completeness/ Comparability	Library must include signatures for all items considered by the project team to be TOI, as listed in the CSM, or the classifier must include a method for correctly classifying any munitions not included in the library	Verification of site-specific library
9. Anomaly classification (AGC sensor with classification)	Completeness	All detected anomalies classified as: 1. TOI 2. Non-TOI 3. Inconclusive	Data verification
10. Anomaly classification (AGC sensor with classification)	Accuracy	100% of predicted non-TOI that are intrusively investigated are confirmed to be non-TOI	Visual inspection of recovered items from classification validation
NEU Confirmation			
11. NEU Confirmation	Representative-ness/ Completeness	Well-developed CSM, confirmed by survey results, showing no evidence of munitions use	DUA

Table 5.2 – Site Preparation Measurement Quality Objectives

Measurement Quality Objective	Frequency	Responsible Person/ Report Method/ Verified by	Acceptance Criteria	Failure Response
Vegetation clearance verification	Once, following vegetation clearance in each SWMU	SUXOS/ Surface Sweep Technical Memorandum/ Lead Organization	All vegetation removed to height not exceeding 15 cm; all trees less than 6" diameter at breast height are removed; no obstacles (e.g., felled trees or limbs) remain	RCA/CA; Re-verify
Vegetation clearance (mechanized): verify correct assembly (1 of 2)	Once following assembly	SUXOS/ Instrument Assembly Checklist/ Lead Organization	As specified in Assembly Checklist	RCA/CA; Make necessary adjustments and re-verify
Vegetation clearance (mechanized) verify correct deployment (2 of 2)	Daily, prior to operations	SUXOS/ Daily QC Report/ Lead Organization	Deck height is set to 15 cm	RCA/CA; Make necessary adjustments and re-verify
Construct IVS: Verify as-built IVS against design plan (UltraTEM)	Once, following IVS construction	Project Geophysicist/ IVS Technical Memorandum/ Lead Organization	Seeds buried as described in **Section 5.1.5**	RCA/CA; Make necessary changes to seeded items and re-verify

Table 5.2 – Site Preparation Measurement Quality Objectives

Measurement Quality Objective	Frequency	Responsible Person/ Report Method/ Verified by	Acceptance Criteria	Failure Response
Construct ITS: Verify as-built ITS against design plan (Analog sensors)	Once, following ITS construction	Project Geophysicist/ IVS Technical Memorandum/ Lead Organization	Small ISO seed items for analog methods buried at 30 cm. All seeds buried horizontally in the cross-track orientation	RCA/CA; Make necessary changes to seeded items and re-verify
Initial geodetic equipment function test (RTK GPS and SLAM)	Once, prior to start of data acquisition	Field Team Leader and Project Geophysicist/ IVS Technical Memorandum / QC Geophysicist	Measured position of control point within 10cm of ground truth	RCA/CA; document questionable information in database
IVS SLAM georeferencing accuracy	Evaluated for IVS initial base map	Field Team Leader and Project Geophysicist / IVS Technical Memorandum/ QC Geophysicist	Georeferenced point cloud position of control point within 8cm of ground truth	CA assumption: Re-do affected work unless initial base map can be re-processed to achieve required accuracy
Verify correct assembly (UltraTEM)	Once, following assembly	Field Geophysicist/ Instrument Assembly Checklist/ Project Geophysicist	Assembled as specified in Assembly Checklist	RCA/CA: Make necessary adjustments and re-verify

Table 5.2 – Site Preparation Measurement Quality Objectives

Measurement Quality Objective	Frequency	Responsible Person/ Report Method/ Verified by	Acceptance Criteria	Failure Response
Initial instrument function test (UltraTEM)	Once, following assembly	Field Geophysicist/ Initial IVS Memorandum/ Project Geophysicist	For all channels tested, the response (mean static spike minus mean static background) is within 25% of predicted response	RCA/CA: Make necessary adjustments, and re-verify
Initial instrument function test (Analog)	Once, upon arrival at project site	Field Geophysicist or UXO Team Lead/ Initial IVS Memorandum/ Project Geophysicist or designee	Audible response consistent with expected change in tone in presence of a standard object	RCA/CA: Make necessary adjustments, and re-verify
Initial dynamic survey positioning accuracy (IVS) (UltraTEM)	Once, prior to start of data acquisition	Project Geophysicist/ IVS Memorandum/ QC Geophysicist	Derived positions of IVS target(s) are within 25cm of the ground truth locations	RCA/CA: Make necessary adjustments, and re-verify
Initial dynamic survey Check for interference surrounding seed response (IVS) (UltraTEM)	Once, prior to start of data acquisition	Project Geophysicist/ IVS Memorandum/ QC Geophysicist	All seeds placed in locations that are free of detected anomalies within a radius of ≥1.5m	RCA/CA; and re-verify MQO

Table 5.2 – Site Preparation Measurement Quality Objectives

Measurement Quality Objective	Frequency	Responsible Person/ Report Method/ Verified by	Acceptance Criteria	Failure Response
Initial derived polarizabilities match for IVS Items (IVS) (UltraTEM)	Once prior to start of data acquisition	Project Geophysicist/ IVS Memorandum/ QC Geophysicist	Library match metric ≥ 0.9 for each set of inverted polarizabilities	RCA/CA

Table 5.3 – Dynamic Survey Measurement Quality Objectives

Measurement Quality Objective	Frequency	Responsible Person/ Report Method/ Verified by	Acceptance Criteria	Failure Response
Surface Sweep: Documenting recovered surface MEC and debris	Daily	UXOQC/ GIS data recorded/ Project/QC Geophysicist or designee	All metallic debris collected is counted and documented in the project database for the following attributes: designation as UXO, MD, RRD, or other debris; UXO and MD described by type, wight, and as TOI or non-TOI. Photos displaying all MD recovered (individual MD photos not necessary), and photos showing all surfaces of each MEC/TOI are recorded	RCA/CA; document questionable information in database; justify safety concerns
Geodetic equipment function test (RTK GPS and SLAM)	Daily	Field Team Leader and Project Geophysicist/ Running QC Summary/ QC Geophysicist	Measured position of control point within 10cm of ground truth	RCA/CA; document questionable information in database
SLAM georeferencing accuracy	Evaluated for each initial base map	Project Geophysicist/ Running QC Summary/ QC Geophysicist	Georeferenced point cloud position of control point within 8cm of ground truth	CA assumption: Re-do affected work unless initial base map can be re-processed to achieve required accuracy
Geodetic accuracy (Confirm valid position)	Evaluated for each measurement	Field Team Leader and Project Geophysicist/ Running QC Summary/	RTK GPS: status flag indicates RTK fix.	RTK GPS CA: Interpolate positions for minor (<3 m) GPS fluctuations

Table 5.3 – Dynamic Survey Measurement Quality Objectives

Measurement Quality Objective	Frequency	Responsible Person/ Report Method/ Verified by	Acceptance Criteria	Failure Response
		QC Geophysicist	SLAM: initial localization achieves confidence quality indicator > 50,000 before moving; confidence values < 50,000 within datasets will be reviewed by the data analyst, if possible, based on recorded data [(1)]	along straight lines, longer out-of-spec data rejected. SLAM CA: New recording and re-localize if initial confidence > 50,000 cannot be achieved; low confidence locations within datasets will be rejected if the position appears incorrect
Ongoing instrument function test (UltraTEM)	Beginning and end of each day and each time instrument is turned on	Project Geophysicist/ Running QC Summary/ QC Geophysicist	For all channels tested, the response (mean static spike minus mean static background) is within 25% of predicted response	RCA/CA: Make necessary repairs and re-verify
Ongoing instrument function test (Analog)	Beginning and end of each day and each time instrument is turned on	Field Team Leader/ Running QC Summary/ Project or QC Geophysicist or designee	Audible response consistent with expected change in tone in presence of object with documented response	RCA/CA
Ongoing derived target position precision (IVS) (UltraTEM)	Beginning and end of each day	Project Geophysicist/ Running QC Summary/ QC Geophysicist	All IVS items' fit locations within 25cm of ground truth locations	RCA/CA
Ongoing derived polarizabilities	Beginning and end of each day	Project Geophysicist/ Running QC Summary/	Library match metric ≥ 0.9 for each set of inverted polarizabilities	RCA/CA

Table 5.3 – Dynamic Survey Measurement Quality Objectives

Measurement Quality Objective	Frequency	Responsible Person/ Report Method/ Verified by	Acceptance Criteria	Failure Response
match for IVS Items (IVS) (UltraTEM)		QC Geophysicist		
In-line measurement spacing (UltraTEM)	Verified for each survey area using BTField coverage tools	Project Geophysicist/ Running QC Summary/ QC Geophysicist	98% ≤ 0.2m between successive measurements Mean ≤ 0.1m	RCA/CA: Coverage gaps are filled or adequately explained (e.g., unsafe terrain)
Coverage	Verified for each survey area using BTField coverage tools	Project Geophysicist/ Running QC Summary/ QC Geophysicist	100% at ≤ 0.3m cross-track measurement spacing between outer cubes on adjacent passes	RCA/CA: Collect additional data to increase coverage percentage to meet acceptance criteria or adequately explained (e.g., unsafe terrain)
Transmit current levels (UltraTEM)	Evaluated for each sensor measurement	Project Geophysicist/ Running QC Summary/ QC Geophysicist	Current must be ≥ 15A	CA: Reject failing data files; stop data acquisition activities until condition corrected
Confirm adequate spacing between units (All sensors)	Evaluated at start of each day (or area)	Field Team Leader/ Field Logbook/ Project Geophysicist	Minimum separation of 50m	RCA/CA: Recollect all coincident measurements

Table 5.3 – Dynamic Survey Measurement Quality Objectives

Measurement Quality Objective	Frequency	Responsible Person/ Report Method/ Verified by	Acceptance Criteria	Failure Response
Confirm inversion model supports classification (UltraTEM, 1 of 3)	Evaluated for all models derived from a measurement (i.e., single item and multi-item models)	Project Geophysicist/ BTField/ QC Geophysicist	Derived model response must fit the observed data with a fit coherence ≥ 0.8	Item classified as 'cannot analyze' unless analyst determines target pick is a result of noise, background response, etc.
Confirm inversion model supports classification (UltraTEM, 2 of 3)	Evaluated for each derived source	Project Geophysicist/ BTField / QC Geophysicist	Fit location estimate of item ≤ 1.0m from picked target location	Source not considered for classification as potential TOI
Confirm inversion model supports classification (UltraTEM, 3 of 3)	Evaluated for all seeds	QC Geophysicist/ Running QC Summary/ Lead Organization QA Geophysicist	100% of predicted seed positions ≤ 25cm radially from known position and ≤ 15cm vertically	RCA/CA
Classification performance	Evaluated for all seeds	QC Geophysicist/ Seed Tracking Log/ USACE QA Geophysicist	100% of QC seeds classified as TOI	RCA/CA

Table 5.4 – Intrusive Investigation Measurement Quality Objectives

Measurement Quality Objective	Frequency	Responsible Person/ Report Method/ Verified by	Acceptance Criteria	Failure Response
Geodetic equipment function test (RTK GPS and SLAM)	Daily	Field Team Leader and Project Geophysicist/ Running QC Summary/ QC Geophysicist	Measured position of control point within 10cm of ground truth	RCA/CA; document questionable information in database
Geodetic accuracy (Confirm valid position)	Evaluated for each measurement	Field Team Leader and Project Geophysicist/ Running QC Summary/ QC Geophysicist	RTK GPS: status flag indicates RTK fix (field team leader confirms sensor will not collect static point without fix) SLAM: initial localization achieves confidence quality indicator > 50,000 before moving; operator confirms confidence > 50,000 prior to collection of each source location	RTK GPS CA: Interpolate positions for minor (<3 m) GPS fluctuations along straight lines, longer out-of-spec data rejected. SLAM CA: New recording and re-localize if initial confidence > 50,000 cannot be achieved or if confidence of 50,000+ cannot be achieved at intended data collection point.

Table 5.4 – Intrusive Investigation Measurement Quality Objectives

Measurement Quality Objective	Frequency	Responsible Person/ Report Method/ Verified by	Acceptance Criteria	Failure Response
Ongoing instrument function test (EM61)	Beginning and end of each day and each time instrument is turned on	Field Team Leader and Project Geophysicist/ Running QC Summary/ QC Geophysicist	Response (mean static spike minus mean static background) within 20% of predicted response	RCA/CA: Make necessary repairs and reverify
Documenting recovered sources	Daily	UXOQC/ GIS data recorded/ QC Geophysicist	All metallic debris collected is documented for the following attributes: Designation as UXO, MD, RRD or other debris; UXO and MD described by type, weight, depth. Photos displaying all recovered items for AGC. Individual photos of non-MEC are not necessary for non-AGC. Photos showing all surfaces of each MEC are recorded	RCA/CA; document questionable information in database

Table 5.4 – Intrusive Investigation Measurement Quality Objectives

Measurement Quality Objective	Frequency	Responsible Person/ Report Method/ Verified by	Acceptance Criteria	Failure Response
Confirm derived features match ground truth (UltraTEM, 1 of 2)	Evaluated for all recovered items	Project Geophysicist/ Running QC Summary or Intrusive Database/ QC Geophysicist	100% of recovered item positions (excluding inconclusive category) ≤ 25cm from predicted position (x, y); recovered item depths are recorded within 15cm of predicted	RCA/CA
Confirm derived features match ground truth (UltraTEM, 2 of 2)	Evaluated for all recovered items including seeds	Project Geophysicist/ Dig List and Intrusive Database/ Project or QC Geophysicist	Data analysis shows 100% of seeds & recovered items have at least one physical characteristic (e.g., size, shape/symmetry, or wall thickness) consistent with polarizability parameters	RCA/CA

Table 5.5 – Summary of Analytical Methods, Sample Containers, Preservation, and Holding Times

Analysis (or Analysis Preparation Method)	Matrix	Analytical Method (USEPA SW846 or ASTM)	Sample Volume/Container	Preservative	Maximum Holding Time (collection until extraction/ extraction until analysis)
TAL Metals	Soil	6020B/7471B	4-oz or 8-oz Glass Jar	Cool to ≤ 6°C	6 months (28 days for Hg)
Explosive Compounds	Soil	8330B	4-oz Glass or HDPE Jar	Cool to ≤ 6°C	14/40 days

Notes:

≤ = less than or equal to
°C = degrees Celsius
ASTM = American Society of Testing and Materials
Hg = mercury
oz = ounce(s)
TAL = target analyte list
USEPA = United States Environmental Protection Agency

Samples will be analyzed using the most recently published versions of the analytical methods.

More than one analysis may be performed from the same sample container, as long as all preservation requirements have been met and there is sufficient sample mass available.

Table 5.6 – Quality Control Samples for Precision and Accuracy

Data Quality Indicator	Quality Control Type	Minimum Frequency	Measurement Performance Criteria (MPC)
Precision	Field Duplicate Sample	One every 10 samples (10%)	RPD ≤ 50% for soil and ≤30% for water when target analytes are detected in both samples with concentrations > LOQ
Accuracy/Contamination	Equipment Blank	One every 10 samples (10%) for reusable equipment	No analytes detected > ½ LOQ or > 1/10th the amount measured in any sample or 1/10th the regulatory limit, whichever is greater
Accuracy/Contamination	Method Blank	One per preparation or analytical batch, at least one every 20 samples (rounded up) (5%)	No analytes detected > ½ LOQ or > 1/10th the amount measured in any sample or 1/10th the regulatory limit, whichever is greater
Accuracy/Precision	Laboratory Control Sample or Blank Spike	One per preparation or analytical batch, at least one every 20 samples (rounded up) (5%)	Per QSM criteria. Control limits for each method included in Worksheet #28 of the QAPP.
Accuracy/Precision	MS Percent Recovery (QSM Percent Recovery Goals)	One every 20 samples (rounded up) (5%)	Per QSM criteria. Control limits for each method included in Worksheet #28 of the QAPP.
Accuracy/Precision	Surrogate Spike (for organics only)	All samples and QC	Per QSM criteria. Control limits for each method included in Worksheet #28 of the QAPP.

Notes:

LOQ = Limit of Quantitation
MS = matrix spike
MSD = matrix spike duplicate
QAPP = Quality Assurance Project Plan
QC = quality control
QSM = Quality Systems Manual (U.S. Department of Defense)
RPD = relative percent difference

Table 5.7 – Data Validation Flags

Flag	Interpretation
U	The analyte was not detected and was reported as less than the limit of quantitation (LOQ). The LOQ has been adjusted for any dilution or concentration of the sample.
J	The reported result was an estimated value with an unknown bias.
J+	The result was an estimated quantity, but the result may be biased high.
J-	The result was an estimated quantity, but the result may be biased low.
UJ	The analyte was not detected and was reported as less than the LOQ. However, the associated numerical value is approximate.
X	The sample results (including non-detects) were affected by serious deficiencies in the ability to analyze the sample and to meet published method and project quality control criteria. The presence or absence of the analyte cannot be substantiated by the data provided. Acceptance (J-flag) or rejection (R-flag) of the data should be decided by the project team.

Note: Analytical data will report all detections at or above the detection limit (DL) and qualify all results between the DL and limit of quantitation (LOQ) “J” as estimated. All non-detect results will be reported at the LOQ and qualified “U”, per DoD QSM.

Table 5.8 – Comparison of Screening Levels in Soil to Laboratory Limits

Analyte	Analytical Method	CASRN	Units	Background Value (1)	Selected Human Health Screening Value (2)	Selected Human Health Screening Value Source (2)	Achievable Laboratory Limits		
							LOQ	LOD	DL
TAL Metals									
Aluminum	SW6020B	7429-90-5	mg/kg	23,340	41400	NMED SSL	11	8	3
Antimony	SW6020B	7440-36-0	mg/kg	0.23	31.3	NMED SSL	0.2	0.15	0.05
Arsenic	SW6020B	7440-38-2	mg/kg	5.60	7.07	NMED SSL	0.2	0.15	0.05
Barium	SW6020B	7440-39-3	mg/kg	482	4390	NMED SSL	0.4	0.3	0.15
Beryllium	SW6020B	7440-41-7	mg/kg	1.49	148	NMED SSL	0.1	0.075	0.025
Cadmium	SW6020B	7440-43-9	mg/kg	0.224	70.5	NMED SSL	0.1	0.075	0.025
Calcium	SW6020B	7440-70-2	mg/kg	91,760	8850000	NMED SSL	50	40	20
Cobalt (3)	SW6020B	7440-48-4	mg/kg	6.82	23.4	NMED SSL	0.1	0.075	0.025
Copper	SW6020B	7440-50-8	mg/kg	18.4	3130	NMED SSL	0.6	0.45	0.3
Iron (3)	SW6020B	7439-89-6	mg/kg	22,660	54800	NMED SSL	40	30	10
Lead (3)	SW6020B	7439-92-1	mg/kg	12.4	200	EPA RSL	0.4	0.3	0.15
Magnesium	SW6020B	7439-95-4	mg/kg	8,170	1550000	NMED SSL	25	18.8	6.25
Manganese (3)	SW6020B	7439-96-5	mg/kg	1,058	464	NMED SSL	0.5	0.4	0.21
Mercury	SW7471B	7439-97-6	mg/kg	0.0300	20.7	NMED SSL	0.017	0.013	0.0055
Nickel	SW6020B	7440-02-0	mg/kg	19.5	753	NMED SSL	0.6	0.45	0.25
Potassium	SW6020B	7440-09-7	mg/kg	3,950	15600000	NMED SSL	50	40	15
Selenium	SW6020B	7782-49-2	mg/kg	0.513	391	NMED SSL	0.2	0.15	0.05
Silver	SW6020B	7440-22-4	mg/kg	0.130	391	NMED SSL	0.1	0.075	0.025
Sodium	SW6020B	7440-23-5	mg/kg	2,526	7820000	NMED SSL	100	75	25
Thallium	SW6020B	7440-28-0	mg/kg	0.213	0.782	NMED SSL	0.1	0.075	0.025
Total Chromium	SW6020B	7440-47-3	mg/kg	18.1	96.6	NMED SSL	0.6	0.45	0.25
Vanadium	SW6020B	7440-62-2	mg/kg	27.2	394	NMED SSL	0.5	0.4	1.5
Zinc	SW6020B	7440-66-6	mg/kg	49.2	23500	NMED SSL	2	1.5	1
Explosives									
1,3,5-Trinitrobenzene	SW8330B	99-35-4	mg/kg	N/A	2200	EPA RSL	0.1	0.075	0.04
1,3-Dinitrobenzene	SW8330B	99-65-0	mg/kg	N/A	6.30	EPA RSL	0.1	0.075	0.025
2,4-Dinitrotoluene	SW8330B	121-14-2	mg/kg	N/A	17.1	NMED SSL	0.1	0.075	0.025
2,6-Dinitrotoluene	SW8330B	606-20-2	mg/kg	N/A	3.56	NMED SSL	0.15	0.1	0.05
2,4,6-Trinitrotoluene (TNT)	SW8330B	118-96-7	mg/kg	N/A	36.0	NMED SSL	0.1	0.075	0.025
2-Amino-4,6-Dinitrotoluene	SW8330B	35572-78-2	mg/kg	N/A	7.70	NMED SSL	0.2	0.15	0.05
2-Nitrotoluene	SW8330B	88-72-2	mg/kg	N/A	31.6	NMED SSL	0.2	0.15	0.05
3-Nitrotoluene	SW8330B	99-08-1	mg/kg	N/A	6.16	NMED SSL	0.2	0.15	0.05
4-Amino-2,6-Dinitrotoluene	SW8330B	19406-51-0	mg/kg	N/A	7.64	NMED SSL	0.1	0.075	0.025
4-Nitrotoluene	SW8330B	99-99-0	mg/kg	N/A	247	NMED SSL	0.2	0.15	0.05

Table 5.8 – Comparison of Screening Levels in Soil to Laboratory Limits

Analyte	Analytical Method	CASRN	Units	Background Value (1)	Selected Human Health Screening Value (2)	Selected Human Health Screening Value Source (2)	Achievable Laboratory Limits		
							LOQ	LOD	DL
Explosives (Continued)									
Hexahydro-1,3,5-trinitro-1,3,5-triazine (RDX)	SW8330B	121-82-4	mg/kg	N/A	83.1	NMED SSL	0.2	0.15	0.05
Methyl-2,4,6-trinitrophenylnitramine (Tetryl)	SW8330B	479-45-8	mg/kg	N/A	156	NMED SSL	0.2	0.15	0.05
Nitrobenzene	SW8330B	98-95-3	mg/kg	N/A	60.4	NMED SSL	0.3	0.25	0.075
Nitroglycerin	SW8330B	55-63-0	mg/kg	N/A	6.16	NMED SSL	2	1.5	0.5
Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine (HMX)	SW8330B	2691-41-0	mg/kg	N/A	3850	NMED SSL	0.1	0.075	0.025
Pentaerythritol Tetranitrate (PETN)	SW8330B	78-11-5	mg/kg	N/A	570	EPA RSL	2	1.5	0.5

Notes:

1. Selected FWDA background values are presented in Table 8-1 from *Soil Background Study and Data Evaluation Report* (Shaw, 2010), except arsenic and antimony:
   - The arsenic background reference value is 5.6 mg/kg per Evaluation of Background Levels for Arsenic in Soil (NMED, 2013b). If the maximum arsenic concentration is greater than 5.6 mg/ then the range of arsenic concentrations in the sample data set is to be compared to the range of arsenic concentrations in the site-specific background data set (0.2 mg/kg to 11.2 mg/kg).
   - The antimony background level of 0.23 mg/kg is from soil unit 350ss as presented in Table 4-1 of the *Phase 2 Soil Background Report* (USACE, 2013).
2. The human health screening value is the lowest NMED direct contact screening level (for residents, industrial/occupational workers, and construction workers; if there is no NMED direct contact screening level, the lowest EPA RSL was selected for a target excess cancer risk level of 1 x 10-5 or target noncancer hazard quotient of 1.0).
   'The most recent screening levels published by NMED and USEPA at the time the risk evaluation is conducted will be used in the risk evaluation.
3. The background value is greater than the human health screening value.

Cells shaded in blue show that the screening level is lower than the achievable LOQ. If identified as a chemical of potential concern, these analytes will be addressed in the uncertainty discussion.

Acronyms and Abbreviations:

CASRN = Chemical Abstracts Service Registry Number
DL = Detection limit
EPA = United States Environmental Protection Agency
FWDA = Fort Wingate Depot Activity
HQ = Hazard quotient
LOD = Limit of detection
LOQ = Limit of quantitation
mg/kg = Milligram per kilogram
N/A = Not applicable
NMED = New Mexico Environment Department
NS = No screening value available

Table 6.1 – RMM, Matrix 1: Likelihood of Encounter

<table>
<tr><th colspan="2" rowspan="2">LIKELIHOOD OF ENCOUNTER
(Likelihood of MEC Presence vs. Exposure)</th><th colspan="4">EXTENT OF EXPOSURE</th></tr>
<tr><th>Full
(>90% coverage)</th><th>Partial
(50 - 90% coverage)</th><th>Limited
(10 - 50% coverage)</th><th>Minimal
(<10% coverage)</th></tr>
<tr><td rowspan="6">Likelihood of MEC Presence</td><td>HUA: likelihood of MEC is HIGH</td><td>5</td><td>5</td><td>5</td><td>5</td></tr>
<tr><td>HUA: likelihood of MEC is MODERATE</td><td>5</td><td>5</td><td>4</td><td>4</td></tr>
<tr><td>LUA: likelihood of MEC is LOW</td><td>3</td><td>2</td><td>2</td><td>1</td></tr>
<tr><td>LUA: likelihood of MEC is VERY LOW</td><td>2</td><td>2</td><td>1</td><td>1</td></tr>
<tr><td>No evidence MEC remain</td><td rowspan="2">1</td><td rowspan="2">1</td><td rowspan="2">1</td><td rowspan="2">1</td></tr>
<tr><td>NEU: no evidence of munitions use</td></tr>
</table>

Table 6.2 – RMM, Matrix 2: Likelihood of Interaction

LIKELIHOOD OF INTERACTION (Likelihood of Activities in the Interaction Zone vs. Likelihood of Encounter)		LIKELIHOOD OF ENCOUNTER (FROM MATRIX 1)				
		5 (highest)	**4**	**3**	**2**	**1 (lowest)**
Frequency of Activities in the Interaction Zone	**Frequent** activities occur in the interaction zone that may result in an interaction with munitions	A	A	B	B	D
	Occasional activities occur in the interaction zone that may result in an interaction with munitions	A	B	B	B	D
	Infrequent activities occur in the interaction zone that may result in an interaction with munitions	B	B	B	C	E
	Unlikely that activities occur in the interaction zone that may result in an interaction with munitions	B	C	C	C	E

Table 6.3 – RMM, Matrix 3: Risk of Harmful Incident

RISK OF HARMFUL INCIDENT (MEC Code vs. Likelihood of Interaction)		**LIKELIHOOD OF INTERACTION (FROM MATRIX 2)**				
		A	**B**	**C**	**D**	**E**
MEC Code	**High (MEC Code 3)**	**Unacceptable**	**Unacceptable**	**Unacceptable**	**Unacceptable**	Acceptable
	Moderate (MEC Code 2)	**Unacceptable**	**Unacceptable**	**Unacceptable**	Acceptable	Acceptable
	Low (MEC Code 1)	**Unacceptable**	**Unacceptable**	Acceptable	Acceptable	Acceptable
	Presents No Explosive Hazard (MEC Code 0)	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable
	No Evidence MEC Remain					
	NEU					

Table 6.4 – RMM, Pre-MEC Investigation Matrix Selections, SMWU 10, Current Land Use

Input Factor	Data Source	Anticipated Selection
Matrix 1: Likelihood of Encounter		
Likelihood of MEC Presence	CSM Previous Investigations MEC Investigation Results	Anticipated based on reported past recovery of numerous 20mm, 37mm, and 40mm projectiles. 2009 geophysical survey results indicate remaining areas of unexplained high anomaly density Likelihood of MEC is **HIGH**
Extent of Exposure	CSM	Anticipated based on CSM **Full Coverage** – One or more receptors traverse and/or conduct activities on greater than or equal to 90% of the assessment area annually
Matrix 2: Likelihood of Interaction		
Frequency of Activities in the Interaction Zone	CSM	Anticipated based on CSM **Infrequent** activities occur in the interaction zone that may result in an interaction with munitions
Matrix 3: Risk of Harmful Incident		
MEC Code	CSM Previous Investigations MEC Investigation Results	Anticipated based on reported past recovery of 20mm, 37mm, and 40mm projectiles. However, any projectiles burned in the incinerator are unlikely to have been fuzed **High (MEC Code 3; HE munitions)**

Table 6.5 – RMM, Pre-MEC Investigation Matrix Selections, Administration Area, Current Land Use

Input Factor	Data Source	Anticipated Selection
Matrix 1: Likelihood of Encounter		
Likelihood of MEC Presence	CSM Previous Investigations MEC Investigation Results	Anticipated based on recovery of a 37mm projectile and 75mm projectile during utility installation. Despite recovery the presence of munitions is considered unlikely in the Administration Area. Likelihood of MEC is **LOW**
Extent of Exposure	CSM	Anticipated based on CSM. **Full Coverage** – One or more receptors traverse and/or conduct activities on greater than or equal to 90% of the assessment area annually
Matrix 2: Likelihood of Interaction		
Frequency of Activities in the Interaction Zone	CSM	Anticipated based on CSM. **Infrequent** activities occur in the interaction zone that may result in an interaction with munitions
Matrix 3: Risk of Harmful Incident		
MEC Code	CSM Previous Investigations MEC Investigation Results	Anticipated based on reported past recovery of 37mm and 75mm projectiles. However, any projectiles being moved between the storage yard and rail cars are unlikely to have been fuzed. **High (MEC Code 3; HE munitions)**

Table 6.6 – RMM, Pre-MEC Investigation Matrix Selections, SMWU 10, Potential Future Residential Use

Input Factor	Data Source	Anticipated Selection
Matrix 1: Likelihood of Encounter		
Likelihood of MEC Presence	CSM Previous Investigations MEC Investigation Results	Anticipated based on reported past recovery of numerous 20mm, 37mm, and 40mm projectiles. 2009 geophysical survey results indicate remaining areas of unexplained high anomaly density Likelihood of MEC is **HIGH**
Extent of Exposure	CSM	Anticipated based on CSM **Full Coverage** – One or more receptors traverse and/or conduct activities on greater than or equal to 90% of the assessment area annually
Matrix 2: Likelihood of Interaction		
Frequency of Activities in the Interaction Zone	CSM	Anticipated based on CSM **Frequent** activities occur in the interaction zone that may result in an interaction with munitions
Matrix 3: Risk of Harmful Incident		
MEC Code	CSM Previous Investigations MEC Investigation Results	Anticipated based on reported past recovery of 20mm, 37mm, and 40mm projectiles. However, any projectiles burned in the incinerator are unlikely to have been fuzed **High (MEC Code 3; HE munitions)**

Table 6.7 – RMM, Pre-MEC Investigation Matrix Selections, Administration Area, Potential Future Residential Use

Input Factor	Data Source	Anticipated Selection
Matrix 1: Likelihood of Encounter		
Likelihood of MEC Presence	CSM Previous Investigations MEC Investigation Results	Anticipated based on recovery of a 37mm projectile and 75mm projectile during utility installation. Despite recovery the presence of munitions is considered unlikely in the Administration Area Likelihood of MEC is **LOW**
Extent of Exposure	CSM	Anticipated based on CSM **Full Coverage** – One or more receptors traverse and/or conduct activities on greater than or equal to 90% of the assessment area annually
Matrix 2: Likelihood of Interaction		
Frequency of Activities in the Interaction Zone	CSM	Anticipated based on CSM **Frequent** activities occur in the interaction zone that may result in an interaction with munitions
Matrix 3: Risk of Harmful Incident		
MEC Code	CSM Previous Investigations MEC Investigation Results	Anticipated based on reported past recovery of 37mm and 75mm projectiles. However, any projectiles being moved between the storage yard and rail cars are unlikely to have been fuzed **High (MEC Code 3; HE munitions)**

Table 8.1 – Deliverable Schedule

Document/Record	Purpose	Completion/ Update Frequency
QC Seed Plan	Describes intended seed types and locations for QC seeds to be placed	Once, prior to seeding
Blind Seed Firewall Plan	Describes methods used to limit QC seed information to Parsons QC personnel and validation seed information to Seed Team Lead	Once, prior to seeding
Verification and Validation Plan	Describes process for selected verification and validation targets to be selected from classified non-TOI	Draft with Final UFP-QAPP, updates as necessary throughout project
Daily Status Reports	Report notable events to project team	Daily while in field
Weekly Status Reports	Report notable events to project team	Weekly while in field
Daily QC Report	Report QC events to project team	Daily, when in field
Weekly Geophysical QC Report	Report of DGM QC results	Weekly while in field
Field Change Request Form	Record non-critical (i.e., minor) deviations from the UFP-QAPP ("non-critical" deviations are defined as those that will not impact project objectives)	As needed
Root Cause Analysis/ Nonconformance Report	Document MPC failures and causes, as well as CAs taken, actions taken to prevent recurrence, and actions taken to monitor effectiveness of CA	If MPC/MQO failures are noted
Production Area QC Seeding Report	Documents seed types, depths, locations, and orientations	Once, following completion of seeding
IVS Technical Memorandum	Documents the results of the initial IVS tests	Once per geophysical method, following initial IVS test
Target Selection Memorandum	Documents the target selection criteria.	Twice, once for DGM methods and once for AGC methods

Table 8.1 – Deliverable Schedule

Document/Record	Purpose	Completion/ Update Frequency
Classification Memorandum	Documents the anomaly classification criteria	Once, following AGC survey
Seed Tracking Log	Document seed placement and record recovery	As seeds are detected/recovered
Data Usability Assessments (AGC, Intrusive, and Final)	Document the results of AGC survey and intrusive investigation with regard to DQOs	Once after completion of AGC survey, once after completion of intrusive investigation, and once after field investigation complete
Intrusive Investigation Results	Record results of intrusive investigation, including anomaly source description, characteristics, and coordinates	Weekly during intrusive investigation of AGC sources
Anomaly Resolution Results	Record results of anomaly resolution QC checks	During source resolution QC checks
AGC Data Deliverable	Document the results of geophysical surveys	Weekly during AGC data collection
AGC QC Deliverable (Includes QC Database)	Documents QC metrics for geophysical surveys	At least weekly during AGC collection
Supporting Classification Images	Summarize modeling and library match information for each UltraTEM target	Weekly during UltraTEM data collection
Verification and Validation Report	Summarize results of the validation digs and comparison between AGC predictions and intrusive results.	Once following completion of intrusive investigation
DD Form 1348-1A	Certify MPPEH as MDAS; maintain Chain of Custody for MDAS	As required for batches of MPPEH
MDAS disposal documentation	To certify that MDAS has been disposed of in accordance with project requirements	After each shipment of MDAS off site
Explosives Usage Record (if applicable)	To record quantities of explosives used	Each demolition operation

Table 8.1 – Deliverable Schedule

Document/Record	Purpose	Completion/ Update Frequency
Demolition Shot Record (if applicable)	To document the item(s) destroyed and the explosives used during demolition shots	Each demolition operation
Final MRS Characterization Technical Memorandum	Summary of the preliminary and high-density area characterization investigation results	Once, 21 days after completion of HD area characterization
MEC Investigation Report	To document the completion of the MEC investigation and describe the process	Once after completion of field work and Final DUA Report
Project GIS	Maintain and manage all project geospatial data in GIS format	Project milestones including UFP-QAPP, field work completion, MEC Investigation Report, and project closeout

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FIGURES

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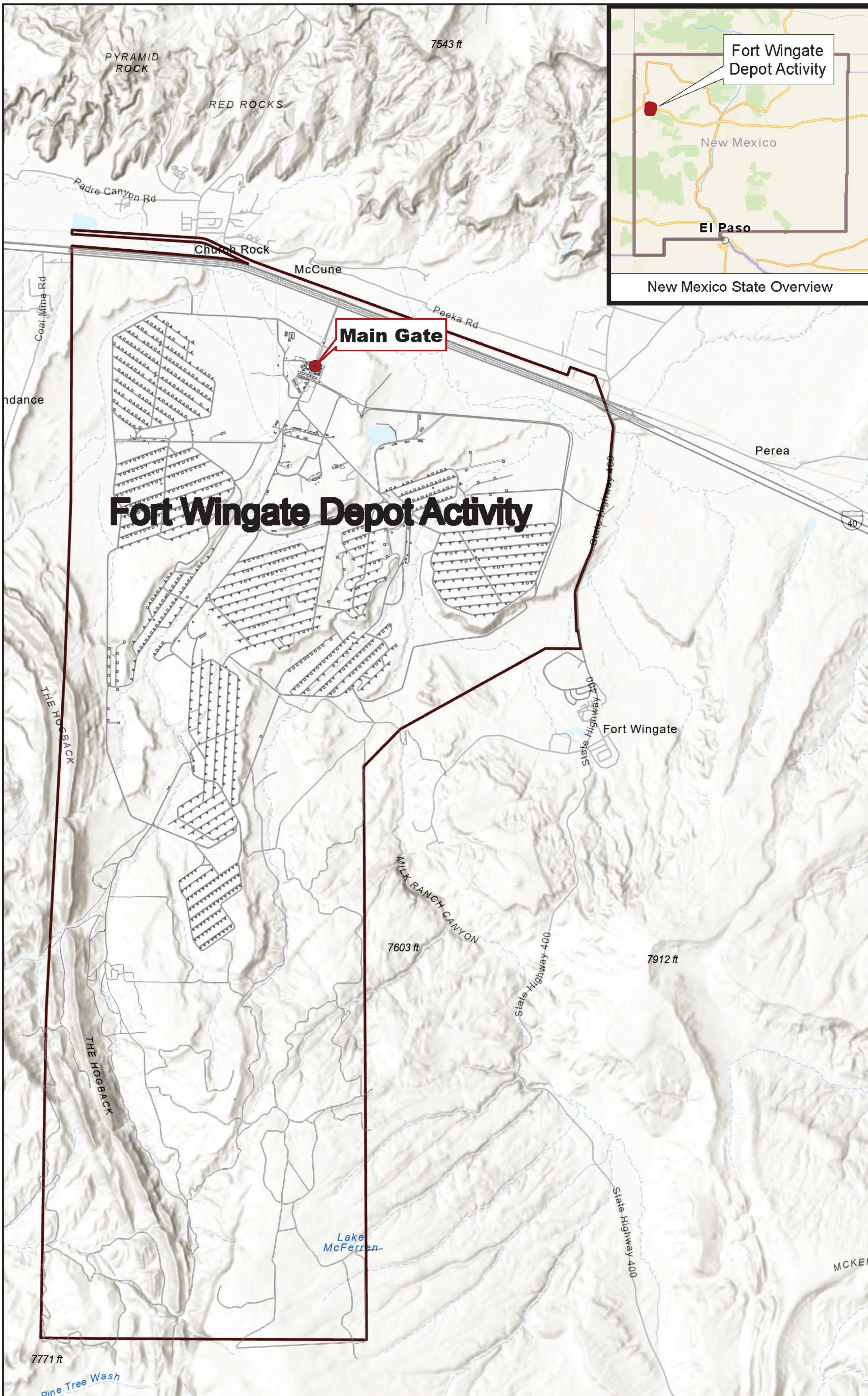

Client	USACE, Albuquerque District				FIGURE 1.1
Notes	MEC Investigation Work Plan, Parcel 11, Fort Wingate Depot Activity, McKinley County, New Mexico				
Revised	5/8/2024	GIS by	AM	5/8/2024	Facility Location Map
Scale	1:55,000	Checked by	JB	5/8/2024	
Basemap: Esri, TomTom, Garmin, FAO, NOAA, USGS, EPA, USFWS, Esri, TomTom, Garmin, SafeGraph, GeoTechnologies,		PM	CR	5/8/2024	

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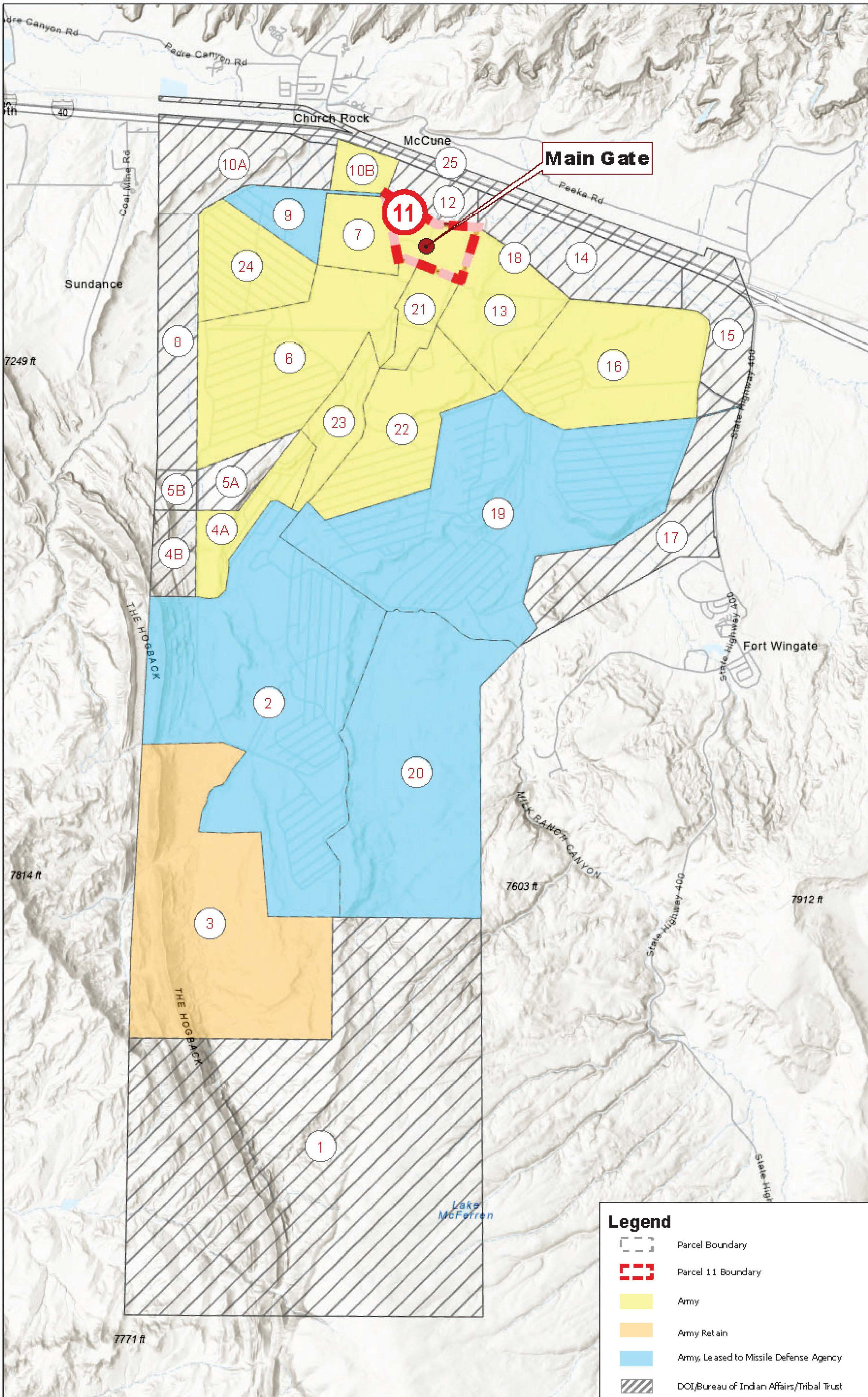

Client	USACE, Albuquerque District			
Notes	MEC Investigation Work Plan, Parcel 11, Fort Wingate Depot Activity, McKinley County, New Mexico			
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Scale	1:50,000	Checked by	JB	5/13/2024
Basemap: Esri, TomTom, Garmin, SafeGraph, GeoTechnologies, Inc, METI/NASA, USGS, Bureau of Land Management, EPA,		CR	CR	5/13/2024

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FIGURE 1.2

Parcel Map

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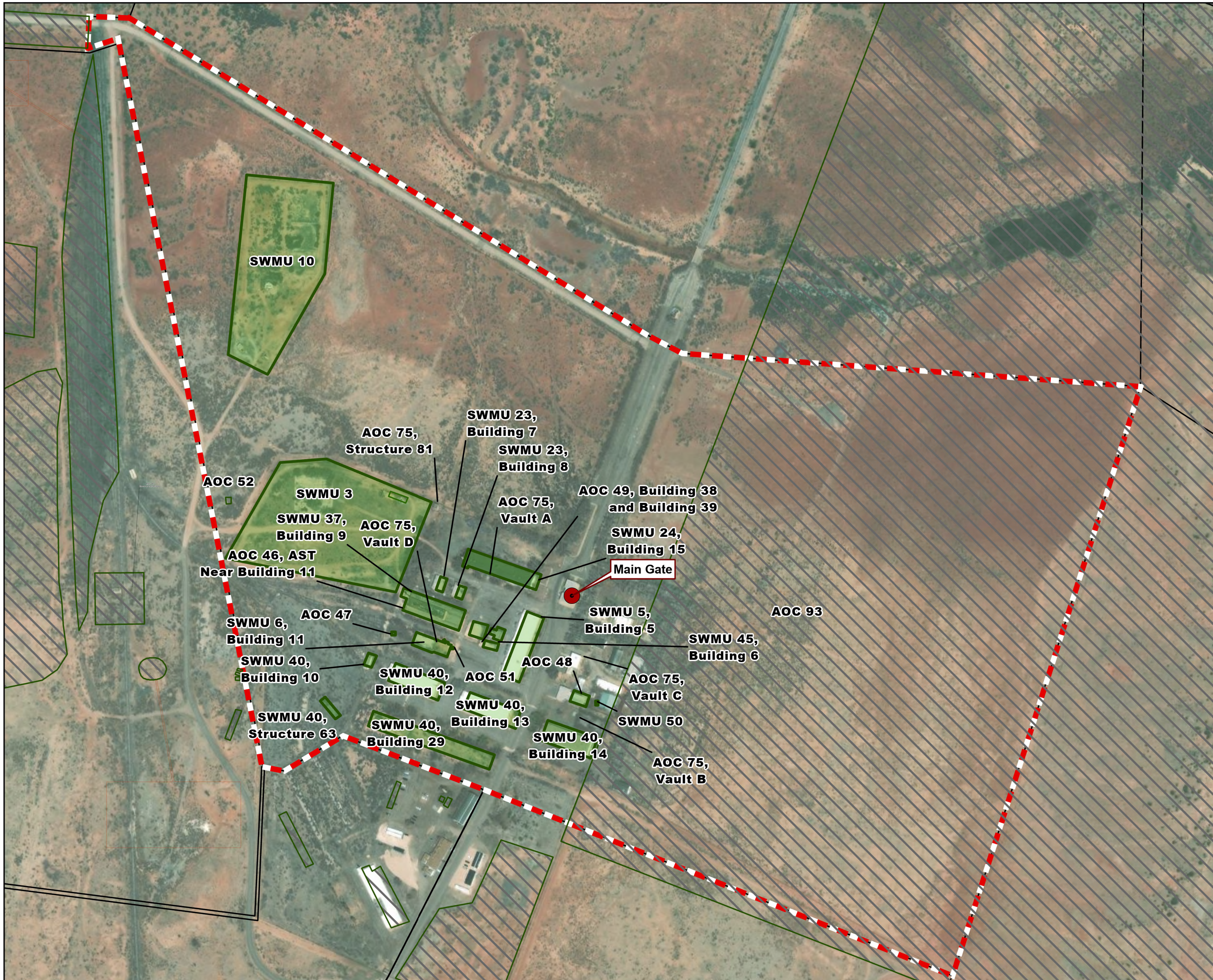

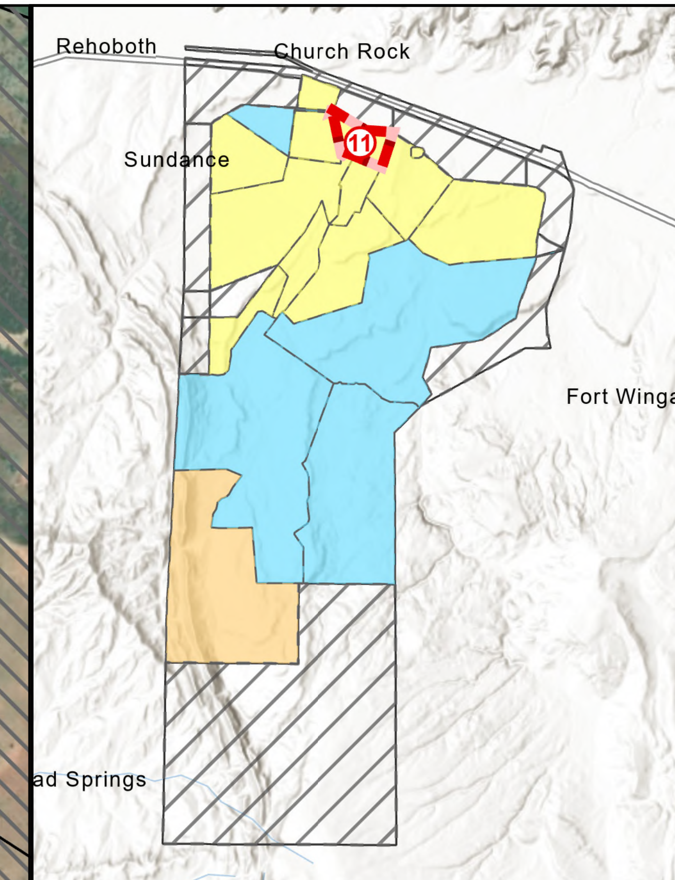

Legend

- AOC/SWMU Boundary
- AOC/SWMU Boundary (not addressed in this Parcel 11 Phase 2 Work Plan)
- Parcel 11 Boundary

0 250 500 Feet

N

MEC Investigation Work Plan, Parcel 11,
Fort Wingate Depot Activity,
McKinley County, New Mexico

FIGURE 1.3

AOC/SWMU Boundaries

Client	USACE, Albuquerque District	GIS by	AM	4/15/2025
		Checked by	JB	4/15/2025
		PM	CR	4/15/2025

Path: V:\MMRP_FtWin\ArcPro\Parcel11_MEC\WorkPlan\Wingate_P11_MEC_Background.aprx Layout: Fig 1.3 Parcel 11 AOC and SWMU Overview Layout
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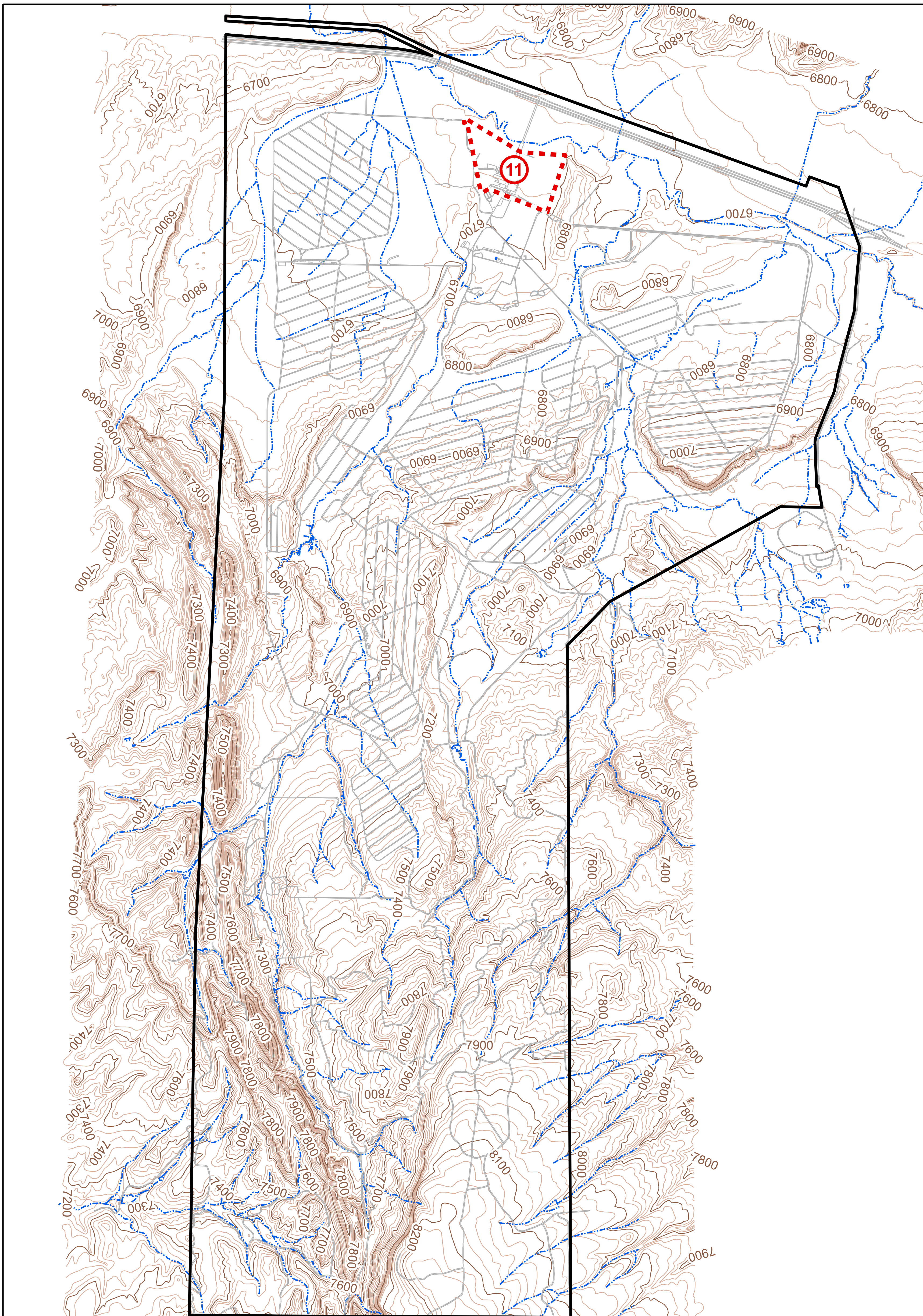

Legend

- 100-Foot Topographic Contour Line
- 20-Foot Topographic Contour Line
- Arroyo
- FWDA Boundary
- FWDA Roads
- Parcel Boundary
- (11) Parcel Number

Source : AMEC Foster Wheeler, 2018
Reference: Thorstenson, D.J., and Beard, L.S., U.S. Geological Survey, 2000.

Client	USACE, Albuquerque District			
Notes	MEC Investigation Work Plan, Parcel 11, Fort Wingate Depot Activity, McKinley County, New Mexico			
Revised	4/8/2024	GIS by	AM	4/8/2024
Scale	1:50,000	Checked by	LR	4/8/2024
Source: Amec Foster Wheeler, 2018		PM	CR	4/8/2024

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FIGURE 2.1

Facility-Wide Topographic Map

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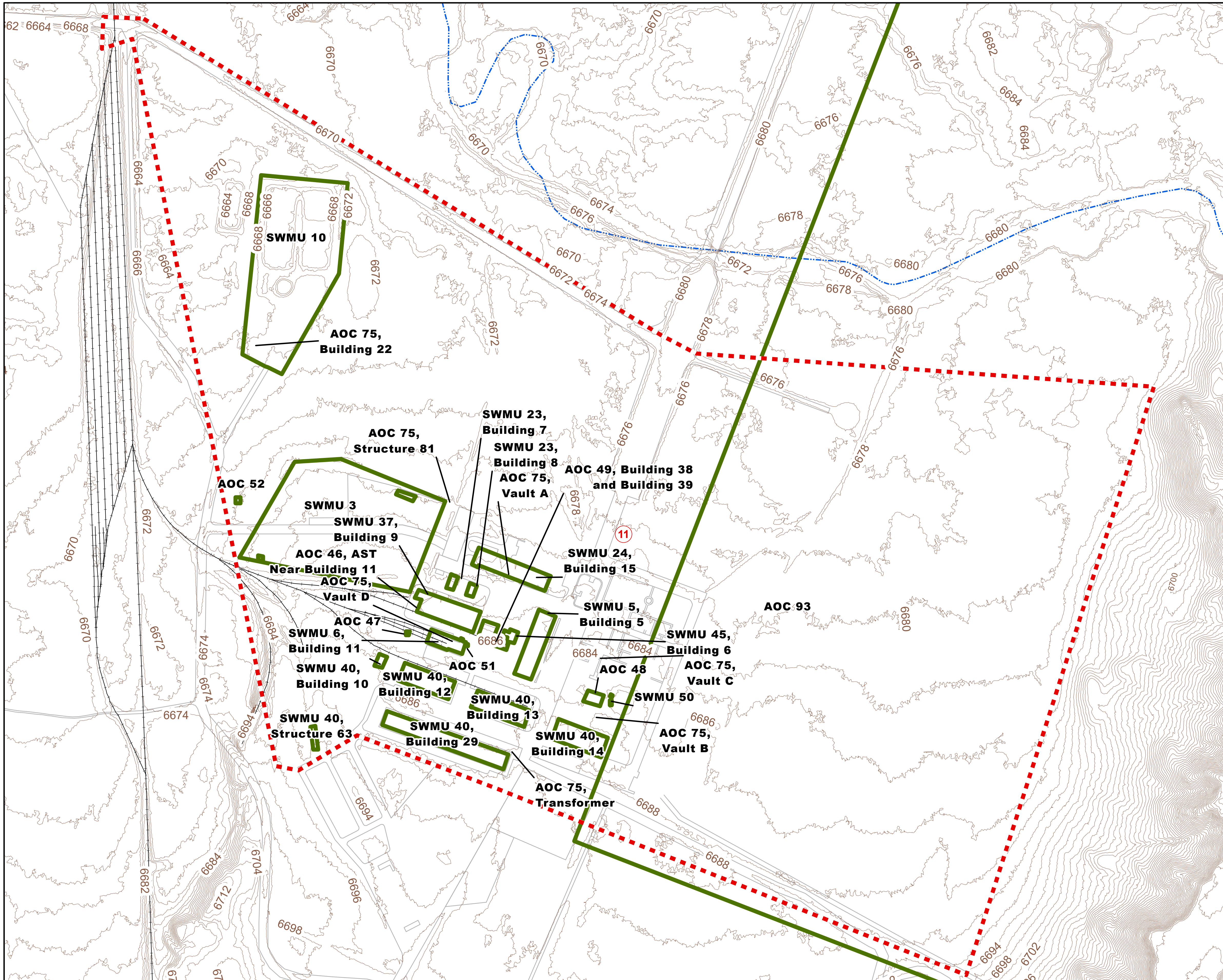

Legend

- FWDA Railroad
- FWDA Boundary
- 2-Foot Topographic Contour Line
- FWDA Roads
- Arroyo
- Parcel Number
- Parcel 11 Boundary
- AOC/SWMU Boundary

Notes:

AOC= Area of Concern
SWMU = Solid Waste Management Unit

Source : AMEC Foster Wheeler, 2018
Reference: Thorstenson, D.J., and Beard, L.S., U.S. Geological Survey, 2000.

0 125 250 Feet

N

MEC Investigation Work Plan, Parcel 11, Fort Wingate Depot Activity, McKinley County, New Mexico

Figure 2.2
Parcel 11
Topographic Map

Client	USACE, Albuquerque District	GIS by	AM	5/13/2024
		Checked by	JB	5/13/2024
		PM	CR	5/13/2024

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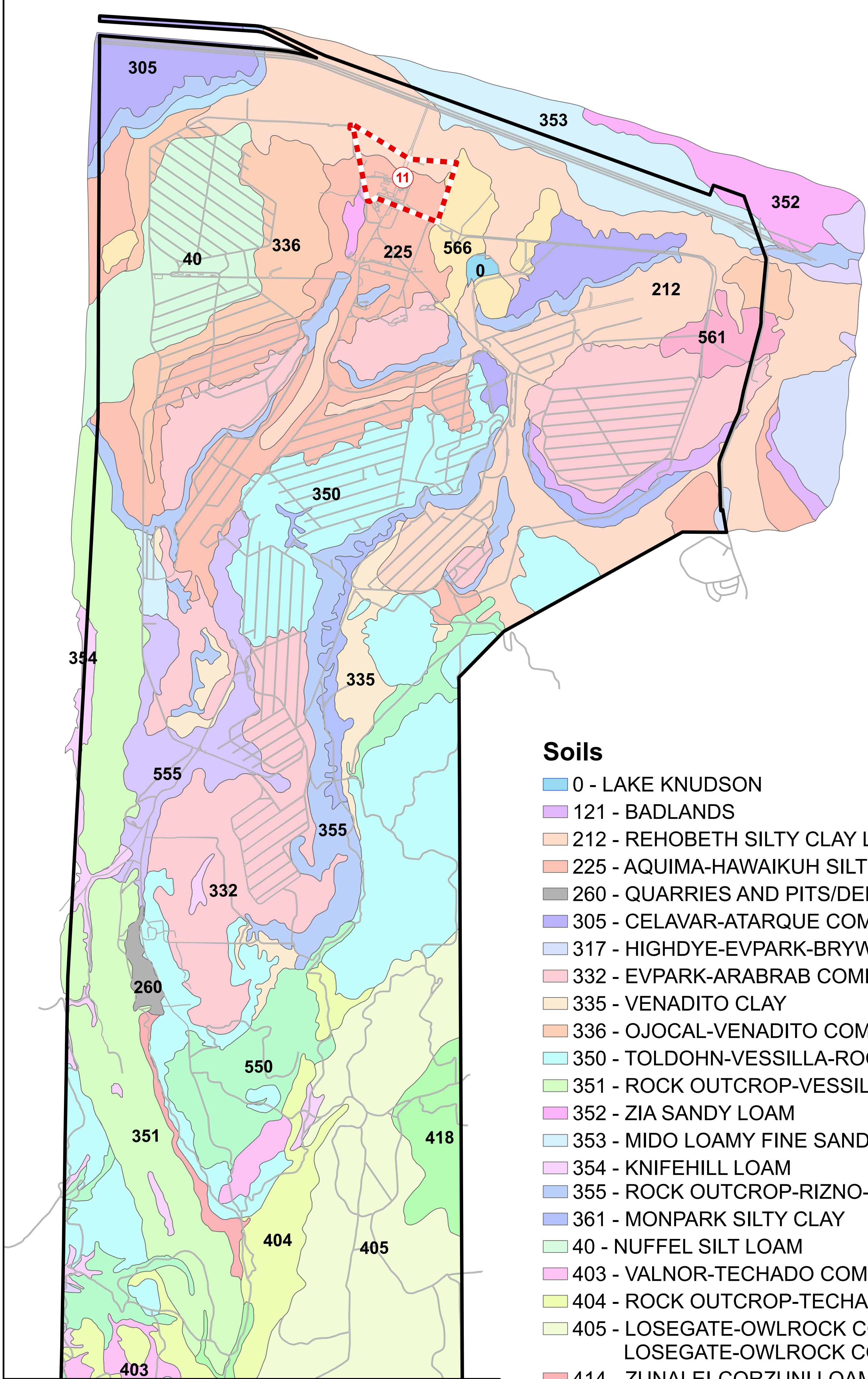

Soils

- 0 - LAKE KNUDSON
- 121 - BADLANDS
- 212 - REHOBETH SILTY CLAY LOAM
- 225 - AQUIMA-HAWAIKUH SILT LOAM
- 260 - QUARRIES AND PITS/DEMOLITION AREA
- 305 - CELAVAR-ATARQUE COMPLEX
- 317 - HIGHDYE-EVPARK-BRYWAY COMPLEX
- 332 - EVPARK-ARABRAB COMPLEX
- 335 - VENADITO CLAY
- 336 - OJOCAL-VENADITO COMPLEX
- 350 - TOLDOHN-VESSILLA-ROCK OUTCROP COMPLEX
- 351 - ROCK OUTCROP-VESSILLA COMPLEX
- 352 - ZIA SANDY LOAM
- 353 - MIDO LOAMY FINE SAND
- 354 - KNIFEHILL LOAM
- 355 - ROCK OUTCROP-RIZNO-TEKAPO COMPLEX
- 361 - MONPARK SILTY CLAY
- 40 - NUFFEL SILT LOAM
- 403 - VALNOR-TECHADO COMPLEX
- 404 - ROCK OUTCROP-TECHADO-STOZUNI COMPLEX
- 405 - LOSEGATE-OWLROCK COMPLEX; LOSEGATE-OWLROCK COMPLEX
- 414 - ZUNALEI-CORZUNI LOAMY FINE SANDS
- 418 - ASAAYI-OSORIDGE COMPLEX
- 550 - BRYWAY-GALZUNI LOAMS
- 555 - PARKELEI-EVPARK FINE SANDY LOAM
- 561 - FLUGLE-PLUMASANO ASSOCIATION
- 565 - PLUMASANO - ROCK OUTCROP COMPLEX
- 566 - BAMAC EXTREMELY GRAVELLY SAND/LOAM
- UNKNOWN - UNKNOWN

Legend

- FWDA Boundary
- FWDA Roads
- Parcel Number
- Parcel 11 Boundary

Source : AMEC Foster Wheeler, 2018
Reference: Natural Resources Conservation Service (NRCS).

Client	USACE, Albuquerque District				
Notes	MEC Investigation Work Plan, Parcel 11, Fort Wingate Depot Activity, McKinley County, New Mexico				
Revised	4/8/2024	GIS by	AM	4/8/2024	
Scale	1:56,560	Checked by	LR	4/8/2024	
Source: Amec Foster Wheeler, 2018		PM	CR	4/8/2024	

N

FIGURE 2.3

Facility-Wide Soils Map

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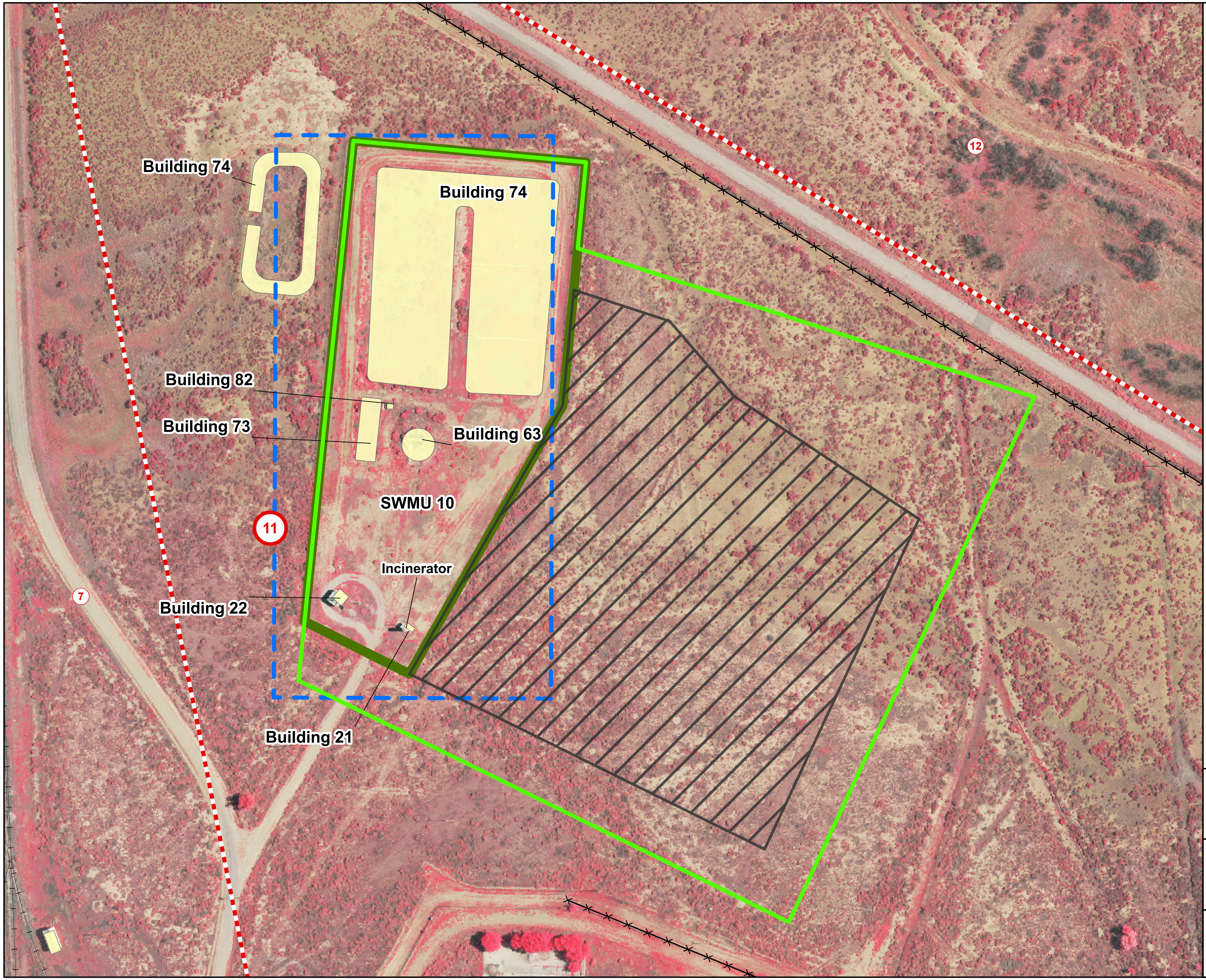

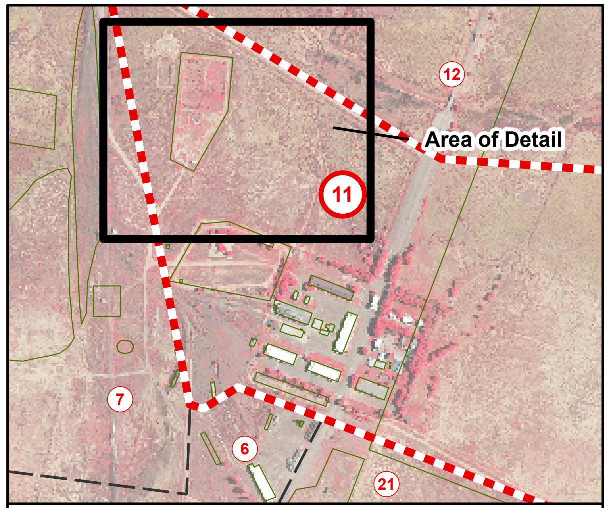

Parcel 11 Detail

Legend

- Structure
- 1993 and 1996 Document Incinerator Clearances (Approximate)
- 2009 EM61 Survey Boundary
- Proposed Investigation Area
- SWMU 10 (coincident with STP fence line)
- Parcel 11 Boundary
- Parcel Boundary
- Railroad
- FWDA Fence

Note:

SWMU = Solid Waste Management Unit

0 125 250 Feet

N

MEC Investigation Work Plan, Parcel 11,
Fort Wingate Depot Activity,
McKinley County, New Mexico

Figure 3.1

SWMU 10 Previous and Proposed Investigation Boundaries

Client	USACE, Albuquerque District	GIS by	AM	5/13/2024
		Checked by	JB	5/13/2024
		PM	CR	5/13/2024

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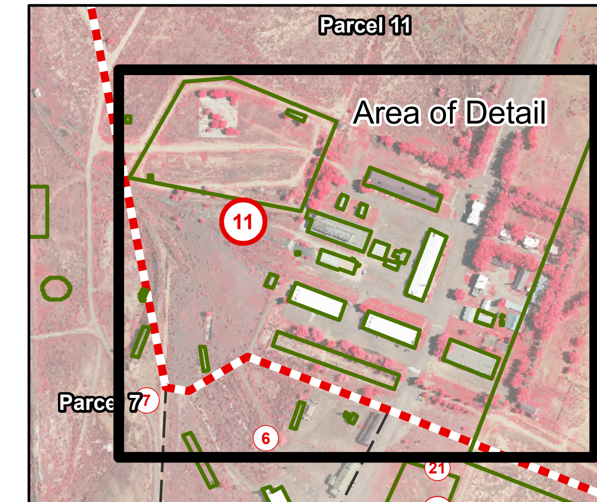

Administration Area Overview

Legend

- Structure
- Proposed Investigation Area
- Previous Investigation Area
- AOC/SWMU Boundary
- Parcel 11 Boundary
- Parcel Boundary
- Railroad

Note:

AOC = Area of Interest
SWMU = Solid Waste Management Unit

0 150 300 Feet

N

MEC Investigation Work Plan, Parcel 11,
Fort Wingate Depot Activity,
McKinley County, New Mexico

Figure 4.1
Administration Area Survey Area

Client	USACE, Albuquerque District	GIS by	AM	4/16/2025
		Checked by	LR	4/16/2025
		PM	CR	4/16/2025

Path: V:\MMRP_FtWin\ArcPro\Parcel11_MEC\WorkPlan\Wingate_P11_MEC.aprx Layout: Figure4.1_SWMU40_B012_B013_Structures
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APPENDIX A
NMED Disapproval Letter

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MICHELLE LUJAN GRISHAM
GOVERNOR

JAMES C. KENNEY
CABINET SECRETARY

Certified Mail - Return Receipt Requested

February 4, 2025

George H. Cushman
Headquarters, Department of the Army
Office of the DCS, G-9
Army Environmental Office, Room 5C140
600 Army Pentagon
Washington, DC 20310-0600

RE: DISAPPROVAL
FINAL MEC INVESTIGATION WORK PLAN PARCEL 11
FORT WINGATE DEPOT ACTIVITY
MCKINLEY COUNTY, NEW MEXICO
EPA ID# NM6213820974
HWB-FWDA-24-015

Dear Mr. Cushman,

The New Mexico Environment Department (NMED) is in receipt of the Fort Wingate Depot Activity (Permittee) *Final MEC Investigation Work Plan Parcel 11* (Work Plan), dated October 15, 2024. NMED has reviewed the Work Plan and hereby issues this Disapproval with the following comments.

COMMENTS

1. **Executive Summary, ES.2, Purpose and Scope, page 13, lines 8-11, and Section 4.1, [SWMU 40] Background, page 43, lines 7-9**

   Permittee Statements: "This MEC [(munitions and explosives of concern)] Investigation Work Plan contains investigative information for two solid waste management units (SWMUs) and adjacent areas in Parcel 11:
   • SWMU 10 – Sewage Treatment Plant (approximately 17.5 acres), and
   • SWMU 40 – South Administration Area (approximately 3.5 acres)."
   and,
   "It is unknown how deep the munitions were when they were found or why they were buried, if intentionally buried, but it was assumed that they were related to munitions transport."

   NMED Comment: The latter statement indicates that the historical operations at the Facility have not been documented and are not fully understood. The Permit lists 10 SWMUs and seven areas of concern 10 (AOCs) within Parcel 11. In the revised Work Plan, explain why SWMUs 10 and 40 only pertain to the MEC investigation while others do not. If the other SWMUs and AOCs have previously been investigated and MEC was not found, state such a fact, or if other SWMUs and AOCs have not previously been investigated, the presence/absence of MEC may be unknown. In this case, propose to investigate all SWMUs and AOCs in Parcel 11 in the revised Work Plan, as appropriate.

2. Section 1.1, Purpose and Scope, page 25, lines 38-41

Permittee Statement: "The boundaries of the 2009 surveys adjacent to the SWMU 40 buildings/structures were based on proximity to specific buildings or structures. MEC contamination is not expected outside of these areas. Therefore, the SWMU 40 surveys will cover the same areas surveyed in 2009 (see Figure 4.1)."

NMED Comment: According to Figure 4.1, *SWMU 40 Structures*, the areas (a) surrounding Building 14, (b) between Buildings 12/13 and the former Building 29, and (c) surrounding structure 63 have not previously been investigated and are not proposed to be investigated in the Work Plan. Explain why these areas are not covered under this investigation in the response letter. Although the Permittee states, "MEC contamination is not expected outside of these areas," the presence/absence of MEC contamination is unknown because the areas were not previously investigated. Propose to investigate the areas in the revised Work Plan, as appropriate.

3. Section 1.2, Parcel 11 Background Information, page 27, lines 24-25

Permittee Statement: "Activities for the RFI were detailed in the RFI Report (USACE, 2014), which was approved with modifications in 2013."

NMED Comment: The statement may contain a typographical error. It is unclear how the 2014 RFI report could be approved in the previous year 2013. Correct the typographical error in the revised Work Plan or provide a clarification in the response letter.

4. Section 3.1, Background, page 33, lines 11-12, Section 3.2, Previous Investigations, page 34, lines 2-4, and Section 5.1.7, Intrusive Investigation, page 59, lines 37-39

Permittee Statements: "A subset of the subsurface sources identified will be excavated to help determine the presence/absence of MEC."
and,
"According to the RFI Report for Parcel 11 (USACE, 2014), prior to 1993, the area around the incinerator was littered with munitions items that had apparently been burned to set off the tracer elements."
and,
"Once the source of an anomaly has been identified and necessary MEC operations have

been completed, the excavation will be filled in and tamped to the approximate consistency and grade of the surrounding soil."

NMED Comment: The Work Plan does not include a scope to address potential soil contamination in the pertinent areas of Parcel 11. If the presence of MEC is identified during the investigation, residual soil contamination may potentially remain in the proximity of the areas/depths where MEC is identified. In this case, confirmation soil samples must be collected from the excavation while MEC removal is being conducted before it is backfilled.

In addition, the analytical suite of confirmation soil samples must include all analytes associated with the operations of the SWMU (e.g., incineration). Propose to collect confirmation soil samples from the excavation, as applicable, and provide a description of the analytical suite in the revised Work Plan. Alternatively, propose to submit a phase 2 investigation work plan to address potential residual soil contamination in the vicinity of the locations where MEC is identified in the revised Work Plan. In this case, the excavation must not be backfilled until the confirmation sampling is complete.

5. **Sections 3.3.4.2 and 4.3.4.2, Spatial and Temporal Boundaries, page 38, lines 16-17, and page 48, lines 11-12**

Permittee Statement: "The detection threshold will be based on response five times the site-specific background noise."

NMED Comment: Targets of interest (TOI) may be present if the response is greater than the background level regardless of its strength. Explain why the response less than five times can be interpreted as non-detection in the revised Work Plan. The noise level may be inversely proportional to reliable detection depth. Explain the basis for the set detection threshold (i.e., response five times the site-specific background noise) in the revised Work Plan.

In addition, NMED recommends that standard objects be buried in various depths to evaluate response strengths relative to their corresponding depths. An appropriate detection threshold may be established with the correlation. Include a provision to evaluate depth-specific detection threshold in the revised Work Plan, as appropriate.

6. **Sections 3.3.4.4 and 4.3.4.4, Vertical Boundaries, page 38, lines 30-32, and page 48, lines 30-32**

Permittee Statement: "The vertical boundary for each confirmed or suspected munition that may be present is the munition-specific maximum reliable depth of detection based on the detection threshold discussed above."

NMED Comment: Clarify that the maximum reliable depths provided by the instrument are sufficient to cover potential depth where each munition is likely to be detected in the response letter. Unless the instrument is capable of screening the entire vertical extent where each specific munition is potentially present, explosive hazards will remain at the sites.

7. Section 3.3.5.1, AGC Survey, page 39, lines 9-10

Permittee Statement: “Geophysical anomalies exceeding the project-specific detection threshold and sources classified as either potential TOI or inconclusive.”

NMED Comment: The inconclusive source classification may be considered as a detection of MEC. Discuss the subsequent step(s) when/if geophysical anomalies are classified as inconclusive in the revised Work Plan.

8. Section 4.1.1, Location, Description, and Operational History, page 43, lines 23-24

Permittee Statement: “The storage yard was reportedly used to store munitions prior to transport.”

NMED Comment: The storage yard area depicted in Figure 4.1, *SWMU 40 Structures*, is not proposed to be investigated. Since the storage yard was used to store munitions, the area occupied by the storage yard must be investigated for the presence/absence of MEC. Revise the Work Plan accordingly.

9. Section 4.2, Previous Investigation, page 44, lines 17-18

Permittee Statement: “They [(projectiles)] were near an area where railcars were loaded with scrap from the storage yard via a loading dock to the northeast of Building 10.”

NMED Comment: According to Figure 4.1, the footprint of the loading dock and its immediate surrounding areas are not proposed to be investigated. Since MEC may potentially be detected in the vicinity of the loading dock, propose to investigate the areas in the revised Work Plan, as practicable.

10. Section 4.2, Previous Investigation, page 44, lines 28-30, and Section 4.3.4.1, Target Population, page 48, lines 3-4

Permittee Statements: “It was determined that this would require the excavation of 254 of the 748 anomalies identified in the EM61 data (7 mV or higher response on EM61 channel 2). The proposed intrusive investigation was never performed.”
and,
“The investigation in SWMU 40 area is based on the recovery of 37mm and 75mm

projectiles during utility trenching in 1998."

NMED Comment: The entire areas where previous investigation was conducted are overlapped by the footprint of the proposed SWMU 40 investigation area. It is expected that the same anomalies will be detected during this investigation because neither the intrusive investigation nor remedial activities were previously performed. Although the advanced instrument that will be used for this investigation may distinguish between a MEC and non-hazardous clutter with a better accuracy and reduce the number of anomalies necessary to be excavated, the proposed investigation areas do not cover any new/additional areas where MEC may potentially be detected. The investigation areas should cover entire areas where the presence of MEC is reasonably suspected in Parcel 11. Propose to investigate previously uninvestigated new/additional areas where MEC may potentially be detected in addition to the areas covered by this investigation in the revised Work Plan (see also Comments 2, 8, and 9).

11. Section 4.3.4.3, Horizontal Boundaries, page 48, lines 26-28

Permittee Statement: "Without an obvious reason to extend the survey boundaries, no buffer was added to the previous SWMU 40 investigation boundary."

NMED Comment: There appears to be reasons to extend the survey boundaries. For example, Section 4.1.1 states that the storage yard was used to store munitions. See the relevant comments above. Unless clear reasons are provided, the survey boundaries must be extended to cover the areas where MEC may potentially be present. Revise all sections of the Work Plan, as appropriate.

12. Section 5.1.8.2.2, MEC/MPPEH Disposal, page 60, lines 31-32

Permittee Statement: "Items that cannot be moved will ideally be blown in place the day they are discovered in accordance with the ESP."

NMED Comment: If such a situation arises, soil confirmation samples must be collected from the detonation crater to evaluate potential soil contamination associated with the detonation. Acknowledge the provision in the response letter.

13. Section 6.0, Risk Assessment and Reporting, page 63, lines 8-10

Permittee Statement: "RMM [(risk management methodology)] is a tool used to assess risks at MEC contaminated sites and can serve as the baseline risk assessment and facilitate communication about risk."

NMED Comment: The risk assessment included in the Work Plan only pertains to potential explosive hazards. As stated in Comment 4 above, residual soil contamination may potentially remain in the proximity of the areas/depths where MEC is identified. The risk associated with residual soil contamination must also be evaluated in the revised Work Plan if confirmation soil sampling is included as part of the Work Plan. In addition, Section 7.0, *Waste Management Plan*, and its subsections must include a provision to manage contaminated soil associated with excavation and sampling activities, as appropriate.

14. Section 6.3, Overview of Input Factors for Decision Logic to Assess Risks from Explosive Hazards, page 65, lines 29-31

Permittee Statement: "If an acceptable risk scenario is identified and concurred by the project team and stakeholders, then it may be possible to recommend no further action."

NMED Comment: According to Table 6.3, *RMM Matrix 3: Risk of Harmful Incident*, an acceptable scenario is identified under MEC Code 2 or 3, which causes death or major injury through MEC interaction because likelihood of the encounter is infrequent/unlikely. In order to completely eliminate an incident of death/major injury, all scenarios under MEC Codes 2 and 3 must be identified as unacceptable scenarios. Unless a remedial response is practicable in such areas, institutional control (e.g., access restriction) must permanently be implemented. Revise the Work Plan accordingly.

The Permittee must submit the revised Work Plan that addresses all comments contained in this letter. Two hard copies and an electronic version of the revised Work Plan must be submitted to the NMED. The Permittee must also include a redline-strikeout version in electronic format showing where all revisions to the Work Plan have been made. The revised Work Plan must be accompanied by a response letter that details where all revisions have been made to the Work Plan, cross-referencing NMED's numbered comments. The revised Work Plan must be submitted to NMED no later than **June 6, 2025**.

Should you have any questions regarding this letter, please contact Michiya Suzuki of my staff at (505) 690-6930.

Sincerely,

JohnDavid Nance Digitally signed by JohnDavid Nance
Date: 2025.02.04 06:41:55 -07'00'

JohnDavid Nance
Chief
Hazardous Waste Bureau

cc: N. Dhawan, NMED HWB
M. Suzuki, NMED HWB
L. King, EPA Region 6 (6LCRRC)

S. Begay-Platero, Navajo Nation
A. Kucate, Pueblo of Zuni
M. Bowekaty, Pueblo of Zuni
D. Hickman, Southwest Region BIA
G. Padilla, Navajo BIA
M. Wischnewski, BIA
R. White, BIA
C. Esler, Sundance Consulting, Inc.
C. Frischkorn, BRAC
A. Soicher, USACE

File: FWDA 2025 and Reading