SUMMARY REPORT OF HISTORICAL INFORMATION
OB/OD UNIT HWMU AND PARCEL 3 SWMUS AND AOCS
FINAL

FORT WINGATE DEPOT ACTIVITY
McKinley County, New Mexico

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Prepared for:

U.S. Army Corps of Engineers
Fort Worth, Texas

Prepared by:

TerranearPMC
222 Valley Creek Blvd
Suite 210
Exton, PA 19341

Requests for this document must be referred to:
Commander, U.S. Army Corps of Engineers
Fort Worth District
Attn: CESWF-PER-DI (Beverly Post)
819 Taylor Street
Room 3A12
Fort Worth, TX 76112

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LIST OF ACRONYMS

AOCs	Areas of Concern
ASR	Archive Search Report
bgs	below ground surface
BIP	blown-in-place
BLU	Bomb. Live Unit
BRAC	Base Realignment and Closure
BRACD	BRAC Office
CBU	Cluster Bomb Unit
CDC	Current Detonation Craters
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFP	Closure Field Program
cm/sec	centimeters per second
CRPs	Current Residue Piles
CY	cubic yards
DMM	Discarded Military Munition
DOD	Department of Defense
DOI	U.S. Department of the Interior
EM	electromagnetic induction
EOD	Explosives Ordnance Disposal
FSP	Field Sampling Plan
FWDA	Fort Wingate Depot Activity
GPR	ground-penetrating radar
HWB	Hazardous Waste Bureau
HWMU	Hazardous Waste Management Unit
lbs	Pounds
MAG	magnetic
MC	Munitions Constituents
MD	munitions debris
MEC	munitions and explosives of concern
MMRP	Military Munitions Response Program
MR	Munitions Response
NARA	National Archives and Records Administration
NMED	New Mexico Environment Department
NOD	Notice of Deficiency
OB	Open Burning
OB/OD	Open Burning/Open Detonation
OD	Open Detonation
PDF	Portable Document Format
QAPP	Quality Assurance Project Plan
QA/QC	Quality Assurance/Quality Control
RCRA	Resource Conservation and Recovery Act
RFI	RCRA Facility Investigation
SOP	Standard Operating Procedure
SPLP	Synthetic Precipitation Leaching Procedure
SRHI	Summary Report of Historical Information
SWMUs	Solid Waste Management Units
TAL	Target Analyte List

LIST OF ACRONYMS (CONTINUED)

TCLP	Toxicity Characteristics Leaching Procedure
TDS	Total Dissolved Solids
TEAD	Tooele Army Depot
TM	Technical Manual
TOC	total organic carbon
TSS	Total Suspended Solids
USACE	U.S. Army Corps of Engineers
USC	U.S. Code
USEPA	U.S. Environmental Protection Agency
UXO	unexploded ordnance
WP	white phosphorus
WSMR	White Sands Missile Range
XRF	X-Ray Fluorescence

1.0 INTRODUCTION

This Summary Report of Historical Information (SRHI) for Parcel 3 at Fort Wingate Depot Activity (FWDA) summarizes previous investigations and historical records for the Open Burning/Open Detonation (OB/OD) Unit Hazardous Waste Management Unit (HWMU). This report also summarizes historical information for the Solid Waste Management Units (SWMUs) and Areas of Concern (AOCs) located in Parcel 3.

This document was prepared by TerranearPMC, LLC of Exton, Pennsylvania, in partial fulfillment of the requirements of Task Order No. 0011 under Contract W9126G-06-D-0016. Contracting Officer's Representative and technical oversight responsibilities for the tasks described in this document were provided by the U.S. Army Corps of Engineers (USACE), Fort Worth District.

This document has been prepared for submission to the New Mexico Environment Department (NMED) Hazardous Waste Bureau (HWB), as required by Section VIII.A.2.2 of the Resource Conservation and Recovery Act (RCRA) Permit (hereinafter referred to as "the Permit") for FWDA. The Permit (NM 6213820974) was finalized in December 2005 and became effective 31 December 2005.

This document has been prepared as a companion report to the Closure Phase I Work Plan for the OB/OD Unit, and will also be referenced in preparation of other future documents for Parcel 3, such as the RCRA Facility Investigation (RFI) Work Plan and Release Assessment Report.

1.1 PURPOSE/OBJECTIVE

The purpose of this SHRI is to summarize historical information and previous environmental investigation and restoration activities at the OB/OD Unit HWMU, as well as SWMUs and AOCs located within Parcel 3.

As stated in Section VIII.A.2.2, the Permit requires the submittal of "a summary report of historical information… including maps and data tables, of historical documents and records relating to the OB/OD Unit, including records, maps, photographs, Department of Defense and other governmental databases, environmental site investigation and remedial action documents, construction records, treatment and disposal records, interviews, and other sources of historical information" (NMED, 2005).

The Army has elected to include summary information for Parcel 3 SWMUs and AOCs in this document.

2.0 BACKGROUND

2.1 DESCRIPTION OF THE FACILITY

FWDA is a closed U.S. Army depot whose former mission was to receive, store, maintain, and ship assigned materials (primarily explosives and military munitions), and to dispose of obsolete or deteriorated explosives and military munitions. Since 1975, the installation has been under the administrative command of Tooele Army Depot (TEAD), located near Salt Lake City, Utah. The active mission of FWDA ceased and the installation closed in January 1993, as a result of the Defense Authorization Amendments and Base Realignment and Closure (BRAC) Act of 1988. In 2002, the Army reassigned many functions at FWDA to the BRAC Division (BRACD), including property disposal, caretaker duties, management of caretaker staff, and performance of environmental restoration and compliance activities. TEAD retained command and control responsibilities, and continued to provide support services to FWDA until January 31, 2008. On January 31, 2008, command and control and support functions were transferred to White Sands Missile Range (WSMR).

FWDA currently occupies approximately 24 square miles (approximately 15,277 acres) of land in northwestern New Mexico, in McKinley County. The installation is located 8 miles east of Gallup on U.S. Route 66 and approximately 130 miles west of Albuquerque on Interstate 40 (Figure 2-1). FWDA contains facilities formerly used to operate a reserve storage activity providing for the care, preservation, and maintenance of assigned commodities, primarily conventional military munitions. The installation mission included the disassembly and demilitarization of unserviceable and obsolete military munitions.

The installation is divided into areas based upon location and historical land use (Figure 2-2). These major land-use areas include the Administration Area, the Workshop Area, nine munitions storage areas (Igloo Blocks A through H, J and K), protection and buffer areas, and the OB/OD areas.

FWDA has been undergoing final environmental restoration prior to property transfer/reuse. As part of the planned property transfer to the Department of the Interior (DOI), the installation has been divided into reuse parcels (Figure 2-2). Parcels transferred to date consist of Parcels 1, 15, and 17. The OB/OD Unit is located in Parcel 3.

When the environmental restoration process began at FWDA, the OB/OD Area was divided into two subareas based on period of operation. An area known as the Closed OB/OD Area was used from 1948 to 1955. Residues and debris from open burning and open detonation operations were placed at various locations within the Closed OB/OD Area. Because the period of operations in the Closed OB/OD Area predated RCRA by approximately 25 years, the Closed OB/OD Area was not permitted under RCRA. Therefore, when the Permit was issued, the area previously known as the Closed OB/OD Area was identified as three separate SWMUs (see Figure 2-3):

- SWMU 14, which consists of the Old Burning Ground and Demolition Landfill Area;

- SWMU 15, which consists of the Old Demolition Area; and
- SWMU 33, which consists of one residue/debris pile south of SWMU 15.

From approximately 1948 until installation closure in January 1993, burning and detonation operations were performed within an area known as the Current OB/OD Area. The OB/OD Unit HWMU is an area within the Current OB/OD Area. The OB/OD Unit (Figure 2-3) includes the Burning Ground, the twelve detonation craters in existence at the time of installation closure, and ten areas of surface and subsurface residue and debris derived from OB/OD activities during the approximately 45 years of operation.

In addition to the OB/OD Unit HWMU and three Closed OB/OD Area SWMUs listed above, Parcel 3 contains one additional SWMU and four AOCs, as follows (Figure 2-3):

- SWMU 74 Area 16 or Site 16 (Proposed Burning Ground);
- AOC 89 Features 30 and 34 on the 1973 Aerial Photo API-5;
- AOC 90 Feature 36 on the 1973 Aerial Photo API-5;
- AOC 91 Feature 41 on the 1973 Aerial Photo API-5 and Feature 27 on the 1978 Aerial Photo API-7; and
- AOC 92 Feature 31 on the 1973 Aerial Photo API-5 and Feature 21 on the 1978 Aerial Photo API-7.

2.2 OB/OD OPERATIONS OVERVIEW

As described above, part of the FWDA mission was to demilitarize unserviceable, obsolete, and/or waste explosives, propellants, munitions and munitions components. Some of these demilitarization activities were accomplished using treatment by open burning (OB) or open detonation (OD) in the OB/OD areas. Related materials were also treated in the OB/OD areas, including objects that were potentially contaminated with explosives during storage and handling, such as shipping containers and dunnage. Historical FWDA standard operating procedures (SOPs) for OB/OD operations were found in the 1988 RCRA Part B Permit Application (Engineering, Design and Geosciences Group, 1988, Appendix V; a copy of these SOPs is provided in Appendix A to this SRHI). Additional general information on destruction of unusable ammunition and explosives was found in Technical Manual (TM) 9-1904 (War Department, 1944, pages 748-778; a copy of these materials is included in Appendix A to this SRHI).

OB was used to treat energetic wastes by self-sustained combustion. Typical materials treated by OB include bulk propellants and energetic materials that were not detonable and/or could be burned without causing an explosion. Dunnage was often added to aid burning.

OD was used to destroy detonable energetic materials and munitions. Disposal charges were used to initiate detonations. OD was conducted in detonation

craters either on the ground surface, or under earthen cover to minimize fragmentation dispersal.

From approximately 1948 until 1993, OD was performed in earthen detonation craters constructed at various locations within the OB/OD Unit. During operation, the area was used to detonate (at one time) up to 5,000 pounds (lbs) of explosives without earth cover, and up to 10,000 lbs of explosives with earth cover. At the time of installation closure in 1993, twelve detonation craters existed. Several of the demolition craters were used in the period from 1993 to 1999 to support remedial activities being conducted in the OB/OD Areas and other parts of the installation. At the direction of NMED, this practice was ended in 1999 and all but one of the detonation craters were backfilled/regraded and revegetated.

As a result of the nature of OB/OD operations, the potential exists for materials potentially presenting an explosive hazard, including munitions and explosives of concern (MEC), to be present in the OB/OD areas. Munitions response activities in Parcel 3 are discussed further in Section 3.5.2.

2.3 SUMMARY OF GENERAL HISTORICAL INFORMATION

A number of record searches and document reviews relating to FWDA operations in general as well as the OB/OD Unit and Parcel 3 SWMUs and AOCs in particular have been performed since the environmental restoration program began in 1980.

Available records pertaining to operations at the OB/OD Unit and Parcel 3 SWMUs and AOCs were reviewed in preparation of past documents and this SRHI.

Records reviewed included:

- A historical aerial photograph analysis for FWDA (ERI, 2006);
- Historical maps, drawings, and records located at FWDA;
- Historical records and documents, obtained from the National Archives and Records Administration (NARA), stored in multiple locations;
- Historical records obtained from Army Field Support Command/Joint Munitions Command History Office's archives and document collection; and
- Other historical documents contained in the FWDA Information Repository.

Historical information regarding environmental characterization of the OB/OD Unit and the Parcel 3 SWMUs is discussed in later sections of this SRHI.

All historical maps/drawings reviewed confirmed the general operational timeframes and locations of OB/OD operations at FWDA. Historical drawings are included in Appendix B. The area is first shown as a detonation area in a 1947 map (FWDA Drawing No. C-8-9), and operations areas are shown in the same general locations in 1955 (FWDA Drawing No. A-3-4), 1963 (FWDA Drawing No. C-9-12), and 1985 (FWDA Drawing No. C-9-23).

The amounts and types of materials treated by OB or OD in the SWMUs located in the Closed OB/OD Area are not well documented.

Limited information regarding the amounts and types of materials treated by OB or OD in the OB/OD Unit has been found. According to one historical document, for the period from 1976 to 1981, records identified a total of 7,640 tons of munitions detonated in the Current OB/OD Area (Inland Pacific, 1982, page 8). Limited demolition records were presented in a document entitled *Installation Assessment of Fort Wingate Army Depot Activity* (USATHAMA, 1980, page 31), and additional records were located in files at FWDA during a file search in 2007; copies of the available records are included in Appendix C.

2.4 INTERVIEWS

Interviews of former FWDA personnel familiar with OB/OD operations were conducted in 1994 and 1995 as part of the archives search, and were documented in the document entitled *Archive Search Report, Fort Wingate*, dated July 1995 (USACE, 1995, pages 4-7 and 4-8, and Appendix H). Additional interviews were conducted by USACE in 2006-2007 and were documented in a document entitled *Summary of Interviews, Fort Wingate Depot Activity* (USACE, 2007, Section 3.0).

2.5 AERIAL PHOTOGRAPH ANALYSIS

Historical aerial photographs were analyzed as presented in a document entitled *Aerial Photographic Analysis, Fort Wingate Depot Activity* (ERI, 2006); information for Parcel 3 is included in Appendix D of this SRHI. Analysis findings been incorporated into the summaries for the OB/OD Unit HWMU and individual SWMUs and AOCs.

2.6 ENVIRONMENTAL INVESTIGATION AND RESTORATION ACTIVITIES

The purpose of this section is to provide summary level information regarding development and implementation of environmental characterization efforts.

The Current OB/OD Area (including the OB/OD Unit) and the Closed OB/OD Area (including SWMUs 14, 15, and 33) had been identified as areas requiring environmental characterization and evaluation many years prior to Permit issuance, and thus have been the subject of many phases of investigation to characterize wastes, soils, ground water, surface water, and sediment.

Development of a Closure Plan and the progression of efforts to evaluate potential constituents of concern prior to Permit issuance are described in Section 2.6.1. Past efforts to characterize the OB/OD Unit and Parcel 3 SWMUs are identified in Section 2.6.2.

2.6.1 Closure Plan Development

This section describes development of a Closure Plan prior to Permit issuance.

OB/OD operations within the OB/OD Unit were listed on the FWDA's initial RCRA Part A Permit Application, dated August 1980. The permitted OB/OD activities thereafter operated under Interim Status (USEPA ID No. NM 6213820974) and

the regulations of 40 CFR 265.382: open burning, waste explosives. An Interim Status Closure Plan was submitted to NMED where it was kept on file. Subsequently, in November 1988, a RCRA Part B Permit Application for OB/OD activities was submitted to the United States Environmental Protection Agency (USEPA) Region 6 and NMED (Engineering, Design and Geosciences Group, 1988).

In response to the BRAC Act of 1988, which targeted FWDA for closure and disposal by the Army, the RCRA Part B Permit Application was withdrawn in November 1992. A *Draft Interim Status Closure Plan* (ERM, 1992) was submitted on 6 November 1992 to address final closure of the regulated OB/OD unit, which, as discussed in Section 2.0, was then called the Current OB/OD Area.

The *Final Interim Status Closure Plan* (ERM, 1993) was then submitted to NMED on 1 March 1993 presenting a two phased approach to closure. In the first phase, the preliminary characterization sampling would be performed to identify areas of concern within the OB/OD Unit and to direct a more comprehensive sampling and analysis effort to be performed during the second, or confirmation phase.

The *Final Interim Status Closure Plan* was approved by NMED on 20 January 1994. The Approved Interim Status Closure Plan included a phased approach to closure including environmental characterization sampling. Site conditions, primarily concerns for safety [with respect to the presence of unexploded ordnance (UXO) and other MEC] in the OB/OD Area, were determined to preclude the performance of clean closure.

Preliminary characterization of the OB/OD Area began in 1993 with screening level sampling of surface soils, surface water, and shallow ground water within and around the OB/OD Unit. The findings of the screening level sampling were submitted to NMED in the *Modification to the Final Interim Status Closure Plan* (ERM, 1994a, pages 4-1 through 4-4). Because some of the screening level sample locations fall within the OB/OD Unit HWMU and/or Parcel 3 SWMUs and AOCs, this effort is discussed further in later sections; however, it should be noted that the primary objective of the 1993 effort was to generate a basis for later investigations. The preliminary characterization confirmed visual observations that OB/OD operations within the Current OB/OD Area had been concentrated in a small portion (5-10 acres) of the overall area, located in the immediate vicinity of the arroyo.

Several comments regarding the *Modification to the Final Interim Status Closure Plan* were provided by NMED in a Notice of Deficiency (NOD) letter to the Army dated 26 August 1994. These comments, requiring additional characterization of the OB/OD Area, were considered during preparation of an amendment to the approved Closure Plan. The *Final Interim Status Closure Plan* (ERM, 1996a) was submitted to NMED on 21 May 1996, and approved on 10 April 1997.

2.6.2 Environmental Investigations Conducted Under Pre-Permit Closure Plan

This section summarizes environmental characterization efforts completed under the approved (pre-Permit) Closure Plan, prior to Permit issuance. More detailed

information regarding investigations in the OB/OD Unit HWMU and Parcel 3 SWMUs and AOCs is included in Sections 4.0 through 11.0 of this SRHI.

The NMED-approved *Final Interim Status Closure Plan* (ERM, 1996a) incorporated Closure Field Program (CFP) Work Plans that presented the approach to perform environmental sampling, site characterization, and engineering evaluations of the OB/OD Area. These activities were necessary to support finalization of the Closure Plan and select a closure/remedial option for implementation. As specified by NMED, the CFP contained three phases:

- Phase I – Characterization and Assessment of Site Conditions;
- Phase II – Description, Evaluation, and Recommendation of Closure-Remedial Options; and
- Phase III – Design, Construction & Operation of Selected Closure Option.

Field efforts to satisfy Phase I of the CFP were conducted from 1996 through 1998. Soil and waste characterization efforts in the OB/OD Unit and Parcel 3 SWMUs were performed during 1996. Eleven monitoring wells were installed and sampled in October 1996 and February 1997. Water level data collected indicated that the distribution of hydraulic heads was complex and required additional definition.

Further subsurface characterization consisting of subsurface seismic profiling, geophysical borehole logging, geologic mapping, and fracture trace analysis was proposed in the *Final OB/OD Area Work Plan* (PMC, 1997a). These characterization efforts were completed in 1997 and the results used to select locations for additional monitoring wells.

Further characterization of the OB/OD Area was proposed in the *Final OB/OD Area Work Plan* (PMC, 1998). The characterization activities consisted of focused geologic mapping within the OB/OD Area arroyos, identification of wells near FWDA, completion of eight additional boreholes/monitoring wells, and collection and analysis of surface water, sediment, and ground water samples. These efforts were completed in 1998.

The results of Phase I of the CFP were provided to NMED in two documents:

- The first document, entitled Final Open Burning/Open Detonation Area RCRA Interim Status Closure Plan Phase IA – Characterization and Assessment of Site Conditions for the Soils/Solid Matrix (Phase IA Report) (PMC, 1999a), was submitted to NMED on 25 November 1999. A Portable Document Format (PDF) copy of this document is included as Appendix E to this SRHI.
- The second document, entitled Final Open Burning/Open Detonation Area RCRA Interim Status Closure Plan Phase IB – Characterization and Assessment of Site Conditions for the Ground Water Matrix (Phase IB Report) (PMC, 1999b), was submitted to NMED on 29 December 1999. A PDF copy of this document is included as Appendix F to this SRHI.

Discussion of Phase I investigations, performed primarily to characterize the OB/OD Unit HWMU as well as the "Closed OB/OD Area" (SWMUs 14, 15, and 33), is included in their respective sections of this SRHI.

Interim ground water sampling was performed during 2000, 2001, 2002, 2003, and 2005 for continued monitoring of ground water at both the OB/OD Unit HWMU and the Parcel 3 SWMUs. These sampling events are detailed in the *Hydrogeologic Summary Report* dated 27 February 2006 (TPMC, 2006).

3.0 SUMMARY OF MUNITIONS RESPONSE ACTIONS

As discussed in Section 2.1, as a result of the nature of OB/OD operations, the potential exists for MEC to be present in the OB/OD areas.

3.1 MUNITIONS RESPONSE TERMINOLOGY

In order to discuss potential safety hazards related to past FWDA operations and current conditions, it is necessary to introduce several terms used in the Army's Military Munitions Response Program (MMRP) (Department of the Army, 2005).

The term "munitions and explosives of concern" or MEC distinguishes specific categories of military munitions that may pose unique explosives safety risks, and includes:

- UXO, as defined in 10 U.S. Code (USC) 2710(e)(9);
- Discarded military munitions (DMM), as defined in 10 USC 2710(e)(2); or
- Munitions constituents (MC), as defined in 10 USC 2710(e)(3), present in high enough concentrations to pose an explosive hazard.

The term unexploded ordnance or UXO applies to military munitions that:

- Have been primed, fuzed, armed, or otherwise prepared for action;
- Have been fired, dropped, launched, projected, or placed in such a manner as to constitute a hazard to operations, installation, personnel, or material; and
- Remain unexploded by malfunction, design, or any other cause.

The term discarded military munitions or DMM applies to military munitions that have been abandoned without proper disposal or removed from storage in a military magazine or other storage area for the purpose of disposal. The term does not include UXO, military munitions that are being held for future use or planned disposal, or military munitions that have been properly disposed of, consistent with applicable environmental laws and regulations.

The term munitions constituents or MC applies to any materials originating from unexploded ordnance, discarded military munitions, or other military munitions, including explosive and non-explosive materials, and emission, degradation, or breakdown elements of such ordnance or munitions.

The term munitions debris or MD applies to remnants of munitions (e.g., fragments, penetrators, projectiles, shell casings, links, and fins) remaining after munitions use, demilitarization, or disposal. MD is considered MEC until technically qualified personnel either: 1) inspect, verify, and certify that it does not present an explosive hazard and consequently is safe for all (e.g., the general public) to receive; or 2) inspect, verify, and certify it as to the explosive hazards it may present to a qualified receiver.

3.2 MUNITIONS RESPONSE ACTIONS PERFORMED WITHIN PARCEL 3

Past OB/OD operations (e.g., demilitarization of unserviceable, obsolete, and/or waste explosives, propellants, munitions, and munitions components) have resulted in areas of the installation which presented explosive safety concerns as the environmental restoration program began. The purpose of this section is to summarize efforts to locate, identify, and remove explosive safety hazards as part of the environmental restoration at FWDA.

Munitions response activities (i.e., surveys and clearance) have been performed in and around the OB/OD Unit since 1992. These activities have been conducted to determine the extent of MEC contamination that constituted an imminent and substantial endangerment to the local populace and site personnel, to support RCRA closure activities, and for various construction purposes (e.g., construction of boundary fencing). Additional MEC activities have included avoidance and removal and demolition support during environmental investigation and characterization efforts.

Areas where MEC activities have been conducted in and around the OB/OD Unit are shown in the military munitions map (Appendix G).

3.2.1 UXO Survey, 1992-1993

Munitions response activities were initiated at FWDA in 1992. These activities consisted of surveys conducted by UXB International, beginning in November 1992 and ending in December 1993 (ERM, 1994b), to support the planned environmental investigation activities at areas that had been identified as potentially impacted by MEC, including in and around the OB/OD Unit. The survey activities were limited in nature and did not constitute comprehensive and fully documented clearance and removal efforts. The MEC and MD items recovered during these surveys are summarized in Appendix G. In most cases individual items were not mapped as part of this effort, with only outer boundaries of items observed at a given site being documented. These boundaries were used to guide later clearance efforts.

3.2.2 Archive Search Report, 1995

Under the requirements of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) for Army remediation of munitions response sites, an Archive Search Report (ASR) was prepared for FWDA by USACE, St. Louis District in July, 1995 (USACE, 1995). The ASR compiled information obtained through historical research at various archives and records-holding facilities, interviews with persons associated with the site or its operations, review of environmental reports, aerial photographs, and maps, and personal visits to the site. The investigation centered on identifying the exact location of potential environmental contamination from the past demilitarization activities occurring on FWDA. A total of 19 numbered sites and two additional locations were identified as Specific Areas of Concern and were further investigated during the site visits. Additional investigation/work was recommended for more than half of the sites.

The ASR was the source of information that led to the identification of SWMU 74 and the four AOCs in Parcel 3 in the Permit.

3.2.3 Facility-Wide Removal Actions, 1996-1998

Removal actions at various sites facility-wide were completed by CMS Environmental, Inc. from 1996 through 1998 (CMS, 1998). During this facility-wide effort, recovered MEC items were transported to the OB/OD Unit, where they were staged in one of the existing OD craters to await treatment. All potential recovered MEC items were either inspected and classified as MD, or treated by detonation and then inspected and classified as MD. At the end of the facility-wide effort, all the MD and scrap generated by the effort was inspected and certified as inert scrap prior to being transported off-site for disposal/recycling. Additional MEC activities conducted by CMS Environmental in and around the OB/OD Unit during this time period included clearance along five seismic survey lines (1997), clearance along a survey line for a proposed southern fence line (1998), and clearance of a suspected kick-out area outside the eastern fence line designated the OB/OD Area Buffer Zone (1998).

3.2.4 Munitions Response Activities in Support of RCRA Closure, 1995-2000

Munitions response activities were performed in the OB/OD Area to support environmental characterization efforts during the Closure Field Program. These efforts were performed by UXB International from 1995-1996 and by Safe Environment, Inc. from 1997-2000. These activities were focused on providing safe access for environmental characterization in specific areas. Items found during MEC activities in support of environmental investigations are identified in the Phase IA Report (PMC, 1999a; Appendix C).

Various site walkover, geophysical surveys, and preliminary environmental sampling events were conducted during 1995 to support preparation of RCRA Closure Field Program work plans. Numerous MEC items were encountered, including UXO. Locations of these items were not surveyed or otherwise documented.

The implementation of the RCRA Closure Field Program work plans in 1996 included excavation of investigation trenches through previously identified geophysical anomalies, MEC-related debris/residue areas, and detonation craters to characterize environmental impacts of historic disposal activities. Locations of geophysical anomalies, debris/residue areas, and detonation craters are shown in the military munitions map (Appendix G). Numerous MEC items were encountered, including UXO. Locations of these items were not surveyed or otherwise documented.

3.2.5 Proposed Fence Line and Other Area Clearance, 1998-1999

Additional munitions response activities were performed by Environmental Hazards Specialists International during late 1998 and 1999 (EHSI, 2000). This effort resulted in the clearance of OB/OD Area lands to the east of the Current OB/OD Area, a small area along the northern Parcel 3 boundary (two grids), Area 16 (SWMU 74, identified in the ASR as Site #16, Proposed Burning Ground), and 21 search routes extending radially from a proposed fence line at the southern half of the Current OB/OD Area. The findings of these efforts were detailed in the *Final OE Location and Removal Report, Fort Wingate Depot Activity, New Mexico* (EHSI, 2000). The areas cleared by EHSI are shown in the

military munitions map (Appendix G), and the MEC and MD items recovered are summarized in the report (EHSI, 2000) and in Appendix G.

FWDA originally intended to minimize the size of the OB/OD Area parcel to be retained by the Army, in order to release the maximum area possible for beneficial reuse. To serve that purpose, the original scope of the EHSI effort was to clear areas outside the original proposed OB/OD Area parcel (Parcel 3) boundary. The removal action was initially planned to clear approximately 339 acres, as well as a 25-foot wide corridor for an additional southern parcel boundary fence. As shown in the military munitions map (Appendix G), grids totaling approximately 82 acres along the eastern side of the OB/OD Area were cleared to varying depths before the removal action was stopped as a result of the amount of MEC-related scrap being found.

A new approach, employing predetermined search routes (transects) to establish the presence or absence of MEC and/or MD, was established by USACE, Huntsville. This resulted in 21 linear transects projecting radially (to the east and south) from the previously proposed fence line, as shown in the military munitions map (Appendix G). The searches consisted of visual surface sweeps along the transect bearing until no MEC or MD were observed. Magnetometers were then used to investigate for subsurface anomalies. When neither surface nor subsurface anomalies were detected, the spot was marked and surveyed; these end points are shown in the military munitions map (Appendix G) as the end of each transect farthest from the OB/OD Area. An additional 100 feet beyond the end point of each transect was then checked for surface and/or subsurface anomalies. A total of three MEC items were recovered during the transect searches; all three items were found on Lane #1. No MEC items were found on the remaining transects.

As noted above, the location of SWMU 74 was also investigated as part of this effort. As shown in the report (EHSI, 2000), approximately 1.4 acres were evaluated using handheld magnetometers with a 5-foot lane spacing. No MEC/UXO was observed. A total of 15 contacts were located and excavated, and approximately 29 pounds of MD (fragments) were recovered. The MD was inspected by UXO-qualified personnel and determined to be scrap, and was turned in with other scrap for off-site recycling.

3.3 SUMMARY OF MEC ENCOUNTERED IN AND AROUND PARCEL 3

As required by Permit Section I.L.2, a map showing where MEC items and MD have been encountered in the OB/OD Unit to date was prepared; a copy of the current military munitions map is included in Appendix G.

A table listing specific types (where possible, based on available documentation), locations, and depths where MEC items and/or MD have been encountered within and around Parcel 3 is included in Appendix G. As noted in the table, with the exception of a few MD locations mapped during recent site walkovers, all of the MEC items encountered to date were either detonated in place or removed from the investigated areas and stockpiled until being treated in existing detonation craters in the OB/OD Unit or certified as scrap. The table also includes MD that has been recovered, certified, and sent off-site for disposal/recycling.

A summary table showing the documented types of MEC encountered during previous investigations is included in Table 3-1.

As noted in historical records (Appendix C), cluster bomb units (CBU) containing Bomb, Live Unit (BLU) -3 and BLU-4 submunitions were treated in the OB/OD Unit HWMU. As noted in Appendix G, more than 100 BLU-3 and more than 250 BLU-4 submunitions have been encountered and blown in place (BIP) in and around the OB/OD Unit HWMU to date. In addition, more than 600 M83 "butterfly" bomblets have been encountered and BIP in and around the OB/OD Unit HWMU to date.

4.0 OB/OD UNIT HWMU

4.1 LOCATION, DESCRIPTION, AND OPERATIONAL HISTORY

The OB/OD Unit HWMU is an area within the Current OB/OD Area, and consists of the Burning Ground Area, 10 areas identified as Current Residue Piles (CRPs) 1 through 10, and 12 OD craters identified as Current Detonation Craters (CDC) 01 through 12. The OB/OD Unit HWMU is shown in Figure 2-3.

Operations conducted in the OB/OD Unit HWMU were summarized in Section 2.1. OB/OD operations were conducted on the ground surface within the OB/OD Unit, and residual materials appear have been placed around the OB/OD Unit via a variety of mechanisms, including earthmoving (e.g., piles of residuals were pushed onto/over arroyo banks using earthmoving equipment during FWDA operations), erosion (e.g., surface runoff has transported residual materials from the piles where they were initially placed down arroyo banks and into/along the arroyo bottoms), and explosions (e.g., detonations have forced fragments and/or MEC beneath the ground surface).

4.2 PREVIOUS INVESTIGATIONS

As noted in Section 2.6.2, characterization of the OB/OD Unit HWMU and surrounding areas has been conducted as part of an NMED-approved CFP. The purpose of this section is to provide a brief summary of investigations and findings to date. Ground water characterization efforts are summarized in Section 6.0.

4.2.1 Waste and Underlying Soil Characterization

The purpose of this section is to provide a brief summary of investigations to date for waste and soil media; ground water characterization efforts are described in Section 6.0.

Although the majority of characterization activities were completed more than 10 years ago, all data were collected following the end of OB/OD operations in 1992/1993; therefore, with the exception of possible contaminant migration or reduction as a result of natural processes, the data remain relatively representative of current conditions.

As described in Section 2.6.2, investigations were performed in 1996 to characterize conditions in 10 areas where waste materials were visible on the ground surface within the OB/OD Unit HWMU. These 10 areas were identified as CRPs 1 through 10, as shown in Figure 4-1.

Investigations were also performed in 1996 to characterize conditions in five of the 12 OD craters. The five craters investigated were identified as CDC02, CDC04, CDC06, CDC08, and CDC10, as shown in Figure 5-1. As described in the Phase IA Report (PMC, 1999a, page 2-3) these five craters were selected based upon their periods of use. Two of the investigated craters were located on the eastern side of the arroyo and three were located on the western side. Crater CDC04 had been used most recently at the time of the investigation; Army Explosives Ordnance Disposal (EOD) operations used this crater during

the UXO survey of the OB/OD Areas performed in 1992 and 1993, and therefore CDC04 was thought to have the greatest likelihood, of the 12 existing craters, to contain explosives and metals contamination. The investigation results collected from CDC04 are also considered representative of conditions at CDC05 which was used during the same time period as CDC04.

CDC02 had been inactive longer than the other existing craters and was overgrown with vegetation. Investigation of this crater evaluated the potential for explosives and metals contamination to persist in craters where detonation activities have not occurred for long periods of time. The investigation results collected from CDC02 are also considered representative of conditions at CDC01 and CDC03 which were used during the same time period as CDC02.

Seven craters were located on the western side of the arroyo. These craters were used during permitted OB/OD activities up until 1992 when regularly scheduled OB/OD operations in the Current OB/OD Area ceased. Three of these craters, CDC06, CDC08, and CDC10, were investigated. Because all of the craters located on the western side of the arroyo appeared to have been used during the same time period, the investigation results collected from CDC06, CDC08, and CDC10 are also considered representative of conditions at CDC07, CDC09, CDC11, and CDC12.

The primary objectives of the investigations were:

- To characterize the types of waste/debris present;
- To confirm the lateral extent of the waste/debris identified by the geophysical and/or visual surveys;
- To delineate the vertical extent of the waste/debris; and
- To estimate the volumes of waste/debris and potentially impacted soil.

As described in the Phase IA Report (PMC 1999a, Sections 2.0 and 3.0) a program to characterize individual waste areas and surrounding areas was implemented. The areas were mapped (PMC, 1999a, page 3-4 and 3-5) and investigation trenches were completed using a shielded trackhoe (PMC, 1999a, pages 3-6 through 3-9) to allow observation and sampling of waste and underlying soil. Field teams consisted of a UXO-qualified equipment operator, a UXO-qualified safety observer, and an environmental professional. Samples of waste and/or soil were screened in a field laboratory using immunoassay test kits for explosives and an x-ray fluorescence (XRF) instrument for metals; field screening results were used to guide further trenching and/or select samples for off-site laboratory confirmation analyses (PMC 1999a, Section 4.4, page 4-8).

Two types of waste characterization samples were collected during the CFP (PMC 1999a, Section 4.4, page 4-8). Representative (grab) waste samples were analyzed for total organic carbon (TOC), particle size distribution, Toxicity Characteristics Leaching Procedure (TCLP) for explosives and metals, and Synthetic Precipitation Leaching Procedure (SPLP) for explosives and metals. Composite waste samples were submitted for laboratory analysis of total explosives and total Target Analyte List (TAL) metals.

"Background" soil data were acquired during the CFP via collection and analysis of near-surface soil samples. Soil samples were collected from 20 locations in two areas (CBK samples south of the OB/OD Unit and KBK samples south of the Parcel 3 SWMUs, as shown in Figure 2-3) believed to be unimpacted/undisturbed by FWDA operations. Samples were collected from each location at depths of 0.5 feet to 1.0 feet bgs. Background samples were analyzed for total explosives, TAL metals, salinity, acidity, and total phosphorus (KBK samples only). Although data from these "background" locations was submitted to NMED for review as part of the Phase IA Report in November 1999, no comments on, nor approval of, the Phase IA Report was received from NMED and thus these data do not represent approved background values. The "background" data were discussed in the Phase IA Report (PMC, 1999a, Section 3.3 page 3-5, Section 4.3 page 4-8, Section 5.1 page 5-1, and Table 5-1). The "background" data have not been used in evaluation of existing data in the companion Closure Plan Phase I Work Plan.

Two types of soil samples were collected during the trenching program (PMC, 1999a, Section 4.4, pages 4-8 and 4-9). Confirmatory grab soil samples were submitted for laboratory analysis of explosives and TAL metals once the extent of a trench was beyond the visible limits of waste or contaminated soil (based on field screening results). The purpose of these samples was to document the results of field screening and to evaluate constituent concentrations in the native soils situated just beyond the horizontal and/or vertical extents of waste materials and/or impacted soil. "Representative" soil samples were grab samples collected from generally the same locations (just beyond the horizontal and/or vertical extents of waste materials and/or impacted soil) to characterize soil properties that may affect fate and transport of detected constituents through site soils. Representative soil samples were analyzed for moisture content, cation exchange capacity, TOC, particle size distribution, and pH.

Samples to characterize deeper subsurface soils outside the waste areas were collected during completion of soil borings (which were later completed as ground water monitoring wells). These samples were analyzed for explosives and TAL metals. Results were presented in the Phase IB Report (PMC, 1999b, Section 3.5, pages 3-15 through 3-17).

All samples were collected and managed as described in the NMED-approved Field Sampling Plan (FSP) (ERM, 1996b, Section 4.6, pages 4-11 through 4-13, Section 4.14, pages 4-32 and 4-33, and Section 4.15, pages 4-33 and 4-34). Samples were analyzed in certified laboratories using NMED-approved methodologies (ERM, 1996b, Section 5.0, pages 5-1 through 5-12). Quality assurance/quality control (QA/QC) samples were collected, QA/QC procedures followed, and data validated as specified in the NMED-approved Quality Assurance Project Plan (QAPP) (ERM, 1996c, Sections 4.0 through 14.0).

4.2.1.1 Waste Characterization

As described in the Phase IA Report (PMC 1999a, Section 4.4.2, pages 4-26 through 4-46 and Figure 4-16), approximately 83 investigation trenches were completed through the 10 areas (CRP1 through CRP10) and five open detonation craters (CDC02, CDC04, CDC06, CDC08, and CDC10) investigated within the OB/OD Unit HWMU. Investigation findings for the OB/OD Unit HWMU

are summarized below. Trench logs were presented in Appendix C of the Phase IA Report (PMC, 1999a). Representative photographs were presented in Appendix A of the Phase IA Report (PMC, 1999a).

As described in the Phase IA Report (PMC, 1999a, Section 4.4.2, pages 4-26 through 4-46, Tables 4-4 and 4-6, and Figures 4-16 through 4-21), residual materials from OB/OD operations were found on and beneath the ground surface at nine of the 10 areas; the CRP4 area had only limited amounts of debris (e.g., metal pallet/container banding) on the ground surface. The waste materials encountered and estimated in-place volumes for each area were summarized in Tables 4-4 and 4-6 of the Phase IA Report (PMC, 1999a). Limited amounts of residual materials, primarily MEC, were encountered in the five detonation craters investigated (PMC, 1999a, Section 4.4.2, pages 4-46 through 4-50, Tables 4-5 and 4-6, and Figures 4-16, 4-22 through 4-24).

Table 4-1 summarizes the types of wastes observed, estimated in-place volume, and the number and types of waste samples collected. Figure 4-1 shows waste characterization sample locations and locations of surface/subsurface waste/debris.

As shown in Table 4-1, approximately 44,385 cubic yards (CY) of waste were identified within ten disposal areas (identified as “CRP” areas) and five detonation craters characterized within the OB/OD Unit during the CFP.

As noted in Table 4-1, “live” munitions items were identified. For the most part, the items were not identified as UXO, but rather as items with confirmed or possible explosive filler remaining, as determined by UXO-qualified personnel. As the terminology of the DOD Munitions Response (MR) program has evolved in the 11 years since the CFP was initiated, the “live” items would likely be identified as MEC. Although numerous MEC items that were identified as safe to move were staged for treatment and later treated (by detonation) or certified as MD by a USACE contractor, the effort was not a clearance/removal action and an undeterminable number of MEC items remain within the OB/OD Unit HWMU.

It should be noted that all but one of the demolition craters were filled in (using the surrounding soil as fill) as directed by NMED in 1999.

Analytical data summary tables including a comparison to Permit cleanup levels are provided in the companion Closure Plan Phase I Work Plan.

4.2.1.2 Soil Characterization

As shown in Figure 4-2, numerous soil samples, both surface and subsurface, have been collected to characterize soils within and around the OB/OD Unit HWMU.

Samples to characterize surface soils within the OB/OD Unit and surrounding areas were collected as part of preliminary efforts for the CFP. These samples were collected in 1993 and analyzed for total explosives and total TAL metals. Approximately 140 surface soil samples were collected: eight samples from the Burning Ground Area (sample identifiers beginning with BGA), 24 samples from residue/debris areas, 68 samples from grids within and around the rest of the Current OB/OD Area (sample identifiers beginning with DBA), 22 samples from

11 existing OD craters (sample identifiers beginning with DC), six samples from the arroyo, and 12 samples from locations where UXO had been BIP. Results were presented in the document entitled *Modification to Final Interim Status Closure Plan* (ERM, 1994a, pages 4-1 through 4-4).

Additional soil samples were collected during the CFP, as described in Section 2.6.2. Results of soil sampling conducted during the CFP were presented in the Phase IA Report (PMC 1999a, Section 4.4, page 4-8).

Samples to characterize deeper subsurface soils outside the waste areas were collected as part of the CFP during completion of soil borings which were later completed as ground water monitoring wells. Results were presented in the Phase IB Report (PMC, 1999b, Section 3.5, pages 3-15 through 3-17).

Locations of soil samples collected within the OB/OD Unit are shown in Figure 4-2. Analytical data summary tables including a comparison to Permit cleanup levels are provided in the companion Closure Plan Phase I Work Plan.

4.2.2 Surface Water and Sediment Characterization

Surface water and sediment samples were collected during a storm event in September 1996 within a normally dry arroyo that bisects the OB/OD Unit (Figure 4-3). All samples were collected and managed as described in the NMED-approved FSP (ERM, 1996b, Section 4.4.2.2, pages 4-8 through 4-10, Section 4.14, pages 4-32 and 4-33, and Section 4.15, pages 4-33 and 4-34). Samples were analyzed in certified laboratories using NMED-approved methodologies (ERM, 1996b, Section 5.0, pages 5-1 through 5-12). QA/QC samples were collected and QA/QC procedures followed as specified in the NMED-approved QAPP (ERM, 1996c, Sections 4.0 through 14.0).

Five surface water samples were collected during a storm event in September 1996. The surface water samples were analyzed for explosives, TAL metals, total dissolved solids (TDS), total suspended solids (TSS), hardness, and salinity.

Five sediment samples were collected during a storm event in September 1996. Additional dry sediment samples were collected in October 1996 from ten locations, five of which had been previously sampled in September. Sediment samples were analyzed for explosives, TAL metals, salinity, TOC, and pH.

The findings of the surface water and sediment sampling were presented in the *Final Open Burning/Open Detonation Area RCRA Interim Status Closure Plan Phase IB – Characterization and Assessment of Site Conditions for the Ground Water Matrix* (PMC, 1999b, Section 3.6, pages 3-17 through 3-21).

Analytical data summary tables including a comparison to Permit cleanup levels are provided in the companion Work Plan.

4.2.3 Ecological Habitat and Wetlands Characterization

An ecological habitat survey and wetlands characterization were performed as part of Phase I CFP activities. The findings of these efforts were described in the Phase IA Report (PMC, 1999a, Sections 4.5 and 4.6, pages 4-51 through 4-56), and were also discussed in a document entitled *Final Risk Assessment Technical*

Memorandum, Open Burning/Open Detonation Areas (PMC, 2000) . Identified habitats and wetlands are shown in Figure 4-3.

The Current OB/OD Area consists primarily of a field/sagebrush community, surrounded by a Pinyon Pine/Juniper woodland community (Figure 3-3 of the companion Closure Plan Phase I Work Plan). A deep arroyo bisects the Current OB/OD Area and creates a variety of favorable wildlife habitats, as well as providing an "edge" effect (i.e., where two habitat types come into contact), which is preferred by many species. Wet periods of the year may result in stream-like conditions in the arroyo; however, these periods appear to be temporary. During dry weather, the bottom of the arroyo, although appearing dry, contains water close to the surface throughout most of its length within the OB/OD Unit HWMU. Periodically, areas containing small water holes that were heavily visited by wildlife as evidenced by the many tracks that were present. However, during geologic investigations spanning 1996 through 1999, water was not observed in these two water holes during dry weather.

The water present close to the ground surface also supports wetland vegetation in the majority of the arroyo (only the northern-most portion of the arroyo does not support these wetland plants). The wetland vegetation form two communities; a sedge meadow community and a coyote willow community. Both wetland communities are important to wildlife. The sedge meadows provide a food source for herbivores, and the willows, which form dense stands of low trees, provide shade and refuge areas as well as ambush sites for predators. In several areas the deer bone remains of mountain lion kills were observed as well as recent mountain lion tracks and coyote tracks.

Based on the preliminary site reconnaissance, the existence of an aquatic community is unlikely or limited to highly seasonal species. The Current OB/OD Area was identified as having plant species that are dependent on wet soils growing in the bottom of the arroyo as well as several small water holes. These water holes have been seen on several site visits but only at wet times of the year (during snowmelt and during the rainy season). Based upon their small size and the large evaporation rate, the observed water holes are believed to be completely dry during the arid portions of the year. Based on these observations, it has been assumed that there are no perennial aquatic ecosystems in the OB/OD Areas, and the existence of even a seasonal aquatic ecosystem is highly unlikely due to the extremely intermittent presence of water and water holes.

Results of the wetlands survey identified wetland habitat within the arroyo that bisects the OB/OD Unit HWMU. Both scrub shrub (coyote willows) and emergent (sedge meadows) wetlands were observed within this arroyo. The approximate location and extent of habitats located within the Current OB/OD Area are shown in Figure 4-3. Both the coyote willow thicket and the sedge meadows in the Current OB/OD Area are unique for the entire length of the arroyo. The remainder of the arroyo in the upland area is shallow; the channel is not well defined and has a sparsely vegetated bottom.

5.0 SWMUS 14, 15, AND 33

5.1 LOCATION, DESCRIPTION, AND OPERATIONAL HISTORY

As shown in Figure 2-3, SWMU 14 (which consists of the Old Burning Ground and Demolition Landfill Area), SWMU 15 (which consists of the Old Demolition Area), and SWMU 33 (which consists of one residue/debris pile south of SWMU 15) are all located in an area known prior to Permit issuance as the "Closed OB/OD Area."

The Closed OB/OD Area was used from 1948 to 1955. Because the period of operations in the Closed OB/OD Area predated RCRA by approximately 25 years, the Closed OB/OD Area was not permitted under RCRA. Therefore, when the Permit was issued, the area previously known as the Closed OB/OD Area was identified as three separate SWMUs.

OB was conducted in the area identified as SWMU 14 in Figure 2-3. OD was conducted in the area identified as SWMU 15 in Figure 2-3. Residual materials appear have been placed around the SWMUs via a variety of mechanisms, including earthmoving (e.g., piles of residuals were pushed onto/over arroyo banks using earthmoving equipment during FWDA operations), erosion (e.g., surface runoff has transported residual materials from the piles where they were initially placed down arroyo banks and into/along the arroyo bottoms), and explosions (e.g., detonations have forced fragments and/or MEC beneath the ground surface).

5.2 PREVIOUS INVESTIGATIONS

As noted in Section 2.6.2, characterization of the Closed OB/OD Area SWMUs and surrounding areas has been conducted as part of an NMED-approved CFP. The purpose of this section is to provide a brief summary of investigations and findings to date. Ground water characterization efforts are summarized in Section 6.0.

5.2.1 Geophysical Surveys

The objectives of the surveys were to delineate the lateral extent of potentially disturbed ground within specific sub-areas of the Closed OB/OD Area and to detect buried metal objects. To achieve these objectives, electromagnetic induction (EM), magnetic (MAG), and ground-penetrating radar (GPR) geophysical techniques were used. EM and MAG surveys were conducted over established survey grids. GPR data were collected at specific anomalies identified by the EM and MAG surveys.

The results of the geophysical surveys for the Parcel 3 SWMUs are presented in the document entitled the *Final Open Burning/Open Detonation Area RCRA Interim Status Closure Plan Phase IA – Characterization and Assessment of Site Conditions for the Soils/Solid Matrix.* (PMC, 1999a, Section 4.1 and Figures 4-1 through 4-7). Because accurate mapping had not been completed at the time of the geophysical surveys, local grids (50 foot by 50 foot) were established at the two areas surveyed, and the boundaries of geophysical anomalies identified for further investigation were staked and later surveyed for inclusion on project

maps. A review of the grid maps shown in Figures 4-1 through 4-7 in the above referenced report shows that more than 9 acres in the area of SWMU 14 and more than 11 acres in the area of SWMU 15 were surveyed using geophysical methods.

Five geophysical anomalies (KGA3 through KGA5 within SWMU 14 and KGA1 and KGA2 within SWMU 15) were identified and delineated for further characterization.

5.2.2 Waste and Underlying Soil Characterization

The purpose of this section is to provide a brief summary of investigations to date for waste and soil media; ground water characterization efforts are described in Section 6.0.

Although the majority of characterization activities were completed more than 10 years ago, all data were collected following the end of OB/OD operations in the Closed OB/OD Area; therefore, with the exception of possible contaminant migration or reduction as a result of natural processes, the data remain relatively representative of current conditions.

As described in Section 2.6.2, investigations were performed in 1996 to characterize conditions in six areas where either waste materials were visible on the ground surface or a geophysical anomaly was detected within the Old Burning Ground (SWMU 14). These six areas were identified as Closed Piles (KPs) 2 through 4 and Closed Geophysical Anomalies (KGAs) 3 through 5, as shown in Figure 5-1.

In addition three areas of explosives-stained soil north of SWMU 14 (within what later was identified as part of AOC 89), identified as Closed Stained Areas (KSAs) 1 through 3, were investigated. These areas are discussed further in Section 8.2.2.

The primary objectives of the investigations were:

- To characterize the types of waste/debris present;
- To confirm the lateral extent of the waste/debris identified by the geophysical and/or visual surveys;
- To delineate the vertical extent of the waste/debris; and
- To estimate the volumes of waste/debris and potentially impacted soil.

As described in the Phase IA Report (PMC 1999a, Sections 2.0 and 3.0) a program to characterize individual waste areas and surrounding areas was implemented. The areas were mapped (PMC, 1999a, page 3-4 and 3-5) and investigation trenches were completed using a shielded trackhoe (PMC, 1999a, pages 3-6 through 3-9) to allow observation and sampling of waste and underlying soil. Field teams consisted of a UXO-qualified equipment operator, a UXO-qualified safety observer, and an environmental professional. Samples of waste and/or soil were screened in a field laboratory using immunoassay test kits for explosives and an XRF instrument for metals; field screening results were

used to guide further trenching and/or select samples for off-site laboratory confirmation analyses (PMC 1999a, Section 4.4, page 4-8).

Two types of waste characterization samples were collected during the CFP (PMC 1999a, Section 4.4, page 4-8). Representative (grab) waste samples were analyzed for TOC, particle size distribution, TCLP for explosives and metals, and SPLP for explosives and metals. Composite waste samples were submitted for laboratory analysis of total explosives and total TAL metals. Samples from the Parcel 3 SWMUs were also analyzed for total phosphorous because of reported disposal/treatment of munitions containing white phosphorus (WP) filler in the Closed OB/OD Area. The current USEPA method for determining WP concentrations (SW846 7580) was approved in December 1996, after the field investigations had been completed, and thus was not part of the CFP effort.

"Background" soil data were acquired during the CFP via collection and analysis of near-surface soil samples. Soil samples were collected from 20 locations in two areas (CBK samples south of the OB/OD Unit and KBK samples south of the Parcel 3 SWMUs, as shown in Figure 2-3) believed to be unimpacted/undisturbed by FWDA operations. Samples were collected from each location at depths of 0.5 feet to 1.0 feet bgs. Background samples were analyzed for total explosives, TAL metals, salinity, acidity, and total phosphorus (KBK samples only). Although data from these "background" locations was submitted to NMED for review as part of the Phase IA Report in November 1999, no comments on, nor approval of, the Phase IA Report was received from NMED and thus these data do not represent approved background values. The "background" data were discussed in the Phase IA Report (PMC, 1999a, Section 3.3 page 3-5, Section 4.3 page 4-8, Section 5.1 page 5-1, and Table 5-1). The "background" data have not been used in evaluation of existing data in the companion Closure Plan Phase I Work Plan.

Two types of soil samples were collected during the trenching program (PMC, 1999a, Section 4.4, pages 4-8 and 4-9). Confirmatory grab soil samples were submitted for laboratory analysis of explosives and TAL metals once the extent of a trench was beyond the visible limits of waste or contaminated soil (based on field screening results). The purpose of these samples was to document the results of field screening and to evaluate constituent concentrations in the native soils situated just beyond the horizontal and/or vertical extents of waste materials and/or impacted soil. "Representative" soil samples were grab samples collected from generally the same locations (just beyond the horizontal and/or vertical extents of waste materials and/or impacted soil) to characterize soil properties that may affect fate and transport of detected constituents through site soils. Representative soil samples were analyzed for moisture content, cation exchange capacity, TOC, particle size distribution, and pH.

Samples to characterize deeper subsurface soils outside the waste areas were collected during completion of soil borings (which were later completed as ground water monitoring wells). These samples were analyzed for explosives and TAL metals. Results were presented in the Phase IB Report (PMC, 1999b, Section 3.5, pages 3-15 through 3-17).

All samples were collected and managed as described in the NMED-approved FSP (ERM, 1996b, Section 4.6, pages 4-11 through 4-13, Section 4.14, pages 4-

32 and 4-33, and Section 4.15, pages 4-33 and 4-34). Samples were analyzed in certified laboratories using NMED-approved methodologies (ERM, 1996b, Section 5.0, pages 5-1 through 5-12). QA/QC samples were collected, QA/QC procedures followed, and data validated as specified in the NMED-approved QAPP (ERM, 1996c, Sections 4.0 through 14.0).

Investigation findings for the OB/OD Unit HWMU are summarized in Sections 6.1 and 6.2 of this SRHI. Investigation findings for SWMU 14 (Old Burning Ground and Demolition Landfill Area), SWMU 15 (Old Demolition Area), and SWMU 33 (Waste Pile KP1) are summarized in Sections 7.1 and 7.2 of this SRHI. Trench logs were presented in Appendix C of the Phase IA Report (PMC, 1999a). Representative photographs were presented in Appendix A of the Phase IA Report (PMC, 1999a).

Analytical data summary tables are provided in the companion Work Plan, as are summary tables showing waste materials observed, number of samples collected, and a comparison of detected concentrations to Permit cleanup levels.

5.2.2.1 Waste Characterization

As described in the Phase IA Report (PMC 1999a, Section 4.4.1, pages 4-9 through 4-20 and Figure 4-10), investigation trenches were excavated through each identified area within SWMUs 14, 15, and 33. Approximately 37 investigation trenches were completed through six areas (KP2 through KP4 and KGA 3 through KGA5) investigated within SWMU 14, 13 investigation trenches were completed through the two areas (KGA1 and KGA2) investigated within SWMU 15, and three investigation trenches were completed through SWMU 33. Investigation findings are summarized below. Trench logs were presented in Appendix C of the Phase IA Report (PMC, 1999a). Representative photographs were presented in Appendix A of the Phase IA Report (PMC, 1999a).

As described in the Phase IA Report (PMC, 1999a, Section 4.4.1, pages 4-9 through 4-20, Tables 4-1 and 4-3, Figures 4-1 through 4-4, and Figures 4-10 through 4-13), residual materials from OB operations were found on and beneath the ground surface at five of the nine areas in SWMU 14; the KP3 area had only limited amounts of debris (e.g., metal pallet/container banding) on the ground surface, and the three KSA locations had only surface soil stained with explosives. The waste materials encountered and estimated in-place volumes for each area were summarized in Tables 4-1 and 4-3 of the Phase IA Report (PMC, 1999a).

As described in the Phase IA Report (PMC, 1999a, Section 4.4.1, pages 4-20 through 4-24, Tables 4-2 and 4-3, Figures 4-5 through 4-6, Figure 4-10, and Figure 4-14 through 4-13), residual materials from OB/OD operations were found on and beneath the ground surface in both areas in SWMU 15. The waste materials encountered and estimated in-place volumes for each area were summarized in Tables 4-2 and 4-3 of the Phase IA Report (PMC, 1999a).

As described in the Phase IA Report (PMC, 1999a, Section 4.4.1, pages 4-20 through 4-24, Tables 4-2 and 4-3, Figure 4-10, and Figure 4-15 through 4-13), residual materials from OB/OD operations were found on and beneath the ground surface at SWMU 33. The waste materials encountered and estimated

in-place volumes for KP1 were summarized in Tables 4-2 and 4-3 of the Phase IA Report (PMC, 1999a).

Table 5-1 summarizes the types of wastes observed, estimated in-place volume, and the number and types of waste samples collected. Figure 5-1 shows waste characterization sample locations and locations of surface/subsurface waste/debris. As shown in Table 5-1, approximately 4,115 CY of waste were identified within the three Parcel 3 SWMUs.

Analytical data summary tables including a comparison to Permit cleanup levels are provided in the companion Closure Plan Phase I Work Plan.

5.2.2.2 Soil Characterization

As shown in Figure 5-2, numerous soil samples, both surface and subsurface, have been collected to characterize soils within and around SWMU 14, SWMU 15, and SWMU 33.

Soil samples were collected during the CFP, as described in Section 2.6.2. Results of soil sampling conducted during the CFP were presented in the Phase IA Report (PMC 1999a, Section 4.4, page 4-8).

Samples to characterize deeper subsurface soils outside the waste areas were collected as part of the CFP during completion of soil borings which were later completed as ground water monitoring wells. Results were presented in the Phase IB Report (PMC, 1999b, Section 3.5, pages 3-15 through 3-17).

Locations of soil samples within the Closed OB/OD Area SWMUs are shown in Figure 5-2. Analytical data summary tables including a comparison to Permit cleanup levels are provided in the companion Closure Plan Phase I Work Plan.

5.2.3 Surface Water and Sediment Characterization

Surface water and sediment samples were collected during a storm event in September 1996 from within a normally dry arroyo that bisects the Parcel 3 SWMUs (Figure 5-3). All samples were collected and managed as described in the NMED-approved FSP (ERM, 1996b, Section 4.4.2.2, pages 4-8 through 4-10, Section 4.14, pages 4-32 and 4-33, and Section 4.15, pages 4-33 and 4-34). Samples were analyzed in certified laboratories using NMED-approved methodologies (ERM, 1996b, Section 5.0, pages 5-1 through 5-12). QA/QC samples were collected and QA/QC procedures followed as specified in the NMED-approved QAPP (ERM, 1996c, Sections 4.0 through 14.0).

Ten surface water samples were collected during a storm event in September 1996. The surface water samples were analyzed for explosives, TAL metals, TDS, TSS, hardness, salinity, and total phosphorus; two samples (KSW01 and KSW10) were not analyzed for TDS because of insufficient volume.

Ten sediment samples were collected during a storm event in September 1996. The sediment samples were analyzed for explosives, TAL metals, total phosphorus, salinity, TOC, and pH.

The findings of the surface water and sediment sampling were presented in the *Final Open Burning/Open Detonation Area RCRA Interim Status Closure Plan Phase IB – Characterization and Assessment of Site Conditions for the Ground Water Matrix* (PMC, 1999b, Section 3.6, pages 3-17 through 3-21).

Analytical data summary tables including a comparison to Permit cleanup levels are provided in the companion Work Plan.

5.2.4 Ecological Habitat and Wetlands Characterization

An ecological habitat survey and wetlands characterization were performed as part of Phase I CFP activities. The findings of these efforts were described in the Phase IA Report (PMC, 1999a, Sections 4.5 and 4.6, pages 4-51 through 4-56), and were also discussed in a document entitled *Final Risk Assessment Technical Memorandum, Open Burning/Open Detonation Areas* (PMC, 2000). Identified habitats are shown in Figure 5-3.

Plants indicative of a mature grassland and sagebrush community were dominant in the Closed OB/OD Area, surrounded by Pinyon Pine/Juniper woodland, and the rock faces of the Hogback (Figure 3-3 of the companion Closure Plan Phase I Work Plan).

Two deep arroyos are present within the Closed OB/OD Area. The two arroyos join to form one channel that extends northward and eventually intersects an arroyo that drains the Current OB/OD Area. Surface water flow, when present, within these arroyos is generally toward the east and north. Surface water flow in the arroyos is intermittent and only likely to be found immediately following a rainstorm or during spring snowmelt. The lack of vegetation in the bottom of the arroyos suggests that the sediments are extremely dry during arid times of the year and that significant scouring of the arroyo bottom occurs during flow events. The field investigation revealed no indication of wet areas (e.g., wetlands or springs) close to the ground's surface in the Closed OB/OD Area; however, several stands of cottonwood trees along the arroyo bottom indicated that those areas have a source of subsurface water close to the ground surface. This subsurface water may exist as soil moisture rather than as a zone saturated with ground water.

Most of the Closed OB/OD Area arroyos are sparse in vegetation. As described above, several stands of cottonwoods were observed; one of these stands, located at the confluence of the north and south arroyos, appeared to have high wildlife use. Cliff swallow bank nests are plentiful in the steeper walls of the arroyo and several abandoned coyote dens were observed. This high use is the result of the dense cover provided by the trees in close proximity to the winter foraging areas of the Closed OB/OD Area, and the proximity to other habitats, primarily the Pinyon Pine/Juniper woodland, and the rock faces of the Hogback.

No wetlands were identified in the Closed OB/OD Area.

6.0 PARCEL 3 GROUND WATER

As described in Section 2.6.2, investigations were performed in the period from 1996 through 2005 to characterize ground water within and around the OB/OD Unit HWMU and Parcel 3 SWMUs. Previous investigations have shown the hydrogeologic regime in and around the OB/OD Unit HWMU and Parcel 3 SWMUs to be extremely complex, and the conceptual model is incomplete. In order to make this SRHI more streamlined for review and use, previous and proposed investigations relating to Parcel 3 ground water are discussed in this section. Existing ground water monitoring wells are shown in Figure 6-1. Well construction information for existing wells is included in Table 6-1.

6.1 PREVIOUS INVESTIGATIONS

Ground water monitoring wells were completed in several characterization efforts. The reasoning and methodology of the monitoring well installations are presented in the document entitled *Final Open Burning/Open Detonation Area RCRA Interim Status Closure Plan Phase IB – Characterization and Assessment of Site Conditions for the Ground Water Matrix* (PMC, 1999b, Section 2.0, pages 2-1 through 2-33), and were re-presented in the document entitled *Hydrogeologic Summary Report* (TPMC, 2006, Section 3.5, pages 3-8 through 3-16).

Field teams consisted of a drilling crew, a UXO-qualified safety observer, and an environmental professional. All wells were installed, tested, and sampled as described in the NMED-approved FSP (ERM, 1996b, Sections 4.7 through 4-12, pages 4-13 through 4-26, Section 4.14, pages 4-32 and 4-33, and Section 4.15, pages 4-33 and 4-34). Samples were analyzed in certified laboratories using NMED-approved methodologies (ERM, 1996b, Section 5.0, pages 5-1 through 5-12). QA/QC samples were collected and QA/QC procedures followed as specified in the NMED-approved QAPP (ERM, 1996c, Sections 4.0 through 14.0).

As described in the Phase IB Report (PMC, 1999b) and the Hydrogeological Summary Report (TPMC, 2006, Section 3.5, pages 3-8 through 3-16), ground water investigations were conducted in the OB/OD Areas during 1996, 1997, 1998, and 1999. These efforts consisted of monitoring well installation and sampling, a seismic profile survey, ground water elevation measurements, a well survey, geologic mapping, surface water sampling, and sediment sampling.

6.1.1 1996 Investigation

A ground water investigation was performed in the OB/OD Areas in 1996 to assess the presence and quality of shallow ground water and characterize the shallow hydrogeologic regime. This investigation consisted of drilling and sampling of soil borings, completion of shallow and intermediate depth monitoring wells, performance of downhole video logging and slug tests on newly-installed monitoring wells, and collection of ground water, surface water, and sediment samples.

Two conceptual models were initially proposed to describe potential ground water flow in the OB/OD Areas. In the first model, the arroyo bisecting the Current OB/OD Area was viewed as part of a losing stream system. All shallow ground

water base flow would be derived from infiltration of surface water from periodic stream flow in the arroyo. The lateral extent of shallow ground water would be limited to areas immediately adjacent to the arroyo. In the second model, the arroyo was viewed as part of a gaining stream system. The shallow ground water surface (i.e., the water table) generally would follow the land surface contours adjacent to the arroyo and, therefore, shallow ground water would flow downgradient toward the arroyo from the surrounding highlands. In this model, the lateral extent of the shallow ground water would not be limited to the immediate vicinity of the arroyo.

Three wells (KMW09, KMW10, and KWM11) were installed in the Closed OB/OD Area and 11 wells (CMW02, CMW04, CMW06, CMW07, CMW10, CMW14, and CMW16 through CMW20) were installed in the Current OB/OD Area. Monitoring wells locations are presented in Figure 6-1.

Slug tests were performed on selected newly-installed wells located in the Closed and Current OB/OD Areas. Slug-in and slug-out measurements were collected and analyzed.

Ground water level measurements were also collected from all of the wells in the Closed and Current OB/OD Areas during one 12-hour period. This was done in October 1996 and February 1997. A contemporaneous set of water levels was collected to evaluate the direction of ground water flow.

Slug tests were conducted at KMW09 and KMW11. Hydraulic conductivity's ranged from 1.7×10^{-5} centimeters per second (cm/sec) to 4.6×10^{-5} cm/sec. These values are indicative of a mixture of silt and clay (Driscoll, 1986), and the lithology described in the boring logs supports this conclusion. Copies of the hydraulic conductivity graphs are provided in Appendix F of the Hydrogeologic Summary Report (TPMC, 2006).

Slug tests were conducted at CMW02, CMW04, CMW07, and CMW17. Hydraulic conductivity's ranged from 5.8×10^{-6} cm/sec to 6.6×10^{-5} cm/sec. These values are indicative of a mixture of silt and clay (Driscoll, 1986), and the lithology described in the boring logs supports this conclusion. The value for CMW17 (5.8×10^{-6} cm/sec), is an order of magnitude lower than the other wells and may indicate an increased amount of clay. Copies of the hydraulic conductivity graphs are provided in Appendix F.

Water level data collected in October 1996 (and again in February 1997) indicated that the distribution of hydraulic heads within the Current OB/OD Area was complex and did not appear to fit either of the relatively simple conceptual models proposed.

6.1.2 1997 Investigation

Because of the uncertainty associated with the hydrogeology from the 1996 investigation, further subsurface characterization of the Current OB/OD Area was required to define the distribution of ground water and assess potential ground water transport pathways.

Subsurface characterization efforts were conducted during 1997 to obtain additional data concerning the stratigraphy and structural setting of the OB/OD

Areas. This investigation consisted of a seismic survey, borehole installation and logging, geologic mapping, and fracture trace analysis.

Two ground water systems were identified in the OB/OD Areas. Uplifted and tilted sandstone and shale units forming a significant ridgeline known as the Hogback physically separate the ground water systems.

The results of the ground water characterization efforts conducted during 1996 and 1997 identified the Closed OB/OD Area ground water system as physically separated from ground water located on the eastern side of the Hogback.

The seismic survey identified the Sonsela Sandstone Member as the water-bearing zone in CMW16. The Sonsela Sandstone Member was correlated from the location of CMW16 toward the upgradient direction (south) to identify the potential source of the explosives detected in CMW16. Based upon this correlation, it is considered likely that the Sonsela Sandstone Member subcrops beneath the unconsolidated materials located in and near the arroyo of the Current OB/OD Area.

The Sonsela Sandstone Member was also correlated downgradient from the location of CMW16, to identify the probable migration pathway for explosives impacted ground water. Ground water flow in this location is thought to be controlled by the dip of the geologic strata; thus, it may be flowing toward the north and/or the west.

6.1.3 1998/1999 Investigation

Hydrogeologic characterization efforts were performed in 1998 to confirm the conceptual hydrogeologic model of OB/OD Areas, confirm potential ground water transport pathways, and install a compliance monitoring well network.

This investigation consisted of the completion of drilling and sampling of soil borings, installation of monitoring wells, electric logging and slug tests on newly-installed monitoring wells, alluvial and bedrock ground water sampling, an installation-wide ground water elevation survey, an off-site well identification survey to evaluate potential receptors, and focused geologic mapping.

Three borings drilled in 1998 (KMW12, KMW13, and KMW14) were located within the Closed OB/OD Area ground water system (Table 2-2 and Figure 2-7, Appendix F). Drilling of these borings started at the western-most location and progressed eastward based upon the results of previously completed borings.

First water was encountered in KMW12 at a depth of 58 feet bgs within a shale. This material is interpreted to be the Mancos Shale Formation that has been weathered to varying degrees. First water was encountered in KMW13 at a depth of 47 feet bgs within sandstone and siltstone intervals that are interpreted to be part of the Dakota Sandstone Formation. Boring KMW14 was drilled to further evaluate if shallow ground water or surface water are migrating into the Dakota Sandstone Formation. KMW14 was completed as a boring after being drilled to 350 feet bgs and found to have no free water.

Although lithologic recoveries were poor through several sections of wells KMW12 and KMW13, the character correlation of the geophysical logs is good

between the wells indicating that similar geologic materials were encountered in each location.

Slug tests were conducted at KMW12 and KMW13. The hydraulic conductivity values for KMW12, screened within the Mancos Shale, were 8.7 X 10^{-5} cm/sec and 9.7 X 10^{-5} cm/sec (Table 2-5, Appendix F). These values are higher than would be expected for a shale and may be the result of weathering decreasing the competency of the bedrock and thus, increasing the water transmitting ability. KMW13, screened within the Dakota Sandstone Formation, had hydraulic conductivity values of 3.5 X 10^{-5} cm/sec and 4.3 X 10^{-5} cm/sec. These values are similar to those expected for a friable sandstone (Driscoll, 1986). Copies of the hydraulic conductivity graphs are provided in Appendix F.

Four borings drilled in 1998 (CMW21, CMW22, CMW23, and CMW25) were located north of previously-installed monitoring well CMW16 to identify the northern extent of impacted ground water within the first and second water-bearing zones (Table 2-2 and Figure 2-7, Appendix F). Drilling of these borings started at the southern-most location and progressed northward based upon the results of previously completed borings.

First water was encountered in CMW21 at a depth of 28 feet bgs within a sandstone that is interpreted to be the Painted Desert Member. Second water was encountered at a depth of 58 feet bgs within a sandstone that is interpreted to be the Sonsela Sandstone Member. First water in CMW22 was encountered at a depth of 29.5 feet bgs within a sandstone that is interpreted to be the Painted Desert Member. Second water was encountered at a depth of 96.5 feet bgs within a sandstone that is interpreted to be the Sonsela Sandstone Member. First water in CMW23 was encountered at a depth of 46 feet bgs within a sandstone that is interpreted to be the Painted Desert Member. Second water was encountered at a depth of 100 feet bgs within a sandstone that is interpreted to be the Sonsela Sandstone Member. First water in CMW25 was encountered at a depth of 74 feet bgs within mudstone and muddy sandstone intervals that are interpreted to be portions of the Painted Desert Member.

One boring drilled in 1998 (CMW24) was located north and west of previously-installed monitoring well CMW16 to determine if faults identified in the subsurface by the geophysical survey act as a ground water flow barrier or conduit, and to determine the direction of ground water flow in that area. The stratigraphy encountered in CMW24 was not consistent with that observed in the other soil borings drilled in 1998, and it appeared to be highly structurally deformed with identified fractures, along some of which mineralization was observed. First water was encountered in CMW24 at a depth of 223 feet bgs within siltstone and sandstone intervals.

Interpretation of logs collected at CMW21 through CMW25 indicate few correlatable features. The screened water-bearing interval in CMW24 may be the Sonsela Sandstone Member; however, the depth it was encountered (223 feet bgs) makes this correlation very uncertain. At CMW22 and CMW23, a distinct decrease in the gamma ray log indicates the presence of a sandy interval. This log response is consistent with the description of the Sonsela Sandstone Member as quartzose sandstone. These interpreted depths are consistent with the results of the seismic survey. Lithologies and ground water

occurrence observed for each of the boreholes is also consistent with the interpreted depths to the top of the Sonsela Sandstone Member.

Slug tests were conducted at CMW21, CMW23, and CMW24. Hydraulic conductivities for CMW21 and CMW23, screened within the Sonsela Sandstone Member, ranged from to 9.7 X 10^{-7} cm/sec to 3.5 X 10^{-5} cm/sec (Table 2-5, Appendix F). These values are similar to those expected for a sandstone that is well cemented to slightly friable, respectively (Driscoll, 1986). CMW24, screened within siltstone and sandstone intervals and located within the highly deformed strata of the Hogback, had hydraulic conductivity values of 2.3 X 10^{-5} cm/sec and 2.5 X 10^{-5} cm/sec. The higher hydraulic conductivity values obtained for CMW24 are likely the result of fractures increasing the bedrock's ability to transmit water. Copies of the hydraulic conductivity graphs are provided in Appendix F.

Depth to ground water measurements were collected in association with each ground water sampling event. Based upon the ground water elevation data, ground water flow within the first and second water-bearing intervals is generally toward the north.

The off-site well closest to the OB/OD Areas, Well No. 19, is approximately 1,100 feet west of the western boundary of the OB/OD Areas (Table G-1 and Figure G-1, Appendix F). Well No. 19 was identified as a dug well, and therefore, is likely to be completed in shallow unconsolidated materials. The site of this well is approximately 100 feet topographically higher than the site of the monitoring wells installed in the Closed OB/OD Area ground water system.

Other supply wells are located more than 10,000 feet north, east and south of the OB/OD Areas. Geologic structure causes ground water within the Current OB/OD Area ground water system to flow toward the north; thus, water wells located to the east and south are not likely to be affected by ground water migration from the OB/OD Areas.

6.1.4 2000 Through 2005 Investigations

Ground water samples were collected from selected monitoring wells during quarterly sampling events conducted during the period January 2000 through April 2003. A single ground water sampling event was conducted August 2005 at ten selected monitoring wells.

Ground water elevation data were collected from all wells within the OB/OD Areas during the ground water sampling events. No hydrogeologic assessment was completed for the data collected during these sampling events.

6.2 PARCEL 3 GEOLOGY/HYDROGEOLOGY

Data collected during the investigations described above were used to develop the Parcel 3 geology/hydrogeology description included as Section 3.5.2 of the companion Closure Plan Phase I Work Plan.

Analytical data summary tables, including a comparison of detected concentrations to Permit cleanup levels, are provided in the companion Work Plan.

7.0 SWMU 74

7.1 LOCATION, DESCRIPTION, AND OPERATIONAL HISTORY

SWMU 74 is identified in the Permit as Area 16 or Site 16 (Proposed Burning Ground). The designation comes from the ASR (see Section 3.2.2) prepared by USACE. As described in the ASR (USACE, 1995, Table 1 and Section 7.3.16, page 7-6), "Site 16" was a "proposed burning ground from 1958 map". SWMU 74 is shown in Figure 2-3 and Figure 7-1.

There are no records showing a burning ground was established at "Site 16", and the ASR concluded that no burning ground was ever placed in this location, and no further action was recommended.

7.2 PREVIOUS INVESTIGATIONS

7.2.1 Historical Aerial Photograph Analysis

As noted in the aerial photo analysis report (ERI, 2006, findings included in Appendix D of this SRHI), no features were identified within SWMU 74, but a single feature (cleared area) was noted nearby to the northwest in the 1952 photo.

7.2.2 Historical Document Review

As noted above, the ASR (USACE, 1995, Table 1 and page 7-6) identified "Site 16" as a "proposed burning ground from 1958 map". There are no records showing a burning ground was established at "Site 16", and the ASR concluded that no burning ground was ever placed in this location, and no further action was recommended (USACE, 1995, Section 7.3.16, page 7-6).

A review of FWDA records located a 1955 map (FWDA Drawing No. A-3-4, included in Appendix B) showing the area labeled as "powder burning ground – proposed location."

As described in Section 3.2.5, the location of SWMU 74 was also investigated as part of previous MR activities. As shown in the report (EHSI, 2000, pages 2-14 and 2-15), approximately 1.4 acres were evaluated using handheld magnetometers with a 5-foot lane spacing. No MEC/UXO was observed. A total of 15 contacts were located and excavated, and approximately 29 pounds of MD (fragments) were recovered. The MD was inspected by UXO-qualified personnel and determined to be scrap, and was turned in with other scrap for off-site recycling.

7.2.3 Site Reconnaissance Findings

A site visit was conducted by the USACE 18 October 2006. A copy of the trip report is included in Appendix C.

The site was located using global positioning system. While the site had been cleared of vegetation, it did not appear as though the area had ever been utilized as a burning ground.

8.0 AOC 89

8.1 LOCATION, DESCRIPTION, AND OPERATIONAL HISTORY

AOC 89 is identified in the Permit as Features 30 and 34 on the 1973 Aerial Photo API-5. The designation comes from the ASR (see Section 3.2.2) prepared by USACE. As described in the ASR (USACE, 1995, aerial photo API-5), Feature 30 was three U-shaped and one L-shaped revetments. Feature 34 is described in API-5 as a rectangular cleared area with shallow trenches along two sides. One of the three U-shaped revetments in Feature 30 is located adjacent to Feature 34. Features 30 and 34 are located in the northern portion of Parcel 3 along Demil Road. AOC 89 is shown in Figure 8-1.

Feature 30 includes four temporary storage areas used for staging military munitions prior to treatment in the OB/OD Area. The southernmost revetment along the existing gravel road (part of Feature 30) contains a small pile of soil and metal debris created during UXO survey efforts in 1992/1993.

8.2 PREVIOUS INVESTIGATIONS

8.2.1 Historical Aerial Photograph Analysis

As noted in the aerial photo analysis report (ERI, 2006, findings included in Appendix D of this SRHI), seven features within AOC 89 were identified by the aerial photograph analysis.

8.2.2 Historical Document Review

As noted in Section 3.2.2, the ASR (USACE, 1995) was the source of information that led to the identification of AOC 89 in the Permit. While the ASR did identify these features on the 1973 aerial photo, these features were not among the 19 numbered sites and two additional locations identified as Specific Areas of Concern in need of further investigation.

A review of FWDA records located a 1964 map (FWDA Drawing No. C-8-3, included in Appendix B) showing the Feature 30 locations labeled as barricades for the open storage of munitions awaiting treatment in the OB/OD Area.

As described in Section 5.2.2, three areas of explosives-stained soil north of SWMU 14 (within what later was identified as part of AOC 89), identified as Closed Stained Areas (KSAs) 1 through 3, were investigated as part of the 1996 CFP. As described in Section 5.2.2, soil samples were collected under the visibly stained surface soils at depths of 1 foot and 2 feet bgs. The soil samples were analyzed for explosives and TAL metals. Figure 8-1 shows sample locations. Analytical data summary tables including a comparison to Permit cleanup levels are provided in the companion Closure Plan Phase I Work Plan.

9.0 AOC 90

9.1 LOCATION, DESCRIPTION, AND OPERATIONAL HISTORY

AOC 90 is identified in the Permit as Feature 36 on the 1973 Aerial Photo API-5. The designation comes from the ASR (see Section 3.2.2) prepared by USACE. As described in the ASR (USACE, 1995, aerial photo API-5), Feature 36 is described by API-5 as two ponds, dammed downstream. Feature 36 is located in Parcel 3, west of the Hogback and near the western property boundary in Closed OB/OD Area. One pond was outside the FWDA western property boundary. AOC 90 is shown in Figure 9-1.

As shown in Figure 2-3, AOC 90 is topographically upgradient from all known areas of FWDA operations.

9.2 PREVIOUS INVESTIGATIONS

9.2.1 Historical Aerial Photograph Analysis

As noted in the aerial photo analysis report (ERI, 2006, findings included in Appendix D of this SRHI), three features were identified by the aerial photograph analysis within AOC 90. Each of the findings identified AOC 90 as two ponds.

9.2.2 Historical Document Review

As noted in Section 3.2.2, the ASR (USACE, 1995) was the source of information that led to the identification of AOC 90 in the Permit. While the ASR did identify this feature on the 1973 aerial photo, this feature was not among the 19 numbered sites and two additional locations identified as Specific Areas of Concern in need of further investigation.

10.0 AOC 91

10.1 LOCATION, DESCRIPTION, AND OPERATIONAL HISTORY

AOC 91 is identified in the Permit as Feature 41 on the 1973 Aerial Photo API-5 and Feature 27 on the 1978 Aerial Photo API-7. The designation comes from the ASR (see Section 3.2.2) prepared by USACE. As described in the ASR (USACE, 1995, aerial photo API-5), Feature 41 is described as a disturbed area, within firebreak, east and south of known demolition area, and which was not seen on 1962 aerial photo. As described in the ASR (USACE, 1995, aerial photo API-7), Feature 27 is described as a disturbed area, many roads and paths. Features 41 and 27 are located in Parcel 3, east of the Hogback, and south of the OB/OD Unit. AOC 91 is shown in Figure 10-1; as shown, Feature 41 appears to be a larger area that includes Feature 27.

10.2 PREVIOUS INVESTIGATIONS

10.2.1 Historical Aerial Photograph Analysis

As noted in the aerial photo analysis report (ERI, 2006, findings included in Appendix D of this SRHI), three features were identified within AOC 91.

10.2.2 Historical Document Review

As noted in Section 3.2.2, the ASR (USACE, 1995) was the source of information that led to the identification of AOC 91 in the Permit. While the ASR did identify these features on the 1973 and 1978 aerial photos, these features were not among the 19 numbered sites and two additional locations identified as Specific Areas of Concern in need of further investigation.

11.0 AOC 92

11.1 LOCATION, DESCRIPTION, AND OPERATIONAL HISTORY

AOC 92 is identified in the Permit as Feature 31 on the 1973 Aerial Photo API-5 and Feature 21 on the 1978 Aerial Photo API-7. The designation comes from the ASR (see Section 3.2.2) prepared by USACE. As described in the ASR (USACE, 1995, aerial photo API-5), Feature 31 is described as bare areas on hillside with a loop road around area, two trenches, three small pits, and three pit scars. As described in the ASR (USACE, 1995, aerial photo API-7), Feature 21 is described as bare, rough ground on side of hill with loop road and two pits. AOC 92 is shown in Figure 11-1; as shown, Feature 31 on API-5 appears to be the same as Feature 21 on API-7.

11.2 PREVIOUS INVESTIGATIONS

11.2.1 Historical Aerial Photograph Analysis

As noted in the aerial photo analysis report (ERI, 2006, findings included in Appendix D of this SRHI), approximately 14 features were identified by the aerial photograph analysis.

11.2.2 Historical Document Review

As noted in Section 3.2.2, the ASR (USACE, 1995) was the source of information that led to the identification of AOC 91 in the Permit. While the ASR did identify these features on the 1973 and 1978 aerial photos, these features were not among the 19 numbered sites and two additional locations identified as Specific Areas of Concern in need of further investigation.

A review of FWDA records located a 1964 map (FWDA Drawing No. C-8-3, included in Appendix B) showing AOC 92 labeled as a “demil area.”

12.0 REFERENCES

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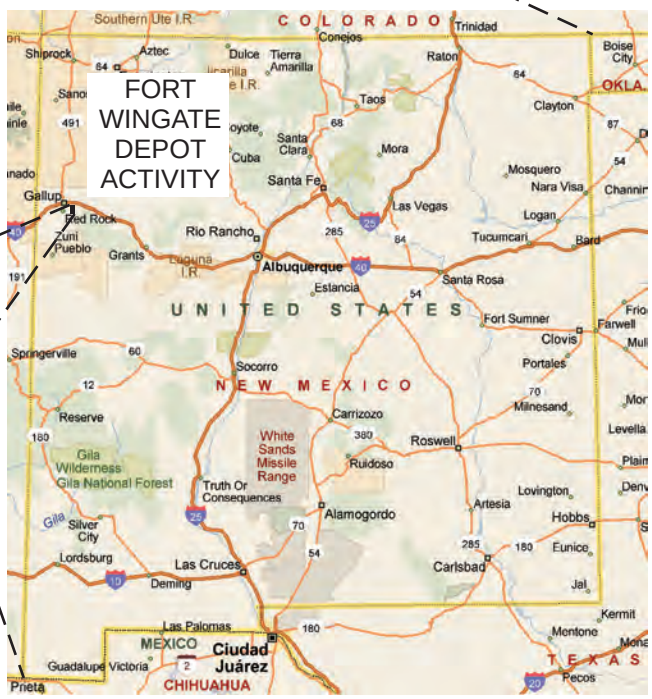
FIGURES

Figure 2-1
Installation Location
Fort Wingate Depot Activity
McKinley County, New Mexico







SOURCE: MICROSOFT STREETS & TRIPS, 2006.

N

NOT TO SCALE

Figure 2-2
Historical Land Use and Reuse Parcel Boundaries
Fort Wingate Depot Activity
McKinley County, New Mexico

N 1650000 N 1640000 N 1630000 N 1620000 N 1610000 N 1600000

E 2510000 E 2500000 E 2490000

TRANSFERRED FWDA PROPERTY

U.S. HIGHWAY 66

INTERSTATE 40

MAIN ENTRANCE

IGLOO BLOCK G

IGLOO BLOCK K

IGLOO BLOCK F

IGLOO BLOCK E

IGLOO BLOCK D

IGLOO BLOCK C

IGLOO BLOCK B

IGLOO BLOCK A

IGLOO BLOCK H

IGLOO BLOCK J

WORKSHOP AREA

ADMINISTRATION AREA

CURRENT FWDA BOUNDARY

APPROXIMATE BOUNDARY OF PARCEL TO BE RETAINED BY ARMY

TRANSFERRED FWDA PROPERTY

CURRENT FWDA BOUNDARY

CLOSED OB/OD AREA

CURRENT OB/OD AREA

LEGEND

TRANSFERRED FWDA PROPERTY

PROPERTY TRANSFER PARCEL BOUNDARY

4000 2000 0 4000

SCALE IN FEET

REV. NO.	DATE	DESCRIPTION OF REVISION	REV. BY	ENG	CHKD BY	APPVD BY

PROJECT MANAGER: E. KAMMERER | DRAWN BY: D. TAYLOR | DATE: 04.09.08

TerranearPMC, LLC
222 VALLEY CREEK BLVD., SUITE 210
EXTON, PA 19341-2843
(610) 862-5000 PHONE
(610) 862-5050 FAX

Figure 2-3
Scale Drawing of the OB/OD Area and the OB/OD Unit

Fort Wingate Depot Activity
McKinley County, New Mexico

PROJECT NO.	FILE NO.	CHKD:	DRAWING NUMBER	REV. NO.
33211		ENG.	511401-1C	0
		APPVD:	SCALE: 1" = 400'	

KEY MAP

FEDERAL GOVERNMENT BLM MANAGED

FEDERAL GOVERNMENT INDIAN TRUST LANDS

FEDERAL GOVERNMENT BIA MANAGED

WESTERN SECURITY FENCE WITH WARNING SIGNS OWNED BY ARMY (EXTENDS NORTH TO NORTHERN BOUNDARY OF FWDA)

AOC 76
FEATURE 19 ON THE 1973 AERIAL PHOTO API-5

MAIN INSTALLATION SECURITY FENCE MAINTAINED BY BMDO

CMW25

GATE 209

IGLOO BLOCK H

APPROXIMATE BOUNDARY OF PARCEL TO BE RETAINED BY ARMY

BUILDING 601 BREAK ROOM

MAIN INSTALLATION SECURITY FENCE MAINTAINED BY BMDO

CMW23

AOC 89
FEATURES 30 AND 34
ON THE 1973 AERIAL PHOTO API-5

APPROXIMATE BOUNDARY OF PARCEL TO BE RETAINED BY ARMY

N 1620000

PINYON-JUNIPER

THE HOGBACK

CMW22

SWMU 14
OLD BURNING GROUND AND DEMOLITION LANDFILL AREA (INCLUDES KGA-3, KGA-4, KGA-5, KP-2, KP-3, KP-4, ARROYO IN FENCED-UP HORSE VALLEY, AND DUMP PILE)

CLOSED OB/OD AREA

OLD BURNING GROUND AND DEMOLITION LANDFILL AREA

CMW24 CMW21 CMW16

KMW11

KGA5 KP3 KP2

FENCED-UP HORSE VALLEY

KMW10

KGA3 KGA4 KP4

SWMU 15
OLD DEMOLITION AREA (INCLUDES INACTIVE EOD AREA, KGA-1, KGA-2, OLD OB/OD AND BURIED PHOSPHORUS ROUNDS, AND THREE MOUNDS IN FENCED-UP HORSE VALLEY)

KMW14

KGA2 KMW13 KGA1

KMW09

KMW12

ESTIMATED EXTENT OF BURIED, BURNED SMOKE CANISTERS FOUND IN 1993

OPEN-SIDED STORAGE SHED

BUILDING 604 CONTROL SHELTER AND TRUCK BARRICADE

GATE (NO ID.)

CMW19

GATE 209A

CRP10

CMW18 CMW17 CMW14

CRP9

CRP8

CRP7 CRP6

FW38 CMW10

BURNING GROUND AREA

CDC5 CDC12 CDC11 CRP5 CDC4 CRP4 CDC10 CDC3

CDC9 CDC8 CDC7 CMW20 CRP3 CDC2

CDC6 CMW07 CMW06 CRP2 CDC1

CRP1 CMW04

CMW02

CBK0401 CBK0301 CBK0201 CBK0101 CBK0801 CBK0701 CBK0601 CBK0501 CBK1101 CBK1201 CBK1001 CBK0901 CBK1601 CBK1901 CBK1401 CBK1301 CBK2001 CBK1801 CBK1701

CURRENT OB/OD AREA

HWMU OB/OD UNIT

GATE (NO ID.)

GATE 209B

CURRENT OB/OD AREA SECURITY FENCE OWNED BY ARMY

AOC 92
FEATURE 31 ON THE 1973 AERIAL PHOTO API-5 AND FEATURE 21 ON THE 1978 AERIAL PHOTO API-7

AOC 36
IGLOO BLOCK J
(INCLUDES MISSILE LAUNCH PAD USED BY MDA)

IGLOO BLOCK J

APPROXIMATE BOUNDARY OF PARCEL TO BE RETAINED BY ARMY

MAIN INSTALLATION SECURITY FENCE MAINTAINED BY BMDO

APPROXIMATE BOUNDARY OF PARCEL TO BE RETAINED BY ARMY

GATE (NO ID.)

EASTERN SECURITY FENCE OWNED BY BMDO (EXTENDS EAST TO FWDA BOUNDARY FENCE)

SWMU 74
AREA 16 OR SITE 16
(PROPOSED BURNING GROUND)

EASTERN SECURITY FENCE WITH WARNING SIGNS OWNED BY ARMY

SOUTHERN SECURITY FENCE OWNED BY ARMY

GATE (NO ID.)

WESTERN SECURITY FENCE WITH WARNING SIGNS OWNED BY ARMY

BK06

APPROXIMATE BOUNDARY OF PARCEL TO BE RETAINED BY ARMY

SOUTHERN BOUNDARY FENCE WITH WARNING SIGNS OWNED BY ARMY

AOC 90
FEATURE 36 ON THE 1973 AERIAL PHOTO API-5

OLD DEMOLITION AREA KP1

SWMU 33
WASTE PILE KP1

FENCED-UP HORSE VALLEY

AOC 91
FEATURE 41 ON THE 1973 AERIAL PHOTO API-5 AND FEATURE 27 ON THE 1978 AERIAL PHOTO API-7

N 1615000

N 1610000

E 2485000

E 2490000

E 2495000

1 2 3 20

LEGEND

- SWMU/AOC BOUNDARY
- APPROXIMATE BOUNDARY OF GEOPHYSICAL ANOMALY/SURFACE DEBRIS/RESIDUE PILE
- INTERPRETED SUBSURFACE RESIDUE/DEBRIS PILE AREA
- EXPLOSIVE STAINED SOIL AREA
- BACKGROUND SOIL SAMPLE
- APPROXIMATE LOCATION OF FORMER OPEN DETONATION CRATER
- APPROXIMATE LOCATION OF EXISTING OPEN DETONATION CRATER
- APPROXIMATE BOUNDARY OF BURNING GROUND AREA
- APPROXIMATE BOUNDARY OF OB/OD UNIT
- 6-FOOT CHAIN LINK SECURITY FENCE WITH 3-STRANDBARBED WIRE TOP
- 5-STRAND BARBED WIRE FENCE
- SENSITIVE HABITAT (WETLAND)
- SENSITIVE HABITAT (WILDLIFE)
- WILLOW THICKET
- COTTONWOOD GROVE
- 6800 TOPOGRAPHIC CONTOUR (FT. MSL)
- 100-YEAR FLOODPLAIN
- ARROYOS
- PROPERTY TRANSFER PARCEL BOUNDARIES
- FWDA PROPERTY BOUNDARY, FEBRUARY 2002
- SWMU 14 SWMUs OR AOCs THAT REQUIRE CORRECTIVE ACTION
- ALLUVIAL MONITORING WELL
- MANCOS SHALE FORMATION MONITORING WELL
- DAKOTA SANDSTONE FORMATION MONITORING WELL
- DAKOTA SANDSTONE FORMATION BORING
- ENTRADA SANDSTONE FORMATION MONITORING WELL
- PAINTED DESERT MEMBER MONITORING WELL
- SONSELA SANDSTONE MEMBER MONITORING WELL

BY PHOTOGRAMMETRIC METHODS FROM AERIAL PHOTOGRAPHS TAKEN SEPTEMBER 28, 1995

400 200 0 400 800
SCALE IN FEET

NOTE:
THERE ARE NO INJECTION OR WITHDRAWAL WELLS WITHIN 1,000 FEET OF THE PARCEL TO BE RETAINED BY THE ARMY.

KEY MAP

AOC 92
FEATURE 31 ON THE 1973
AERIAL PHOTO API-5 AND FEATURE 21
ON THE 1978 AERIAL PHOTO API-7

BURNING
GROUND
AREA

HWMU
OB/OD UNIT

CRP10 CRP9 CRP8 CRP7 CRP6 CRP5 CRP4 CRP3 CRP2 CRP1

CDC01 CDC02 CDC03 CDC04 CDC05 CDC06 CDC07 CDC08 CDC09 CDC010 CDC11 CDC12

GATE 209B

GATE
(NO ID.)

CURRENT OB/OD AREA
SECURITY FENCE
OWNED BY ARMY

SAMPLE ID	DEPTH (FT. BGS)	ANALYTE	RESULT (mg/kg)
CRP80602	5.0	Antimony	33.2

SAMPLE ID	DEPTH (FT. BGS)	ANALYTE	RESULT (mg/kg)
CRP80303	3.0	Lead	6000
	3.0	RDX	576

SAMPLE ID	DEPTH (FT. BGS)	ANALYTE	RESULT (mg/kg)
CRP8150103	3.0	Copper	15000

SAMPLE ID	DEPTH (FT. BGS)	ANALYTE	RESULT (mg/kg)
CRP80103	2.0	Thallium	5.91

SAMPLE ID	DEPTH (FT. BGS)	ANALYTE	RESULT (mg/kg)
CRP70504	4.0	2,4,6-Trinitrotoluene	157

SAMPLE ID	DEPTH (FT. BGS)	ANALYTE	RESULT (mg/kg)
CRP70404	2.0	2,4,6-Trinitrotoluene	292

SAMPLE ID	DEPTH (FT. BGS)	ANALYTE	RESULT (mg/kg)
CRP60115	3.0	Aluminum	120000
	3.0	Copper	4200

SAMPLE ID	DEPTH (FT. BGS)	ANALYTE	RESULT (mg/kg)
CRP6040103	3.0	Antimony	252
	3.0	Vanadium	151

SAMPLE ID	DEPTH (FT. BGS)	ANALYTE	RESULT (mg/kg)
CRP5020403	3.0	2,4,6-Trinitrotoluene	37.6
	3.0	Lead	3600

SAMPLE ID	DEPTH (FT. BGS)	ANALYTE	RESULT (mg/kg)
CRP6020401	1.0	2,4,6-Trinitrotoluene	37.6

SAMPLE ID	DEPTH (FT. BGS)	ANALYTE	RESULT (mg/kg)
CRP5031102	2.0	2,4,6-Trinitrotoluene	2550 D
	2.0	2,4,6-Trinitrotoluene	6230
	2.0	RDX	277 D
	2.0	RDX	2830
	2.0	Barium	211000

SAMPLE ID	DEPTH (FT. BGS)	ANALYTE	RESULT (mg/kg)
CRP512EW	3.0	2,4,6-Trinitrotoluene	740
	3.0	RDX	674

SAMPLE ID	DEPTH (FT. BGS)	ANALYTE	RESULT (mg/kg)
CRP5120103	3.0	Barium	2190000

SAMPLE ID	DEPTH (FT. BGS)	ANALYTE	RESULT (mg/kg)
CRP3010606	6.0	2,4,6-Trinitrotoluene	37.3

SAMPLE ID	DEPTH (FT. BGS)	ANALYTE	RESULT (mg/kg)
CRP3020202	2.0	Aluminum	310000 D
	2.0	Aluminum	160000
	2.0	Antimony	72.7
	2.0	Cadmium	350 D
	2.0	Cadmium	190
	2.0	Copper	15000 D
	2.0	Copper	21000
	2.0	Lead	2700 D
	2.0	Lead	3900
	2.0	Zinc	25000 D
	2.0	Zinc	48000

SAMPLE ID	DEPTH (FT. BGS)	ANALYTE	RESULT (mg/kg)
CDC084803	3.0	Lead	450

SAMPLE ID	DEPTH (FT. BGS)	ANALYTE	RESULT (mg/kg)
CRP2010501	1.0	Aluminum	220000 J
	1.0	Antimony	89.2 J
	1.0	Cadmium	600 J
	1.0	Copper	31000 J
	1.0	Lead	5700 J
	1.0	Nickel	1800 J
	1.0	Zinc	42000 J

SAMPLE ID	DEPTH (FT. BGS)	ANALYTE	RESULT (mg/kg)
CRP2015003	3.0	Cadmium	2420
	3.0	Lead	24400

SAMPLE ID	DEPTH (FT. BGS)	ANALYTE	RESULT (mg/kg)
CRP1DRUM11	0.0	Aluminum	590000

SAMPLE ID	DEPTH (FT. BGS)	ANALYTE	RESULT (mg/kg)
CRP1DRUM12	0.0	Aluminum	430000
	0.0	RDX	84.1

SAMPLE ID	DEPTH (FT. BGS)	ANALYTE	RESULT (mg/kg)
CRP1DRUM10	0.0	Aluminum	680000

SAMPLE ID	DEPTH (FT. BGS)	ANALYTE	RESULT (mg/kg)
CRP1DRUM08	0.0	Aluminum	670000

SAMPLE ID	DEPTH (FT. BGS)	ANALYTE	RESULT (mg/kg)
CRP1DRUM04	0.0	Aluminum	790000
	0.0	Vanadium	120

SAMPLE ID	DEPTH (FT. BGS)	ANALYTE	RESULT (mg/kg)
CRP1010404	4.0	Aluminum	160000
	4.0	RDX	104

SAMPLE ID	DEPTH (FT. BGS)	ANALYTE	RESULT (mg/kg)
CRP1DRUM02	0.0	Aluminum	370000

SAMPLE ID	DEPTH (FT. BGS)	ANALYTE	RESULT (mg/kg)
CRP1DRUM07	0.0	Aluminum	450000
	0.0	RDX	79.6

SAMPLE ID	DEPTH (FT. BGS)	ANALYTE	RESULT (mg/kg)
CRP1020202	2.0	2,4,6-Trinitrotoluene	18100
	2.0	RDX	16000

SAMPLE ID	DEPTH (FT. BGS)	ANALYTE	RESULT (mg/kg)
CRP1DRUM05	0.0	Aluminum	380000

SAMPLE ID	DEPTH (FT. BGS)	ANALYTE	RESULT (mg/kg)
CRP1DRUM06	0.0	Aluminum	500000

SAMPLE ID	DEPTH (FT. BGS)	ANALYTE	RESULT (mg/kg)
CRP1DRUM03	0.0	Aluminum	580000

SAMPLE ID	DEPTH (FT. BGS)	ANALYTE	RESULT (mg/kg)
CRP1DRUM01	0.0	Aluminum	520000 D
	0.0	Aluminum	590000

SAMPLE ID	DEPTH (FT. BGS)	ANALYTE	RESULT (mg/kg)
CDC1DRUM09	0.0	Aluminum	490000
	0.0	RDX	71.9

LEGEND

- ▲ COMPOSITE DEBRIS OR RESIDUE SAMPLE
- ● ADDITIONAL DEBRIS OR RESIDUE SAMPLE
- ◉ DRUM SAMPLE (SOLID RESIDUE)
- SURVEYED INVESTIGATION TRENCH
- APPROXIMATE TEST PIT LOCATION
- SAMPLE EXCEEDING PERMIT CLEANUP LEVEL
- SAMPLE EXCEEDING TCLP LIMIT
- SWMU/AOC BOUNDARY
- AOC 92 SWMUs OR AOCs THAT REQUIRE CORRECTIVE ACTION
- INTERPRETED SUBSURFACE RESIDUE/DEBRIS AREA
- APPROXIMATE BOUNDARY OF SURFACE DEBRIS/RESIDUE PILE
- APPROXIMATE BOUNDARY OF BURNING GROUND AREA
- APPROXIMATE BOUNDARY OF OB/OD UNIT
- 6-FOOT CHAIN LINK SECURITY FENCE WITH 3-STRAND BARBED WIRE TOP
- D DUPLICATE SAMPLE
- J ESTIMATED CONCENTRATION
- SENSITIVE HABITAT (WETLAND)
- SENSITIVE HABITAT (WILDLIFE)
- WILLOW THICKET
- 100-YEAR FLOODPLAIN
- 7200 TOPOGRAPHIC CONTOUR (FT. MSL)

REV. NO.	DATE	DESCRIPTION OF REVISION	REV. BY	ENG	CHKD BY	APPVD BY

PROJECT MANAGER: E. KAMMERER | DRAWN BY: D. TAYLOR | DATE: 04.09.08

TerranearPMC, LLC
222 VALLEY CREEK BLVD., SUITE 210
EXTON, PA 19341-2843
(610) 862-5000 PHONE
(610) 862-5050 FAX

Figure 4-1
Previous Waste Characterization Sample Locations
OB/OD Unit

Fort Wingate Depot Activity
McKinley County, New Mexico

PROJECT NO.	FILE NO.	CHKD:	DRAWING NUMBER	REV. NO.
33211		ENG.	511402 -3C	0
		APPVD:	SCALE: 1" = 100'	

N 1616000 N 1615000 N 1614000 N 1613000
E 2490000 E 2491000 E 2492000

100 50 0 100 200
SCALE IN FEET

KEY MAP

BIPSO12 LOCATED 327' NORTHWEST OF BIPSO11

SAMPLE ID	DEPTH (FT. BGS)	ANALYTE	RESULT (mg/kg)
BIPSO09	0.0	*Cadmium*	71.5 D

SAMPLE ID	DEPTH (FT. BGS)	ANALYTE	RESULT (mg/kg)
CRP1002508	8.0	*Vanadium*	144

SAMPLE ID	DEPTH (FT. BGS)	ANALYTE	RESULT (mg/kg)
CMW17	45.0	*Vanadium*	117

SAMPLE ID	DEPTH (FT. BGS)	ANALYTE	RESULT (mg/kg)
CMW14	40.0	*Vanadium*	96.9
	45.0	*Vanadium*	92.9
	50.0	*Vanadium*	94.5

SAMPLE ID	DEPTH (FT. BGS)	ANALYTE	RESULT (mg/kg)
CRP8100315	15.0	*Aluminum*	82000

SAMPLE ID	DEPTH (FT. BGS)	ANALYTE	RESULT (mg/kg)
BGAS002	0.0	*Antimony*	332

SAMPLE ID	DEPTH (FT. BGS)	ANALYTE	RESULT (mg/kg)
CRP7020416	16.0	*Vanadium*	89.9

SAMPLE ID	DEPTH (FT. BGS)	ANALYTE	RESULT (mg/kg)
RFSO14	0.0	*1,3-Dinitrobenzene*	332

SAMPLE ID	DEPTH (FT. BGS)	ANALYTE	RESULT (mg/kg)
CRP7010612	12.0	*Antimony*	67.7
	12.0	*Selenium*	470
	12.0	*Thallium*	480
	12.0	*Vanadium*	138

SAMPLE ID	DEPTH (FT. BGS)	ANALYTE	RESULT (mg/kg)
DBAS018	0.0	*Antimony*	93.0

SAMPLE ID	DEPTH (FT. BGS)	ANALYTE	RESULT (mg/kg)
DBAS026	0.0	*Antimony*	112

SAMPLE ID	DEPTH (FT. BGS)	ANALYTE	RESULT (mg/kg)
RFSO09	0.0	*Antimony*	84.7

SAMPLE ID	DEPTH (FT. BGS)	ANALYTE	RESULT (mg/kg)
DC3S001	0.0	*Antimony*	665
	0.0	*Manganese*	5250

SAMPLE ID	DEPTH (FT. BGS)	ANALYTE	RESULT (mg/kg)
DC2S002	0.0	*Antimony*	140

SAMPLE ID	DEPTH (FT. BGS)	ANALYTE	RESULT (mg/kg)
RFSO04	0.0	*Antimony*	57.8
	0.0	*Cadmium*	97.3
	0.0	*Copper*	3950

SAMPLE ID	DEPTH (FT. BGS)	ANALYTE	RESULT (mg/kg)
CDC084015	15.0	*Vanadium*	81.7

SAMPLE ID	DEPTH (FT. BGS)	ANALYTE	RESULT (mg/kg)
CDC083715	15.0	*Aluminum*	78000
	15.0	*Vanadium*	85.9

SAMPLE ID	DEPTH (FT. BGS)	ANALYTE	RESULT (mg/kg)
CDC063015	15.0	*Aluminum*	78000
	15.0	*Antimony*	54.8
	15.0	*Vanadium*	690

SAMPLE ID	DEPTH (FT. BGS)	ANALYTE	RESULT (mg/kg)
CDC061015	15.0	*2,4,6-Trinitrotoluene*	90.4

SAMPLE ID	DEPTH (FT. BGS)	ANALYTE	RESULT (mg/kg)
CMW07	35.0	*Vanadium*	162

SAMPLE ID	DEPTH (FT. BGS)	ANALYTE	RESULT (mg/kg)
RFSO03	0.0	*Antimony*	89.9
	0.0	*Cadmium*	237

SAMPLE ID	DEPTH (FT. BGS)	ANALYTE	RESULT (mg/kg)
CDC021915	15.0	*Vanadium*	91.7

SAMPLE ID	DEPTH (FT. BGS)	ANALYTE	RESULT (mg/kg)
CMW04	20.0	*Vanadium*	89.6 D
	60.0	*Vanadium*	152

AOC 92
FEATURE 31 ON THE 1973 AERIAL PHOTO API-5 AND FEATURE 21 ON THE 1978 AERIAL PHOTO API-7

BURNING GROUND AREA

HWMU OB/OD UNIT

CURRENT OB/OD AREA SECURITY FENCE OWNED BY army

GATE (NO ID.)

GATE 209B

CRP10 CRP9 CRP8 CRP7 CRP6 CRP5 CRP4 CRP3 CRP2 CRP1

CDC05 CDC04 CDC03 CDC02 CDC01 CDC09 CDC08 CDC07 CDC06 CDC12 CDC11 CDC10

LEGEND

- SOIL SAMPLE
- ADDITIONAL SOIL SAMPLE
- SURFACE SOIL SAMPLE
- SURVEYED INVESTIGATION TRENCH
- APPROXIMATE TEST PIT LOCATION
- ALLUVIAL MONITORING WELL
- PAINTED DESERT MEMBER MONITORING WELL
- SAMPLE EXCEEDING PERMIT CLEANUP LEVEL
- SWMU/AOC BOUNDARY
- AOC 92 — SWMUs OR AOCs THAT REQUIRE CORRECTIVE ACTION
- INTERPRETED SUBSURFACE RESIDUE/DEBRIS AREA
- APPROXIMATE BOUNDARY OF SURFACE DEBRIS/RESIDUE PILE
- APPROXIMATE BOUNDARY OF BURNING GROUND AREA
- APPROXIMATE BOUNDARY OF OB/OD UNIT
- 6-FOOT CHAIN LINK SECURITY FENCE WITH 3-STRAND BARBED WIRE TOP
- D — DUPLICATE SAMPLE
- J — ESTIMATED CONCENTRATION
- SENSITIVE HABITAT (WETLAND)
- SENSITIVE HABITAT (WILDLIFE)
- WILLOW THICKET
- 100-YEAR FLOODPLAIN
- 7200 — TOPOGRAPHIC CONTOUR (FT. MSL)

REV. NO.	DATE	DESCRIPTION OF REVISION	REV. BY	ENG	CHKD BY	APPVD BY

PROJECT MANAGER: E. KAMMERER | DRAWN BY: D. TAYLOR | DATE: 04.09.08

TerranearPMC, LLC
222 VALLEY CREEK BLVD., SUITE 210
EXTON, PA 19341-2843
(610) 862-5000 PHONE
(610) 862-5050 FAX

Figure 4-2
Previous Soil Characterization Sample Locations OB/OD Unit

Fort Wingate Depot Activity
McKinley County, New Mexico

PROJECT NO.	FILE NO.	CHKD:	DRAWING NUMBER	REV. NO.
33211		ENG.	511402 -2C	0
		APPVD:	SCALE: 1" = 100'	

SCALE IN FEET: 100 50 0 100 200

KEY MAP

AOC 92
FEATURE 31 ON THE 1973
AERIAL PHOTO API-5 AND FEATURE 21
ON THE 1978 AERIAL PHOTO API-7

CRP10
CRP9
CRP8
CRP7
CRP6
CRP5
CRP4
CRP3
CRP2
CRP1

CSW/SED09
CSW/SED08
CSW/SED06
CSW/SED05
CSW/SED04
CSW/SED03
CSW/SED02

SAMPLE ID	ANALYTE	RESULT (ug/L)
CSW08	*Mercury*	2.91
	Selenium	9.46

BURNING GROUND AREA

HWMU
OB/OD UNIT

CDC01
CDC02
CDC03
CDC04
CDC05
CDC06
CDC07
CDC08
CDC09
CDC010
CDC11
CDC12

GATE 209B
GATE (NO ID.)
CURRENT OB/OD AREA SECURITY FENCE OWNED BY ARMY

N 1616000
N 1615000
N 1614000
N 1613000
E 2490000

LEGEND

- SURFACE WATER/SEDIMENT SAMPLE LOCATION
- SAMPLE EXCEEDING PERMIT CLEANUP LEVEL
- SWMU/AOC BOUNDARY
- AOC 92 SWMUs OR AOCs THAT REQUIRE CORRECTIVE ACTION
- INTERPRETED SUBSURFACE RESIDUE/DEBRIS AREA
- APPROXIMATE BOUNDARY OF SURFACE DEBRIS/RESIDUE PILE
- APPROXIMATE BOUNDARY OF BURNING GROUND AREA
- APPROXIMATE BOUNDARY OF OB/OD UNIT
- 6-FOOT CHAIN LINK SECURITY FENCE WITH 3-STRAND BARBED WIRE TOP
- SENSITIVE HABITAT (WETLAND)
- SENSITIVE HABITAT (WILDLIFE)
- WILLOW THICKET
- 100-YEAR FLOODPLAIN
- 7200 TOPOGRAPHIC CONTOUR (FT. MSL)

100 50 0 100 200
SCALE IN FEET

REV. NO.	DATE	DESCRIPTION OF REVISION	REV. BY	ENG	CHKD BY	APPVD BY

PROJECT MANAGER: E. KAMMERER | DRAWN BY: D. TAYLOR | DATE: 04.09.08

TerranearPMC, LLC
222 VALLEY CREEK BLVD., SUITE 210
EXTON, PA 19341-2843
(610) 862-5000 PHONE
(610) 862-5050 FAX

Figure 4-3
Previous Surface Water and Sediment Sample Locations OB/OD Unit

Fort Wingate Depot Activity
McKinley County, New Mexico

PROJECT NO.	FILE NO.	CHKD:	DRAWING NUMBER	REV. NO.
33211		ENG.	511402 -4C	0
		APPVD:	SCALE: 1" = 100'	

E 2486000 E 2487000 E 2488000

N 1619000 N 1618000 N 1617000 N 1616000

THE HOGBACK

APPROXIMATE BOUNDARY OF PARCEL TO BE RETAINED BY ARMY

AOC 89
FEATURES 30 AND 34
ON THE 1973 AERIAL PHOTO API-5

SWMU 14
OLD BURNING GROUND AND DEMOLITION LANDFILL AREA
(INCLUDES KGA-3, KGA-4, KGA-5, KP-2, KP-3, KP-4, ARROYO IN FENCED-UP HORSE VALLEY, AND DUMP PILE)

OLD BURNING GROUND AND DEMOLITION LANDFILL AREA

FENCED-UP HORSE VALLEY

KP301/TP5
KP301/TP4
KP301/TP3
KP301/TP2
KP301/TP1
KP301
KP203
KP204
KP2
KP205
KP201
KP2011201
KP2033101
KP2033201
KP3
KGA5
KGA5010502
KGA501
KGA502
KP303
KP302
KGA409
KGA4090203
KGA4090103
KGA410
KGA401
KGA406
KGA4
KGA402
KGA404
KGA403
KGA4010402
KGA4010302
KGA4060101
KGA4040101
KGA4020101
KGA314
KGA302
KGA3020103
KGA303
KGA3020403
KGA3140301
KGA3140201
KGA313
KGA3
KGA305
KGA312
KGA304
KGA3012903
KGA3030302
KGA3012303
KGA3026001
KP4A
KP4B
KP4C
KP4D
KP4AP0405
KP4BP0505
KP402
KGA3036001
KGA3146001
KGA308
KGA3082402
KGA3082501
KGA310
KGA309
KGA311
KGA3110402
KGA3110302
KGA306
KGA307
KGA3055001
KGA3060203
KGA3070301
KGA3080401
KGA3081201
KGA3010101
KGA3011203
KGA3016001
KGA2060701
KGA2060601
KGA204
KGA205
KGA201
KGA206
KGA203
KGA2TP01
KGA202
KGA2
KGA2010804
KGA2010904
KGA2020103
KGA2021503
KGA2020203
KGA1040203
KGA1040503
KGA1TP01
KGA1041201
KGA1041301
KGA105
KGA1
KGA101
KGA103
KGA104
KGA102
KP1035
KP1020902
KP1020102
KP1015
KP1
OPEN-SIDED STORAGE SHED
BUILDING 604 CONTROL SHELTER AND TRUCK BARRICADE
GATE (NO ID.)
GATE 209A

SAMPLE ID	DEPTH (FT. BGS)	ANALYTE	RESULT (mg/kg)
KGA4100201	1.0	Aluminum	290000
	1.0	Antimony	64.5
	1.0	Cadmium	43.3
	1.0	Copper	14000

SAMPLE ID	DEPTH (FT. BGS)	ANALYTE	RESULT (mg/kg)
KGA4100602	2.0	Lead	54100

SAMPLE ID	DEPTH (FT. BGS)	ANALYTE	RESULT (mg/kg)
KGA3020103	3.0	Barium	23000

SAMPLE ID	DEPTH (FT. BGS)	ANALYTE	RESULT (ug/L)
KGA3082501	1.0	2,4-Dinitrotoluene	150 J

SAMPLE ID	DEPTH (FT. BGS)	ANALYTE	RESULT (mg/kg)
KGA3020403	3.0	Barium	535000

SAMPLE ID	DEPTH (FT. BGS)	ANALYTE	RESULT (mg/kg)
KGA3011203	3.0	2,4,6-Trinitrotoluene	467 J
	3.0	RDX	259 J

SAMPLE ID	DEPTH (FT. BGS)	ANALYTE	RESULT (mg/kg)
KGA3080401	1.0	2,4,6-Trinitrotoluene	97.4
	1.0	Barium	16000

SAMPLE ID	DEPTH (FT. BGS)	ANALYTE	RESULT (mg/kg)
KGA3081201	1.0	Antimony	107
	1.0	Cadmium	990
	1.0	Copper	8200
	1.0	Lead	6600
	1.0	Molybdenum	502
	1.0	Phosphorus	71000
	1.0	Thallium	6.36

SAMPLE ID	DEPTH (FT. BGS)	ANALYTE	RESULT (mg/kg)
KGA1041201	1.0	2,4,6-Trinitrotoluene	40.6 D
	1.0	2,4,6-Trinitrotoluene	111

SAMPLE ID	DEPTH (FT. BGS)	ANALYTE	RESULT (mg/kg)
KGA4090103	3.0	2,4,6-Trinitrotoluene	41.6 J

SAMPLE ID	DEPTH (FT. BGS)	ANALYTE	RESULT (mg/kg)
KGA4010402	2.0	Cadmium	4580
	2.0	Lead	33500

SAMPLE ID	DEPTH (FT. BGS)	ANALYTE	RESULT (mg/kg)
KGA4010302	2.0	Cadmium	180 D
	2.0	Cadmium	140
	2.0	Lead	460 D
	2.0	Lead	530

SAMPLE ID	DEPTH (FT. BGS)	ANALYTE	RESULT (mg/kg)
KGA4060101	1.0	Antimony	41.2
	1.0	Cadmium	89.4
	1.0	Lead	510

SAMPLE ID	DEPTH (FT. BGS)	ANALYTE	RESULT (mg/kg)
KGA4020101	1.0	2,4,6-Trinitrotoluene	687

ESTIMATED EXTENT OF BURIED, BURNED SMOKE CANISTERS FOUND IN 1993

SWMU 15
OLD DEMOLITION AREA
(INCLUDES INACTIVE EOD AREA, KGA-1, KGA-2, OLD OB/OD AND BURIED PHOSPHORUS ROUNDS, AND THREE MOUNDS IN FENCED-UP HORSE VALLEY)

SWMU 33
WASTE PILE KP1

CONTOURS GENERATED WITH SURFACE MODELING SOFTWARE

KEY MAP

REV. NO.	DATE	DESCRIPTION OF REVISION	REV. BY	ENG	CHKD BY	APPVD BY

PROJECT MANAGER: E. KAMMERER | DRAWN BY: D. TAYLOR | DATE: 02.14.08

TerranearPMC, LLC
222 VALLEY CREEK BLVD., SUITE 210
EXTON, PA 19341-2843
(610) 862-5000 PHONE
(610) 862-5050 FAX

Figure 5-1
Previous Waste Characterization Sample Locations
Parcel 3 SWMUs

Fort Wingate Depot Activity
McKinley County, New Mexico

PROJECT NO.	FILE NO.	CHKD:	DRAWING NUMBER	REV. NO.
33211		ENG.	511403 -1C	0
		APPVD:	SCALE: 1" = 100'	

LEGEND

- SWMU/AOC BOUNDARY
- AOC 89 — SWMUs OR AOCs THAT REQUIRE CORRECTIVE ACTION
- ▲ COMPOSITE DEBRIS OR RESIDUE SAMPLE
- ● ADDITIONAL DEBRIS OR RESIDUE SAMPLE
- SURVEYED INVESTIGATION TRENCH
- O SAMPLE EXCEEDING PERMIT CLEANUP LEVEL
- O SAMPLE EXCEEDING TCLP LIMIT
- D DUPLICATE SAMPLE
- J ESTIMATED CONCENTRATION
- INTERPRETED SUBSURFACE RESIDUE/DEBRIS AREA
- APPROXIMATE BOUNDARY OF GEOPHYSICAL ANOMALY/SURFACE DEBRIS/RESIDUE PILE
- 6-FOOT CHAIN LINK SECURITY FENCE WITH 3-STRAND BARBED WIRE TOP
- PROPERTY TRANSFER PARCEL BOUNDARY
- COTTONWOOD GROVE
- 100-YEAR FLOODPLAIN
- ARROYOS
- 7400 TOPOGRAPHIC CONTOUR (FT. MSL)

100 50 0 100 200
SCALE IN FEET

N

E 2496000 E 2497000 E 2498000

N 1619000 N 1618000 N 1617000 N 1616000

THE HOGBACK

APPROXIMATE BOUNDARY OF PARCEL TO BE RETAINED BY ARMY

AOC 89
FEATURES 30 AND 34
ON THE 1973 AERIAL PHOTO API-5

SWMU 14
OLD BURNING GROUND AND DEMOLITION LANDFILL AREA
(INCLUDES KGA-3, KGA-4, KGA-5, KP-2, KP-3, KP-4, ARROYO IN FENCED-UP HORSE VALLEY, AND DUMP PILE)

OLD BURNING GROUND AND DEMOLITION LANDFILL AREA

FENCED-UP HORSE VALLEY

SAMPLE ID	DEPTH (FT. BGS)	ANALYTE	RESULT (mg/kg)
KMW11	20.0	Vanadium	84.6
	25.0	Vanadium	88.7
	35.0	Vanadium	85.9
	55.0	Vanadium	86.4
	58.0	Vanadium	108

SAMPLE ID	DEPTH (FT. BGS)	ANALYTE	RESULT (mg/kg)
KB08	5.0	Manganese	3800

SAMPLE ID	DEPTH (FT. BGS)	ANALYTE	RESULT (mg/kg)
KB07	3.0	2,4,6-Trinitrotoluene	263
	5.0	2,4,6-Trinitrotoluene	156

SAMPLE ID	DEPTH (FT. BGS)	ANALYTE	RESULT (mg/kg)
KGA3140405	5.0	Manganese	4900

SAMPLE ID	DEPTH (FT. BGS)	ANALYTE	RESULT (mg/kg)
CMW19	20.0	Vanadium	87.2

KP301/TP5
KP301/TP4
KP301/TP3
KP301/TP2
KP301/TP1

KGA1
KGA2
KGA3
KGA4
KGA5
KP1
KP2
KP3
KP4

KMW09 KMW10 KMW11 KMW12 KMW13 KMW14 CMW19

SWMU 15
OLD DEMOLITION AREA
(INCLUDES INACTIVE EOD AREA, KGA-1, KGA-2, OLD OB/OD AND BURIED PHOSPHORUS ROUNDS, AND THREE MOUNDS IN FENCED-UP HORSE VALLEY)

ESTIMATED EXTENT OF BURIED, BURNED SMOKE CANISTERS FOUND IN 1993

CONTOURS GENERATED WITH SURFACE MODELING SOFTWARE

SWMU 33
WASTE PILE KP1

OPEN-SIDED STORAGE SHED

BUILDING 604
CONTROL SHELTER AND TRUCK BARRICADE

GATE (NO ID.)

GATE 209A

KEY MAP

LEGEND

- SWMU/AOC BOUNDARY
- AOC 89 — SWMUs OR AOCs THAT REQUIRE CORRECTIVE ACTION
- SOIL SAMPLE
- ADDITIONAL SOIL SAMPLE
- SURFACE SOIL SAMPLE
- SAMPLE EXCEEDING PERMIT CLEANUP LEVEL
- SURVEYED INVESTIGATION TRENCH
- MANCOS SHALE FORMATION MONITORING WELL
- DAKOTA SANDSTONE FORMATION MONITORING WELL
- DAKOTA SANDSTONE FORMATION BORING
- ENTRADA SANDSTONE FORMATION MONITORING WELL
- PAINTED DESERT MEMBER MONITORING WELL
- INTERPRETED SUBSURFACE RESIDUE/DEBRIS AREA
- APPROXIMATE BOUNDARY OF GEOPHYSICAL ANOMALY/SURFACE DEBRIS/RESIDUE PILE
- 6-FOOT CHAIN LINK SECURITY FENCE WITH 3-STRAND BARBED WIRE TOP
- PROPERTY TRANSFER PARCEL BOUNDARY
- COTTONWOOD GROVE
- 100-YEAR FLOODPLAIN
- ARROYOS
- 7400 — TOPOGRAPHIC CONTOUR (FT. MSL)

100 50 0 100 200
SCALE IN FEET

REV. NO.	DATE	DESCRIPTION OF REVISION	REV. BY	ENG	CHKD BY	APPVD BY

PROJECT MANAGER: E. KAMMERER | DRAWN BY: D. TAYLOR | DATE: 02.14.08

TerranearPMC, LLC
222 VALLEY CREEK BLVD., SUITE 210
EXTON, PA 19341-2843
(610) 862-5000 PHONE
(610) 862-5050 FAX

Figure 5-2
Previous Soil Characterization Sample Locations
Parcel 3 SWMUs

Fort Wingate Depot Activity
McKinley County, New Mexico

PROJECT NO.	FILE NO.	CHKD:	DRAWING NUMBER	REV. NO.
33211		ENG.	511403-2C	0
		APPVD:	SCALE: 1" = 100'	

E 2486000 E 2487000 E 2488000

N 1619000 N 1618000 N 1617000 N 1616000

THE HOGBACK

AOC 89
FEATURES 30 AND 34
ON THE 1973 AERIAL PHOTO API-5

SWMU 14
OLD BURNING GROUND AND DEMOLITION LANDFILL AREA
(INCLUDES KGA-3, KGA-4, KGA-5, KP-2, KP-3, KP-4, ARROYO IN FENCED-UP HORSE VALLEY, AND DUMP PILE)

OLD BURNING GROUND AND DEMOLITION LANDFILL AREA

FENCED-UP HORSE VALLEY

APPROXIMATE BOUNDARY OF PARCEL TO BE RETAINED BY ARMY

SWMU 15
OLD DEMOLITION AREA
(INCLUDES INACTIVE EOD AREA, KGA-1, KGA-2, OLD OB/OD AND BURIED PHOSPHORUS ROUNDS, AND THREE MOUNDS IN FENCED-UP HORSE VALLEY)

ESTIMATED EXTENT OF BURIED, BURNED SMOKE CANISTERS FOUND IN 1993

SWMU 33
WASTE PILE KP1

KGA1 KGA2 KGA3 KGA4 KGA5

KP1 KP2 KP3 KP4

KSW/SED01 KSW/SED02 KSW/SED03 KSW/SED04 KSW/SED05 KSW/SED06 KSW/SED07 KSW/SED08 KSW/SED09 KSW/SED10

SAMPLE ID	ANALYTE	RESULT (ug/L)
KSW03	*Selenium*	22.1

SAMPLE ID	ANALYTE	RESULT (ug/L)
KSW02	*Selenium*	7.31

SAMPLE ID	ANALYTE	RESULT (ug/L)
KSW04	*Mercury*	0.925
	Selenium	21.2

SAMPLE ID	ANALYTE	RESULT (ug/L)
KSW05	*Mercury*	1.33
	Selenium	25.6

SAMPLE ID	ANALYTE	RESULT (ug/L)
KSW07	*Mercury*	1.89
	Selenium	15.0

SAMPLE ID	ANALYTE	RESULT (ug/L)
KSW08	*Selenium*	19.2

SAMPLE ID	ANALYTE	RESULT (ug/L)
KSW06	*Selenium*	57.0

SAMPLE ID	DEPTH (FT. BGS)	ANALYTE	RESULT (mg/kg)
KSED06	1.0	*Thallium*	11.0 J

SAMPLE ID	ANALYTE	RESULT (ug/L)
KSW09	*Selenium*	71.1

SAMPLE ID	ANALYTE	RESULT (ug/L)
KSW10	*Selenium*	7.5

SAMPLE ID	DEPTH (FT. BGS)	ANALYTE	RESULT (mg/kg)
KSED10	1.0	*Thallium*	13.0

OPEN-SIDED STORAGE SHED

BUILDING 604 CONTROL SHELTER AND TRUCK BARRICADE

GATE (NO ID.)

GATE 209A

CONTOURS GENERATED WITH SURFACE MODELING SOFTWARE

KEY MAP

REV. NO.	DATE	DESCRIPTION OF REVISION	REV. BY	ENG	CHKD BY	APPVD BY

PROJECT MANAGER: E. KAMMERER	DRAWN BY: D. TAYLOR	DATE: 02.14.08

TerranearPMC, LLC
222 VALLEY CREEK BLVD., SUITE 210
EXTON, PA 19341-2843
(610) 862-5000 PHONE
(610) 862-5050 FAX

Figure 5-3
Previous Surface Water and Sediment Sample Locations
Parcel 3 SWMUs

Fort Wingate Depot Activity
McKinley County, New Mexico

PROJECT NO.	FILE NO.	CHKD:	DRAWING NUMBER	REV. NO.
33211		ENG.	511403 -3C	0
		APPVD:	SCALE: 1" = 100'	

LEGEND

- SWMU/AOC BOUNDARY
- AOC 89 — SWMUs OR AOCs THAT REQUIRE CORRECTIVE ACTION
- * — ADDITIONAL DEBRIS OR RESIDUE SAMPLE
- SAMPLE EXCEEDING PERMIT CLEANUP LEVEL
- J — ESTIMATED CONCENTRATION
- INTERPRETED SUBSURFACE RESIDUE/DEBRIS AREA
- APPROXIMATE BOUNDARY OF GEOPHYSICAL ANOMALY/SURFACE DEBRIS/RESIDUE PILE
- 6-FOOT CHAIN LINK SECURITY FENCE WITH 3-STRAND BARBED WIRE TOP
- PROPERTY TRANSFER PARCEL BOUNDARY
- COTTONWOOD GROVE
- 100-YEAR FLOODPLAIN
- ARROYOS
- 7400 — TOPOGRAPHIC CONTOUR (FT. MSL)

100 50 0 100 200
SCALE IN FEET

REV. NO.	DATE	DESCRIPTION OF REVISION	REV. BY	ENG	CHKD BY	APPVD BY

PROJECT MANAGER: E. KAMMERER | DRAWN BY: D. TAYLOR | DATE: 04.09.08

TerranearPMC, LLC
222 VALLEY CREEK BLVD., SUITE 210
EXTON, PA 19341-2643
(610) 862-5000 PHONE
(610) 862-5050 FAX

Figure 6-1
Ground Water Monitoring Well Locations
OB/OD Unit and Parcel 3 SWMUs

Fort Wingate Depot Activity
McKinley County, New Mexico

PROJECT NO.	FILE NO.	CHKD:	DRAWING NUMBER	REV. NO.
33211		ENG.	511401-2C	0
		APPVD:	SCALE: 1" = 400'	

KEY MAP

FEDERAL GOVERNMENT BLM MANAGED

FEDERAL GOVERNMENT INDIAN TRUST LANDS

WESTERN SECURITY FENCE WITH WARNING SIGNS OWNED BY ARMY (EXTENDS NORTH TO NORTHERN BOUNDARY OF FWDA)

AOC 76
FEATURE 19 ON THE 1973 AERIAL PHOTO API-5

MAIN INSTALLATION SECURITY FENCE MAINTAINED BY BMDO

APPROXIMATE BOUNDARY OF PARCEL TO BE RETAINED BY ARMY

GATE 209

IGLOO BLOCK H

BUILDING 601 BREAK ROOM

MAIN INSTALLATION SECURITY FENCE MAINTAINED BY BMDO

AOC 89
FEATURES 30 AND 34
ON THE 1973 AERIAL PHOTO API-5

APPROXIMATE BOUNDARY OF PARCEL TO BE RETAINED BY ARMY

THE HOGBACK

SWMU 14
OLD BURNING GROUND AND DEMOLITION LANDFILL AREA
(INCLUDES KGA-3, KGA-4, KGA-5, KP-2, KP-3, KP-4, ARROYO IN FENCED-UP HORSE VALLEY, AND DUMP PILE)

CLOSED OB/OD AREA

OLD BURNING GROUND AND DEMOLITION LANDFILL AREA

FENCED-UP HORSE VALLEY

SWMU 15
OLD DEMOLITION AREA
(INCLUDES INACTIVE EOD AREA, KGA-1, KGA-2, OLD OB/OD AND BURIED PHOSPHORUS ROUNDS, AND THREE MOUNDS IN FENCED-UP HORSE VALLEY)

PINYON-JUNIPER

OPEN-SIDED STORAGE SHED

BUILDING 604 CONTROL SHELTER AND TRUCK BARRICADE

GATE (NO ID.)

GATE 209A

ESTIMATED EXTENT OF BURIED, BURNED SMOKE CANISTERS FOUND IN 1993

OLD DEMOLITION AREA

SWMU 33
WASTE PILE KP1

FENCED-UP HORSE VALLEY

BURNING GROUND AREA

CURRENT OB/OD AREA

HWMU OB/OD UNIT

AOC 90
FEATURE 36 ON THE 1973 AERIAL PHOTO API-5

GATE 209B

CURRENT OB/OD AREA SECURITY FENCE OWNED BY ARMY

AOC 92
FEATURE 31 ON THE 1973 AERIAL PHOTO API-5 AND FEATURE 21 ON THE 1978 AERIAL PHOTO API-7

AOC 91
FEATURE 41 ON THE 1973 AERIAL PHOTO API-5 AND FEATURE 27 ON THE 1978 AERIAL PHOTO API-7

APPROXIMATE BOUNDARY OF PARCEL TO BE RETAINED BY ARMY

EASTERN SECURITY FENCE OWNED BY BMDO (EXTENDS EAST TO FWDA BOUNDARY FENCE)

SWMU 74
AREA 16 OR SITE 16
(PROPOSED BURNING GROUND)

EASTERN SECURITY FENCE WITH WARNING SIGNS OWNED BY ARMY

SOUTHERN SECURITY FENCE OWNED BY ARMY

SOUTHERN BOUNDARY FENCE WITH WARNING SIGNS OWNED BY ARMY

WESTERN SECURITY FENCE WITH WARNING SIGNS OWNED BY ARMY

APPROXIMATE BOUNDARY OF PARCEL TO BE RETAINED BY ARMY

AOC 36
IGLOO BLOCK J
(INCLUDES MISSILE LAUNCH PAD USED BY MDA)

IGLOO BLOCK J

MAIN INSTALLATION SECURITY FENCE MAINTAINED BY BMDO

FEDERAL GOVERNMENT BIA MANAGED

2 3 20 1

KMW11 — Ammonia, Anions, Explosives, Nitrate, Metals

ANALYTE	RESULT (mg/L)
Aluminum	61.9
Arsenic	0.0207 FJ
Boron	1.50 F
Iron	36.3
Manganese	0.572 DJ
Vanadium	0.26 D

KMW13 — Ammonia, Anions, Explosives, Nitrate/Nitrite, Metals

ANALYTE	RESULT (mg/L)
Ammonia Nitrogen	0.254
Iron	4.22 J
Manganese	0.522 J
Nitrite	1.26
Sulfate	3150

KMW10 — Ammonia, Anions, Nitrate/Nitrite, Metals

ANALYTE	RESULT (mg/L)
Aluminum	14.0
Ammonia Nitrogen	1.04 J
Iron	8.53 J
Manganese	0.23

KMW09 — Ammonia, Anions, Explosives, Nitrate/Nitrite, Perchlorate, Metals

ANALYTE	RESULT (mg/L)
Aluminum	495
Ammonia Nitrogen	0.961 FJ
Arsenic	0.0337
Barium	1.05
Beryllium	0.0179
Chromium	0.348
Cobalt	0.0784
Iron	227
Lead	0.228
Manganese	4.53
Nickel	0.30
Sulfate	1730

KMW12 — Ammonia, Anions, Nitrate/Nitrite, Metals

ANALYTE	RESULT (mg/L)
Aluminum	45.2
Ammonia Nitrogen	0.547
Iron	22.1
Manganese	1.32 F
Sulfate	1940

CMW25 — Ammonia, Anions, Explosives, Nitrate/Nitrite, Metals

ANALYTE	RESULT (mg/L)
Aluminum	162 J
Boron	0.877 F
Cadmium	0.0227
Chromium	0.18 J
Iron	64.6 J
Lead	0.0324 J
Manganese	1.58 J

CMW23 — Ammonia, Anions, Explosives, Nitrate/Nitrite, Metals

ANALYTE	RESULT (mg/L)
Aluminum	183
Arsenic	0.0104
Beryllium	0.00572
Chromium	0.0671
Fluoride	2.78
Iron	67.0
Lead	0.0437
Manganese	1.59
Nitrite	1.33
Sulfate	1280

CMW22 — Explosives, Nitrate/Nitrite, Perchlorate, Metals

ANALYTE	RESULT (mg/L)
Aluminum	37.4
Iron	15.1
Manganese	0.767

CMW24 — Ammonia, Anions, Nitrate/Nitrite, Metals

ANALYTE	RESULT (mg/L)
Boron	1.85 F
Chloride	333
Iron	1.30 J

CMW21 — Ammonia, Anions, Explosives, Nitrate/Nitrite, Perchlorate, Metals

ANALYTE	RESULT (mg/L)
Aluminum	92.7
Ammonia Nitrogen	0.456 FJ
Boron	1.24
Chromium	0.0661
Iron	38.3
Lead	0.0186
Manganese	1.06

CMW16 — Anions, Explosives, Nitrate/Nitrite, Perchlorate, Metals

ANALYTE	RESULT (mg/L)
Aluminum	46.2
Antimony	0.0233
Iron	19.1
Manganese	0.29
RDX	0.0173

CMW19 — Ammonia, Anions, Explosives, Nitrate/Nitrite, Metals

ANALYTE	RESULT (mg/L)
Aluminum	179
Ammonia Nitrogen	0.452
Boron	1.79 F
Chromium	0.066 D
Iron	101
Lead	0.0259
Manganese	0.862 D
Sulfate	734

CMW18 — Ammonia, Anions, Explosives, Nitrate/Nitrite, Perchlorate, Metals

ANALYTE	RESULT (mg/L)
Aluminum	24.3 J
Iron	14.5 J
Manganese	0.657 J
RDX	0.17

CMW14 — Ammonia, Anions, Nitrate/Nitrite, Metals

ANALYTE	RESULT (mg/L)
Ammonia Nitrogen	1.58 J
Boron	1.05 F
Chloride	252
Chromium	0.142 FJ
Sulfate	1000 J

FW38 — Anions, Explosives, Nitrate/Nitrite, Phosphate, Metals

ANALYTE	RESULT (mg/L)
Aluminum	17.2
Iron	19.2
Lead	0.0231
Manganese	3.04
Nickel	0.439

CMW17 — Ammonia, Anions, Explosives, Nitrate, Metals

ANALYTE	RESULT (mg/L)
Aluminum	88.2
Ammonia Nitrogen	0.251
Boron	1.95
Chromium	0.0586
Iron	46.3
Manganese	0.767
Vanadium	0.205

CMW10 — Ammonia, Anions, Nitrate/Nitrite, Metals

ANALYTE	RESULT (mg/L)
Ammonia Nitrogen	0.557 F
Chloride	398
Chromium	0.282 J
Iron	1.48
Selenium	0.0845
Sulfate	1230

CMW07 — Ammonia, Anions, Nitrate/Nitrite, Metals

ANALYTE	RESULT (mg/L)
Aluminum	52.3
Boron	1.04
Cadmium	0.00681 F
Fluoride	2.19
Iron	27.8
Manganese	0.48

CMW04 — Ammonia, Anions, Nitrate, Metals

ANALYTE	RESULT (mg/L)
Aluminum	30.1 J
Boron	2.03 D
Fluoride	3.89
Iron	15.2 J
Sulfate	2100

CMW20 — Explosives, Metals

ANALYTE	RESULT (mg/L)
Aluminum	138
Barium	1.60
Iron	81.7
Lead	0.0483
Manganese	1.80
RDX	0.000715

CMW06 — Explosives, Metals

ANALYTE	RESULT (mg/L)
Aluminum	12.7
Barium	1.30
Boron	2.21 F
Iron	9.56
Manganese	2.30

CMW02 — Ammonia, Anions, Nitrate/Nitrite, Perchlorate, Metals

ANALYTE	RESULT (mg/L)
Aluminum	84.4
Antimony	0.00613 F
Boron	0.981 F
Iron	35.9
Lead	0.0201
Manganese	2.37

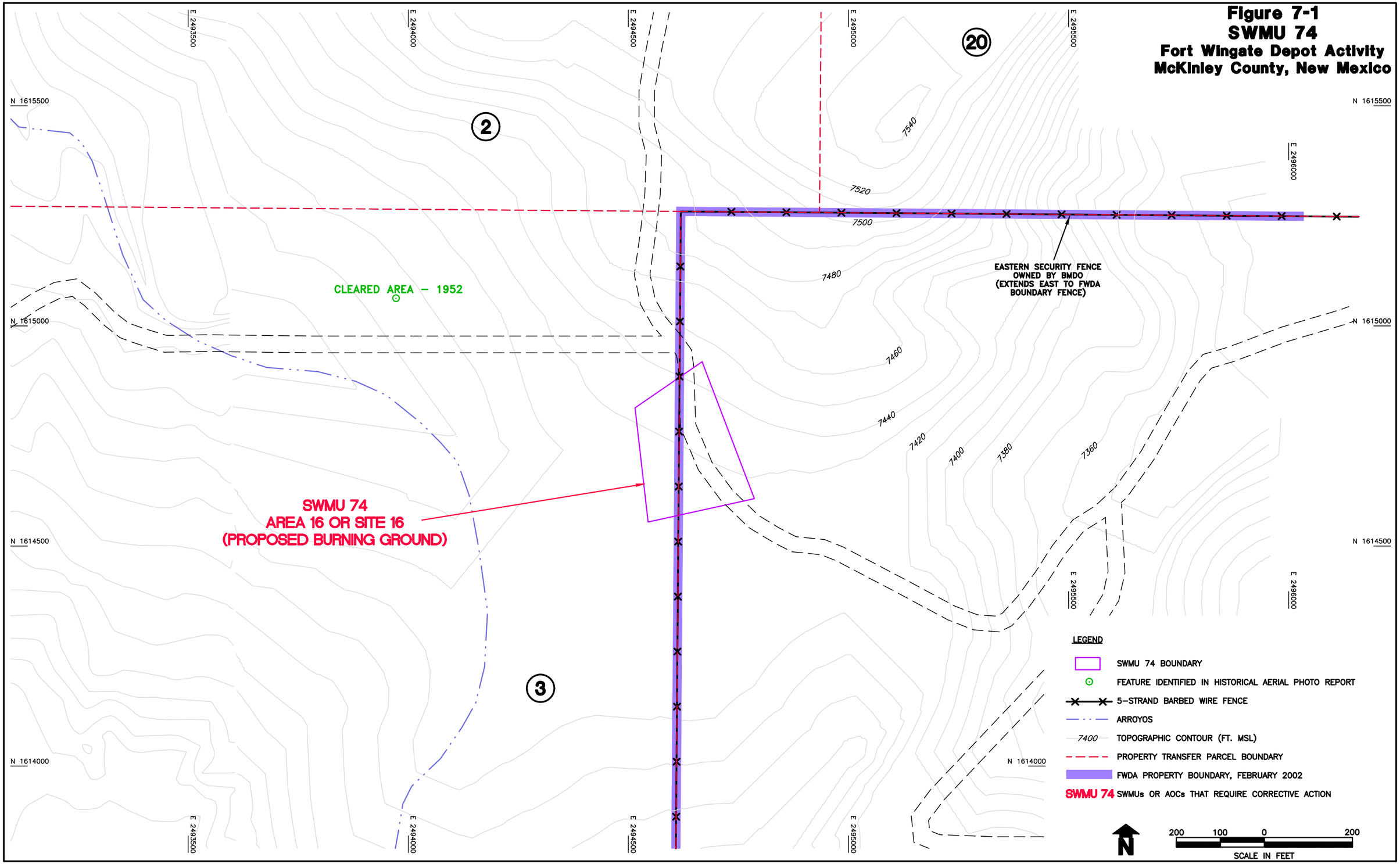
LEGEND

- SWMU/AOC BOUNDARY
- APPROXIMATE BOUNDARY OF GEOPHYSICAL ANOMALY/SURFACE DEBRIS/RESIDUE PILE
- INTERPRETED SUBSURFACE RESIDUE/DEBRIS PILE AREA
- EXPLOSIVE STAINED SOIL AREA
- BACKGROUND SOIL SAMPLE
- APPROXIMATE LOCATION OF FORMER OPEN DETONATION CRATER
- APPROXIMATE LOCATION OF EXISTING OPEN DETONATION CRATER
- APPROXIMATE BOUNDARY OF BURNING GROUND AREA
- APPROXIMATE BOUNDARY OF OB/OD UNIT
- 6-FOOT CHAIN LINK SECURITY FENCE WITH 3-STRANDBARBED WIRE TOP
- 5-STRAND BARBED WIRE FENCE
- SENSITIVE HABITAT (WETLAND)
- SENSITIVE HABITAT (WILDLIFE)
- WILLOW THICKET
- COTTONWOOD GROVE
- TOPOGRAPHIC CONTOUR (FT. MSL)
- 100-YEAR FLOODPLAIN
- ARROYOS
- PROPERTY TRANSFER PARCEL BOUNDARIES
- FWDA PROPERTY BOUNDARY, FEBRUARY 2002
- SWMU 14 — SWMUs OR AOCs THAT REQUIRE CORRECTIVE ACTION
- ALLUVIAL MONITORING WELL
- MANCOS SHALE FORMATION MONITORING WELL
- DAKOTA SANDSTONE FORMATION MONITORING WELL
- DAKOTA SANDSTONE FORMATION BORING
- ENTRADA SANDSTONE FORMATION MONITORING WELL
- PAINTED DESERT MEMBER MONITORING WELL
- SONSELA SANDSTONE MEMBER MONITORING WELL
- SAMPLE EXCEEDING PERMIT CLEANUP LEVEL
- CONSTITUENT GROUP DETECTED
- D DUPLICATE SAMPLE
- F FILTERED SAMPLE
- J ESTIMATED CONCENTRATION

BY PHOTOGRAMMETRIC METHODS FROM AERIAL PHOTOGRAPHS TAKEN SEPTEMBER 28, 1995

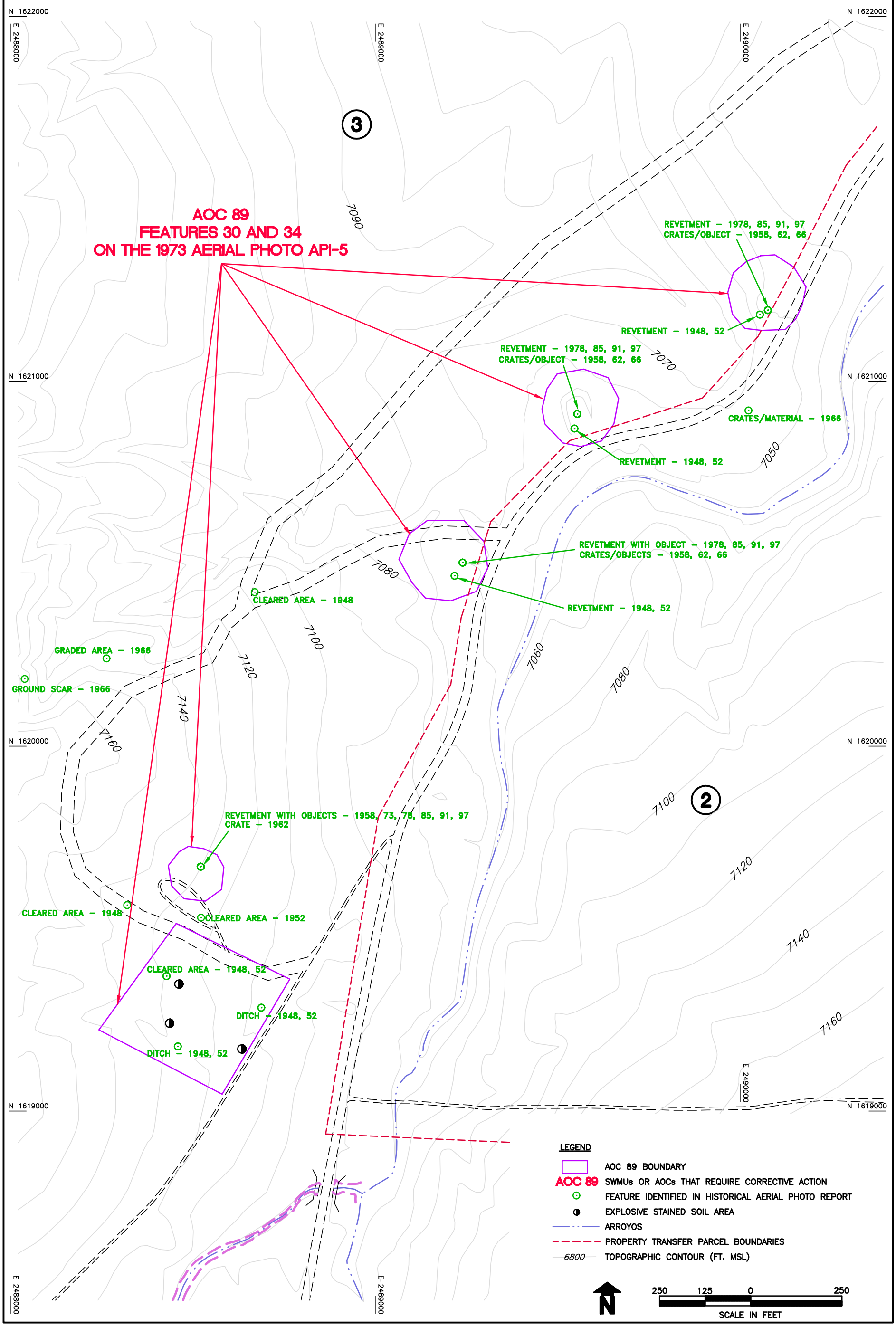
400 200 0 400 800
SCALE IN FEET

Figure 7-1
SWMU 74
Fort Wingate Depot Activity
McKinley County, New Mexico



TerraneaPMC, LLC

Figure 8-1
AOC 89
Fort Wingate Depot Activity
McKinley County, New Mexico



33211.51/02.17.08-DST/04.09.08-DST/1204-1C

Figure 9-1
AOC 90
Fort Wingate Depot Activity
McKinley County, New Mexico

AOC 90
FEATURE 36 ON THE 1973
AERIAL PHOTO API-5

POND – 1973, 78, 85

POND – 1978, 85

POND – 1952, 58

E 2485000 E 2485500 E 2486000 E 2486500 E 2487000 E 2487500

N 1613500 N 1613000 N 1612500 N 1612000

7290 7300 7320 7340 7360 7380 7400 7420 7440

LEGEND

- AOC 90 BOUNDARY
- AOC 90 SWMUs OR AOCs THAT REQUIRE CORRECTIVE ACTION
- FEATURE IDENTIFIED IN HISTORICAL AERIAL PHOTO REPORT
- 6-FOOT CHAIN LINK SECURITY FENCE WITH 3-STRAND BARBED WIRE TOP
- 5-STRAND BARBED WIRE FENCE
- ARROYOS
- PROPERTY TRANSFER PARCEL BOUNDARIES
- FWDA PROPERTY BOUNDARY, FEBRUARY 2002
- 6800 TOPOGRAPHIC CONTOUR (FT. MSL)

N

200 100 0 200

SCALE IN FEET

Figure 10-1
AOC 91
Fort Wingate Depot Activity
McKinley County, New Mexico

E 2490000 E 2490500 E 2491000 E 2491500 E 2492000 E 2492500

N 1612500 N 1612000 N 1611500 N 1611000

GATE 209B

CURRENT OB/OD AREA
SECURITY FENCE
OWNED BY ARMY

SOUTHERN
SECURITY FENCE
OWNED BY ARMY

GATE
(NO ID.)

7380 7400 7420 7440 7460 7480 7500 7520 7540 7560 7580 7600 7620 7640 7660 7680

AOC 91
FEATURE 41 ON THE 1973
AERIAL PHOTO API-5 AND FEATURE 27
ON THE 1978 AERIAL PHOTO API-7

PROB PIT – 1991

GROUND SCAR – 1978, 85
PROBABLE DEBRIS/OBJECT – 1973

PROBABLE DEBRIS/OBJECT – 1973
GROUND SCAR – 1985
EXCAVATION – 1978

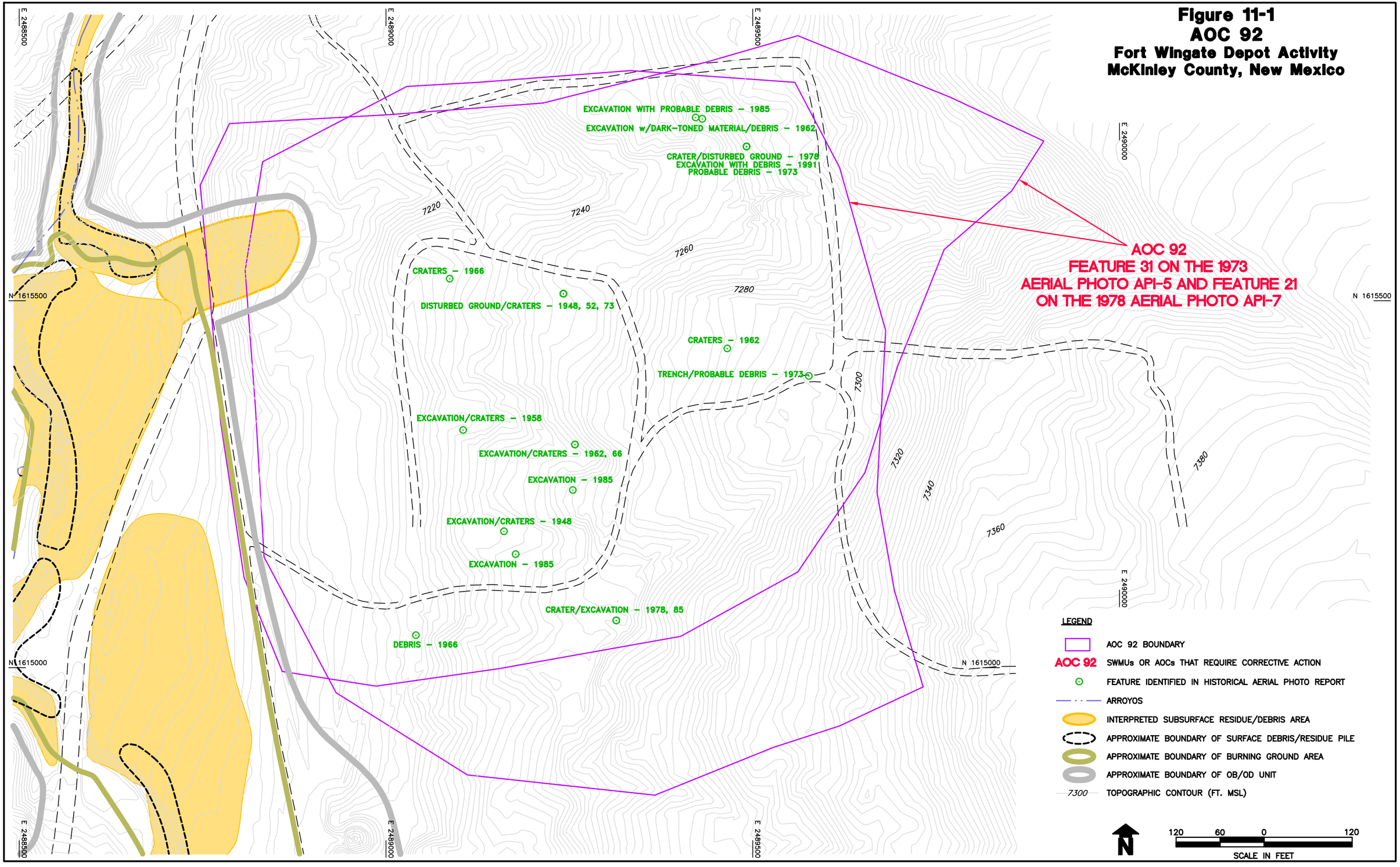
LEGEND

- AOC 91 BOUNDARY
- AOC 91 SWMUs OR AOCs THAT REQUIRE CORRECTIVE ACTION
- FEATURE IDENTIFIED IN HISTORICAL AERIAL PHOTO REPORT
- 6-FOOT CHAIN LINK SECURITY FENCE WITH 3-STRAND BARBED WIRE TOP
- 5-STRAND BARBED WIRE FENCE
- ARROYOS
- PROPERTY TRANSFER PARCEL BOUNDARIES
- 7600 TOPOGRAPHIC CONTOUR (FT. MSL)

N

200 100 0 200
SCALE IN FEET

Figure 11-1
AOC 92
Fort Wingate Depot Activity
McKinley County, New Mexico



TABLES

Table 3-1
List of MEC Encountered During Previous Investigations
Parcel 3
Fort Wingate Depot Activity
McKinley County, New Mexico

100LB General Purpose Bomb - Partial	50 cal. API	Det Lead, M20 Fuze	M49 Trip Flare
102mm Mortar	50 Cal. With Tracer	Explosive C4	M500 Series Fuze
105mm Brass \ Burn Rubble	57mm AP/HE	Frag	M503 Fuze
105mm Projectile	57mm Projectile	Fuze	M503A1 Fuze
107mm Projectile	60mm Mortar	Fuze and Frag	M506 Fuze
120mm Projectile	60mm with HE	Fuze Booster Cup	M52 Fuze
155mm Frag and Fuze	75-76mm Projectile	Fuze component	M52A1 Fuze
155mm Projectile	75mm HE projo (no fuze)	Fuze Components	M53 Fuze
2.75" Rocket Warhead	75mm Projectile	Fuze Detonator	M57 Fuze
20LB. Frag Bomb	75mm Projectile Frag	Fuze Detonator XM 756	M66 BD Fuze
20mm Projectile APT	75mm projo (WP)	Fuze Extender	M66 Fuze
20mm Projectile, HE	81mm Mortar	Fuze M111	M66A1 Full up
20mm Tracer Projectile	81mm Tail Boom	Fuze M56 Rotary Det.	M66A1 tracer
25 lb frag bomb (no fuze)	90 MM	Fuze VT Det Lead	M67 Fuze
3" Projectile	90mm HE projo (no fuze)	Fuzes - Artillery and Bomb	M68 Fuze
3" Rocket	90mm Projectile	M1 Burster	M72 Fuze
3.5 Rocket Motor	90mm Shell Casing	M103 Fuze	M83 Butterfly Bomblets
3.5" Rocket Base Fuze	Adapter 3.2 Sec. Delay	M104 Fuze	Mech time fuze (no clock)
3.5" rocket fuze	Base fuze/booster? (unknown)	M110A1 Fuze	MK 149 Fuze
3.5" Rocket Parts	BLU-3 Bomblet	M120 Fuze	Modified 60mm - M2 mine
37 to 40mm Projectile	BLU-4 Bomblet	M148 PD Fuze	PG-9 Rocket
37mm Projectile APT	BLU-4 Detonator	M149 Fuze	Primer Cartridge
37mm Shot Canisters	Bomb Frag (20 lbs.), AN/M41	M2 Bounding Mine	Primers Unknown
37mm Tracer Projectile	Bomblet Fuze M130	M2 Bounding Mine Parts	Projectile Fuze Comp.
40mm	Bomblet, M83 w/Fuze	M20 Booster	Projo 20mm HET
40mm HE projo	Booster Tube	M28 Fuze	Smoke Canister
40mm HE projo (no fuze)	Bulk High Explosive	M38 Fuze	Smoke Canister/Candle
40mm HE projo tracer	Burn Pans/Scrap	M40 mm	Tracer
40mm Projectile Fuze	Burster Tube	M404 Fuze	Unknown Items
40mm Red Phosphorus	Canister	M48 Fuze	
5" Zuni Rocket Warheads	Delay Element	M48 Fuze, SQ	

Table 4-1
Waste Sampling Summary
OB/OD Unit HWMU
Fort Wingate Depot Activity
Gallup, New Mexico

Waste Area	Description of Waste Materials Encountered	Visible Waste/Debris Volume Estimate (in-place cubic yards)	Number of Grab Samples for TCLP Analyses	Results Exceed TCLP Limits?	Number of Composite Samples for Total Constituent Analyses	Results Exceed Permit Cleanup Levels?
CRP1	Explosives stained soil; empty fuze cans, metal banding, ash, burn residue, ordnance fragments, and wood debris	500	1	No	2, plus 12 from drums on surface	Yes; Residue: RDX (2 samples), TNT (1 sample), and aluminum (1 sample) Drums: RDX (3 samples), aluminum (12 samples), arsenic (2 samples), and vanadium (1 sample)
CRP2	Burn residue, pieces of fuzes, ordnance fragments, demilitarized 75 mm projectiles	250	1	Yes; cadmium and lead	1	Yes; Aluminum, antimony, arsenic, cadmium, copper, iron, lead, nickel, and zinc (1 sample)
CRP3	Ash, slag, and burn residue, empty metal scrap propellant drums, metal banding, pieces of spotting candles, fuzes, and gray-green oxidation powder	750	1	No	2	Yes; TNT (1 sample), antimony (1 sample), aluminum, cadmium, copper, lead, and zinc (1 sample), and iron (2 samples)
CRP4	Rusty and widely scattered ordnance fragments on surface	N/A	0	N/A	0	N/A

Table 4-1
Waste Sampling Summary
OB/OD Unit HWMU
Fort Wingate Depot Activity
Gallup, New Mexico

Waste Area	Description of Waste Materials Encountered	Visible Waste/Debris Volume Estimate (in-place cubic yards)	Number of Grab Samples for TCLP Analyses	Results Exceed TCLP Limits?	Number of Composite Samples for Total Constituent Analyses	Results Exceed Permit Cleanup Levels?
CRP5	One live BLU-3 submunition, blown in place; burned 3.5 inch rocket motors and 3.5 inch rocket canisters, burned parachute flares, burned fuzes and fuze pieces; grenade cans; metal banding; chunks of high explosive mixed through packing material; ammo boxes, powder cases; gray, black and white ash and burn residue; explosives stained soil Pipes, steam headers with asbestos-containing material (ACM) wrapping; wood, wire, hinges; dunnage, cardboard, empty barrels, tin cans and steel beams.	1,600	2	Yes; barium	3	Yes; RDX (2 samples), TNT (3 samples), iron (1 sample), and lead (1 sample)
CRP6	Metal banding and debris, burned ammo boxes and burn residue, nails, hinges, hardware, ordnance fragments, numerous live projectiles, black ash	9,000	0	N/A	4	Yes; TNT (1 sample), antimony, iron, and vanadium (1 sample), and aluminum and copper (1 sample)
CRP7	Various projectiles (some live) and cases; ordnance fragments; ammo box hardware, metal banding; metal rods, braided steel cable, dunnage and packing materials, booster cups, fuze pieces, fragmentation bomb windings, miscellaneous debris, black ash and black stained soil	2,400	4	No	5	Yes; TNT (2 samples), arsenic (2 samples), and iron (2 samples)

Table 4-1
Waste Sampling Summary
OB/OD Unit HWMU
Fort Wingate Depot Activity
Gallup, New Mexico

Waste Area	Description of Waste Materials Encountered	Visible Waste/Debris Volume Estimate (in-place cubic yards)	Number of Grab Samples for TCLP Analyses	Results Exceed TCLP Limits?	Number of Composite Samples for Total Constituent Analyses	Results Exceed Permit Cleanup Levels?
CRP8	Two live M83 "butterfly" bomblets, blown in place; various projectiles (some live); ordnance fragments; fuzes, butterfly bomb pieces, metal banding, ammo box hardware, barrage rocket tubes, fragmentation bomb debris, metal boosters cups and other metal debris, dunnage, container lids, dark stained soil and fractured rock, black ash	15,500	2	No	11	Yes; RDX (samples), antimony (1 sample), arsenic (3 samples), copper (1 sample), iron (6 samples), lead (1 sample), thallium (1 sample)
CRP9	One live M83 "butterfly" bomblet, blown in place; numerous live projectiles, metal banding, fuze components, ordnance fragments, fragmentation bomb windings, ammo box hardware, butterfly bomb fragments, rust stains and white powder, firing wire, dunnage, ash/charcoal and miscellaneous charred debris	2,450	3	No	8	Yes; arsenic and iron (3 samples), arsenic (1 sample), and iron (1 sample)
CRP10	Burn residue, burned smoke cans, ash, ammo box hardware and scattered ordnance fragments	50	0	N/A	1	Yes; arsenic (1 sample)
CDC02	Dark brown/black soil with fractured rock and ordnance fragments	5,000	1	No	1	No
CDC04	Dark brown/black soil with fractured rock and ordnance fragments and ash	3,100	1	No	1	Yes; arsenic (1 sample)
CDC06	Dark stained soil with ash and ordnance fragments	170	0	N/A	0	N/A

Table 4-1
Waste Sampling Summary
OB/OD Unit HWMU
Fort Wingate Depot Activity
Gallup, New Mexico

Waste Area	Description of Waste Materials Encountered	Visible Waste/Debris Volume Estimate (in-place cubic yards)	Number of Grab Samples for TCLP Analyses	Results Exceed TCLP Limits?	Number of Composite Samples for Total Constituent Analyses	Results Exceed Permit Cleanup Levels?
CDC08	Black ash, metal banding, dunnage (packing materials), and ordnance fragments	300	1	No	1	Yes; iron and lead (1 sample)
CDC10	Dark stained soil (some with green coloring), ordnance fragments	3,670	1	No	1	No
	OB/OD Unit Total (does not include seven demolition craters not investigated)	**44,740**	18		53	

Table 5-1
Waste and Sampling Summary
Parcel 3 SWMUs
Fort Wingate Depot Activity
Gallup, New Mexico

Waste Area	Description of Waste Materials Encountered	Visible Waste/Debris Volume Estimate (in-place cubic yards)	Number of Grab Samples for TCLP Analyses	Results Exceed TCLP Limits?	Number of Composite Samples for Total Constituent Analyses	Results Exceed Permit Cleanup Levels?
SWMU 14, KGA3	Metal banding, metal pallets, melted metallic masses, cans and can lids, nails, hinges, and charcoal, ash, fuze components, multiple piles of scrap metal and branches, rods, wood, white insulation and rusted metal Large sized (up to 6' in diameter) metal debris from tanks and pipes, concrete blocks, residue, rebar; and three metal leaching tanks (5.5' wide by 15.2' long by 3.7' deep) and associated piping (all excavated and removed to trash pile at the southwest end of the Closed Area)	2,100	11	Yes; 2,4-DNT (1 sample) and barium (1 sample)	12	Yes; RDX (1 sample), TNT (2 samples), antimony, cadmium, copper, lead, molybdenum, and thallium (1 sample), arsenic (5 samples), barium (2 samples), iron (8 samples),and phosphorus (11 samples, EPA R6 value for white phosphorus used for screening because of reported WP disposal; as shown in figure only one result at 71,000 mg/kg is significantly higher than soil background)
SWMU 14, KGA4	Impact fuzes (both bomb and projectile), scrap metal, ordnance fragments, burn kettle slag, charcoal fragments, partially burned wood, nails, and white ash; white banding, burn residue; small oxidized metal fragments, fuze components, and metal banding, burnt fuzes Dull white, highly-oxidized aluminium or magnesium powdered waste consisting of rusted fuze components and pipe bombs	750	3	Yes; cadmium (1 sample) and lead (2 samples)	6	Yes; TNT (2 samples), aluminum and copper (1 sample), antimony (2 samples), arsenic (1 sample), cadmium (3 samples), lead (2 samples), and phosphorus (5 samples, EPA R6 value for white phosphorus used for screening because of reported WP disposal)

Table 5-1
Waste and Sampling Summary
Parcel 3 SWMUs
Fort Wingate Depot Activity
Gallup, New Mexico

Waste Area	Description of Waste Materials Encountered	Visible Waste/Debris Volume Estimate (in-place cubic yards)	Number of Grab Samples for TCLP Analyses	Results Exceed TCLP Limits?	Number of Composite Samples for Total Constituent Analyses	Results Exceed Permit Cleanup Levels?
SWMU 14, KGA5	Burn residue with metal fragments (nail, flat metal), clay bricks, ash, rusted nails, bullets, scrap metal	10	0	N/A	1	Yes; arsenic and iron (1 sample) and phosphorus (1 sample, EPA R6 value for white phosphorus used for screening because of reported WP disposal)
SWMU 14, KP2	Metal banding and ordnance fragments; debris on arroyo bank	125	3	No	3	Yes; phosphorus (3 samples, EPA R6 value for white phosphorus used for screening because of reported WP disposal)
SWMU 14, KP3	Debris on arroyo bank	90	0	N/A	0	N/A
SWMU 14, KP4	Rusted metal cans, cardboard tubes, melted aluminum, fuze components, burn residue, ammo boxes, charcoal, hinges, nails, and wire rope	400	1	No	1	Yes; iron (1 sample) and phosphorus (1 sample, EPA R6 value for white phosphorus used for screening because of reported WP disposal)
SWMU 15, KGA1	Several 75 mm projectiles, fuze pieces, smoke and flare ejectors, nails and hinges	140	2	No	2	Yes; TNT (1 sample), arsenic and iron (2 samples), and phosphorus (2 samples, EPA R6 value for white phosphorus used for screening because of reported WP disposal)

Table 5-1
Waste and Sampling Summary
Parcel 3 SWMUs
Fort Wingate Depot Activity
Gallup, New Mexico

Waste Area	Description of Waste Materials Encountered	Visible Waste/Debris Volume Estimate (in-place cubic yards)	Number of Grab Samples for TCLP Analyses	Results Exceed TCLP Limits?	Number of Composite Samples for Total Constituent Analyses	Results Exceed Permit Cleanup Levels?
SWMU 15, KGA2	40, 75, 90 and 155 mm projectiles, smoke and flare candles, nails and hinges, can lids, rusted mortars, metal rods	350	3	No	3	Yes; arsenic (3 samples), iron (2 samples), and phosphorus (3 samples, EPA R6 value for white phosphorus used for screening because of proximity to reported area of WP disposal)
SWMU 33, KP1	Two experimental projectiles (rusted and breached); 105 mm experimental mortars (rusted and breached or bent)	150	1	No	1	Yes; arsenic and iron (1 sample) and Yes; arsenic and iron (1 sample) and phosphorus (1 sample, EPA R6 value for white phosphorus used for screening because of reported WP disposal)
	Parcel 3 SWMUs Total (does not include three mounds and buried materials in between mounds that NMED included as part of SWMU 15, which have not been investigated)	**4,115**	18		53	

Table 6-1
Monitoring Well Construction Data
Parcel 3
Fort Wingate Depot Activity
McKinley County, New Mexico

WELL ID	FWDA PARCEL	DATE INSTALLED	DRILLING METHOD	NORTHING	EASTING	GROUND ELEVATION (FT AMSL)	TOP OF CASING ELEVATION (FT AMSL)	PVC STICKUP (FEET)	CASING DIAMETER (INCHES)	BOREHOLE DIAMETER (INCHES)	TOTAL DEPTH DRILLED (FT BGS)	TOTAL WELL DEPTH (FT TOC)	SCREEN LENGTH (FEET)	SCREENED INTERVAL (FT BGS)	SCREENED INTERVAL (FT AMSL)	SCREENED FORMATION
CMW02	3	8/15/1996	A.R.	1612192.54	2489293.48	7256.61	7258.29	2.30	2.0	8.0	43.00	37.90	10.0	25.0 - 35.0	7230.39 - 7220.39	Silty Clay
CMW04	3	8/15/1996	A.R.	1612725.21	2489318.83	7249.50	7251.21	2.30	2.0	8.0	136.60	137.91	20.0	115.0 - 135.0	7133.30 - 7113.30	Silty Clay
CMW06	3	10/5/1996	H.S.A.	1613477.48	2489087.84	7214.13	7216.05	2.50	2.0	4.0	18.60	21.10	10.0	8.3 - 18.3	7204.95 - 7194.95	Silty Clay/Silty Sand
CMW07	3	8/12/1996	H.S.A./A.R.	1613480.48	2488966.63	7233.61	7235.50	2.30	2.0	8.0	65.80	66.60	20.0	44.0 - 64.0	7188.90 - 7168.90	Clayey Silt/Sandstone
CMW10	3	10/1/1996	H.S.A./A.R.	1614801.00	2488526.03	7177.71	7179.59	2.50	2.0	8.0	70.85	73.10	20.0	50.5 - 70.5	7126.49 - 7106.49	Silty Clay
CMW14	3	9/30/1996	H.S.A./A.R.	1615834.07	2488638.27	7151.56	7153.57	2.50	2.0	9.0	94.55	96.75	10.0	84.2 - 94.2	7066.82 - 7056.82	Silty Clay
CMW16	3	9/6/1996	H.S.A./A.R.	1618788.98	2488995.95	7082.17	7084.23	2.00	2.0	8.0	31.80	32.72	10.0	20 - 30	7061.51 - 7051.51	Siltstone/Sandstone
CMW17	3	8/17/1996	H.S.A./A.R.	1615859.71	2488582.77	7143.72	7145.39	1.60	2.0	8.0	53.00	54.24	20.0	32.0 - 52.0	7111.15 - 7091.15	Silty Clay
CMW18	3	8/21/1996	H.S.A./A.R.	1615884.92	2488504.36	7156.63	7158.58	1.95	2.0	8.0	53.00	54.10	20.0	32.0 - 52.0	7124.48 - 7104.48	Silty Clay/Clayey Silt
CMW19	3	9/28/1996	H.S.A./A.R.	1616765.47	2488680.89	7128.11	7130.19	2.50	2.0	8.0	52.80	51.30	15.0	33.5 - 48.5	7093.89 - 7078.89	Silty Clay
CMW20	3	10/5/1996	H.S.A.	1613921.11	2489020.65	7193.14	7194.98	2.50	2.0	4.0	5.80	8.15	3.0	2.5 - 5.5	7189.83 - 7186.83	Clayey Sand
CMW21	2	8/12/1998	H.S.A./A.R.	1618931.33	2488996.93	7083.66	7085.16	1.50	2.0	5.5	74.50	69.44	10.0	57-67	7025.72 - 7015.72	Sandstone/Siltstone
CMW22	2	8/10/1998	H.S.A./A.R.	1619789.76	2489134.45	7077.48	7078.98	1.50	2.0	5.5	122.00	69.30	20.0	96.5-116.5	7029.68 - 7009.68	Sandstone/Siltstone
CMW23	2	9/4/1998	H.S.A./A.R.	1621476.93	2490358.70	7030.22	7032.42	2.20	2.0	5.5	112.00	106.60	20.0	84-104	6945.82 - 6925.82	Sandstone
CMW24	3	7/31/1998	H.S.A./A.R.	1618994.16	2488774.57	7094.94	7096.67	1.73	2.0	6.3	262.00	262.34	30.0	230-260	6864.33 - 6834.33	Sandstone
CMW25	2	9/15/1998	H.S.A./A.R.	1622766.19	2490167.82	7002.19	7004.52	2.33	2.0	5.0	97.00	98.78	25.0	71-96	6930.74 - 6905.74	Sandstone
KMW09	3	9/28/1996	H.S.A./A.R.	1616770.94	2486174.10	7186.54	7188.38	2.50	2.0	9.0	80.40	72.90	10.0	60 - 70	7125.48 - 7115.48	Silty Clay/Sandy Clay
KMW10	3	9/27/1996	H.S.A./A.R.	1618066.38	2487828.13	7129.65	7131.73	2.50	2.0	8.0	168.45	171.02	10.0	158 - 168	6970.71 - 6960.71	Siltstone/Sandstone
KMW11	3	8/6/1996	H.S.A.	1618633.16	2488523.98	7107.25	7109.04	1.80	2.0	9.0	63.00	57.44	20.0	35 - 55	7071.60 - 7051.60	Silty Clay
KMW12	3	9/2/1998	H.S.A./A.R.	1616474.97	2486128.70	7188.48	7190.23	1.75	2.0	8.8	75.00	75.49	20.0	53-73	7134.74 - 7114.74	Claystone
KMW13	3	8/17/1998	H.S.A./A.R.	1617202.52	2486607.02	7163.82	7165.62	1.80	2.0	8.8	52.50	53.83	20.0	32-52	7131.79 - 7111.79	Clayey/Sandy Shale
FW24	2	11/13/1980	H.S.A.	1622438.23	2491682.83	6991.91	6993.91	2.00	4.0	8.0	25.00	24.35	15.0	8-23	6984.56 - 6969.56	Clay
FW31	19	11/14/1980	H.S.A.	1631055.13	2504816.16	6825.71	6827.71	2.00	4.0	8.0	50.00	52.00	40.0	10-50	6815.71 - 6775.71	Clay
FW38	3	11/19/1993	H.S.A.	1614874.93	2488534.12	7169.43	7172.35	2.92	2.0	3.0	7.50	10.55	ND	ND	ND - ND	ND

Notes:

FT AMSL = Feet Above Mean Sea Level
FT BGS = Feet Below Ground Surface
FT TOC = Feet Below Top of Casing
ND = No Data Available

Drilling Method

A.R. = Air Rotary
H.S.A. = Hollow Stem Auger
W.R. = Wet Rotary