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SUBJECT: Final Report – Preliminary Assessment/Site Inspection of DP-63

1. Enclosed is the Final Report – Preliminary Assessment/Site Inspection of DP-63.

2. If you have any questions, please contact Mr. Court Fesmire or Mr. Jose Gallegos at (505) 572-5395.

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Enclosure:
Final Report – Preliminary Assessment/Site Inspection of DP-63

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Final Report for the Preliminary Assessment/Site Inspection of DP-63—Disposal Pit 63

Holloman Air Force Base,
New Mexico

January 2001

49 CES/CEV
Holloman Air Force Base,
New Mexico

Project Number: KWRD19997001

FINAL REPORT
FOR THE PRELIMINARY ASSESSMENT/SITE INSPECTION OF DP-63—DISPOSAL PIT 63

HOLLOMAN AIR FORCE BASE, NEW MEXICO

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Under Contract No. DACW45-94-D-0003
Delivery Order No. 22, Work Authorization Directive 1

U.S. Army Corps of Engineers
Omaha District
Omaha, Nebraska

January 2001

Project Number: KWRD19997001

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF ACRONYMS

AFB	Air Force Base
bgs	below ground surface
DP-63	Disposal Pit 63
EMI	electromagnetic induction
EOD	explosive ordnance disposal
EPA	United States Environmental Protection Agency
ft	feet
GPS	global position system
mg/kg	milligrams per kilograms
mg/L	milligrams per liter
msl	mean sea level
NMED	New Mexico Environment Department
PA	Preliminary Assessment
PCB	polychlorinated biphenyl
PID	photoionization detector
POL	petroleum, oil, and lubricants
PVC	polyvinyl chloride
QAPP	Quality Assurance Project Plan
RCRA	Resource Conservation and Recovery Act
SI	Site Inspection
SVOC	semivolatile organic compound
SWMU	Solid Waste Management Unit
TAL	target analyte list
TDS	total dissolved solids
TPH	total petroleum hydrocarbons

LIST OF ACRONYMS (Continued)

USACE	U. S. Army Corps of Engineers
UST	underground storage tank
UXO	unexploded ordnance
VOC	volatile organic compound
WQCC	Water Quality Control Commission

EXECUTIVE SUMMARY

A Preliminary assessment (PA)/Site Inspection (SI) was conducted at Disposal Pit 63 (DP-63) at Holloman Air Force Base (AFB), New Mexico. The investigation was required to evaluate the extent of abandoned ammunition disposal pits in the area and to determine whether past releases there have impacted soil and groundwater. DP-63 is located in the northern portion of the Ammunition Storage Facility on the eastern side of Holloman AFB.

During the PA/SI, three areas were investigated within DP-63: the East Area; the West Area; and the North Area, which was discovered as a potential site during this investigation. Geophysical surveys were performed in all three areas to locate and determine the extent of any buried metal debris. Based on a record search, review of utility data and the geophysical survey, four DPT (direct push technology) sampling locations were selected. Samples were collected from these four DPT borings in order to assess the impact of site activities on the soil and groundwater at DP-63.

Analytical results for the soil samples collected at DP-63 showed detections of total recoverable petroleum hydrocarbons (TRPH), volatile organic compounds (VOCs), semivolatile organic compounds (SVOCs), cyanide, and metals. VOC and SVOC detections in the East Area are likely due to the presence of fuels that remain in the place since disposal operations ceased. TRPH detections indicate a low-level presence of fuel remaining in the soil at the East and West Areas. Analytical results confirmed that the groundwater at DP-63 contains no explosives and that free-phase fuel product was not observed in any groundwater samples. However, the presence of organic constituents in saturated soil samples collected, indicates that groundwater is potentially impacted by dissolved constituents.

Based on the results of the PA/SI investigation at DP-63, additional investigation and data evaluation is warranted. Due to the North Area being discovered as a potential disposal site during this investigation, only geophysical survey was conducted in this area. Therefore, it is recommended that an additional investigation include soil and groundwater sampling in the North Area to determine whether the environment has been impacted by past site activities.

Based on the detections in the saturated soils of the East and West Areas, it is also recommended that additional groundwater samples be collected for analysis of VOCs and SVOCs. Finally, a screening-level risk assessment should be conducted at DP-63 to evaluate the risk to human health and the environment.

1.0 INTRODUCTION

This report presents the results of the Foster Wheeler Environmental Corporation (Foster Wheeler) Preliminary Assessment (PA)/Site Inspection (SI) of Disposal Pit 63 (DP-63) at Holloman Air Force Base (AFB), New Mexico (Figure 1-1). The investigation, performed under the oversight of the New Mexico Environment Department (NMED, was required to evaluate the location and extent of abandoned ammunition disposal pits in the area and determine whether past releases there have impacted soil and groundwater. The PA/SI, which was conducted following United States Environmental Protection Agency (EPA) guidance under the Comprehensive Environmental Response, Compensation, and Liability Act (EPA, 1991; 1992), was performed for the U.S. Army Corps of Engineers (USACE), Omaha District, under Total Environmental Restoration Contract Number DACW-45-94-D0003. The PA/SI field activities were conducted in accordance with the work plan (Foster Wheeler, 2000a), as described in Section 2.0.

1.1 PURPOSE

The purpose of this report is to present the results of the PA/SI of DP-63 and the surrounding area. These results were used to complete the following assessments:

- Confirm the existence of disposal features at three investigation sites
- Evaluate soil and groundwater sampling results, along with information on site cultural features, to assess whether soil and/or groundwater have been impacted by site activities

The conclusions of the assessments listed above were then used to support recommendations for the future investigation of DP-63.

Foster Wheeler personnel conducted interviews with Base personnel, performed a records search, and conducted a geophysical survey of three sites to determine the presence of the buried metal debris and other potential sources. Based on these results, Foster Wheeler personnel located, drilled, and sampled four direct-push technology (DPT) soil borings to assess the presence and extent of soil and groundwater contamination.

1.2 SITE DESCRIPTION AND BACKGROUND

DP-63 is located in the northern portion of the Ammunition Storage Facility on the eastern side

of the Base (Figure 1-2). Originally, the disposal pit areas were located immediately north and outside of the facility, but expansion of the storage yard in the 1960s enclosed the site within the compound. Two separate disposal pit areas were originally identified by Base Explosive Ordnance Disposal (EOD) personnel:

- Site 1— East Area: Located on the east side of DP-63, this site covers an area of approximately 15,000 square feet (ft) and may contain up to several distinct disposal pits that extend to depths ranging from 6 to 8 ft below ground surface (bgs).

- Site 2 — West Area: Located on the west side of DP-63, this small disposal feature covers an area up to 100 square ft and extends to a depth of 6 ft bgs.

An additional site was discovered during reconnaissance activities in April 2000. This site, designated the North Area in this report, is located north of the Ammunition Storage Facility outside of the fence and was previously noted by Base personnel as an area of potential disposal. No investigations of these three sites were performed prior to the PA/SI. All information presented in this report was acquired through discussions with USACE and Base personnel.

During past operations, munitions were placed into the disposal pits with diesel fuel and wood pallets and ignited to render the ordnance inert. Fuel may have seeped into the soil directly below the disposal areas. The types of ordnance that were treated include munitions ranging from 20-caliber to 50-caliber small arms rounds and grenades. DP-63 was previously referred to as the "bomb dump" by Base EOD personnel. Base environmental personnel performed a visual inspection of the area during summer 1997 and found scrap metal fragments from disposed munitions exposed on the ground surface throughout the area as a result of erosion. The Holloman AFB Resource Conservation and Recovery Act (RCRA) Part B permit requires the Base to identify potential solid waste management units (SWMUs) and determine whether this site should be classified as a SWMU requiring corrective action investigation under RCRA.

1.3 DOCUMENT ORGANIZATION

This PA/SI report presents information gathered as a result of personal interviews conducted with Base personnel, a search of available Base records, and field investigation activities, to support recommendations for DP-63. The remainder of this report is organized into the

following sections:

- Section 2.0 — PA/SI Field Investigation
- Section 3.0 — Physical Setting
- Section 4.0 — Contamination Assessment
- Section 5.0 — Conclusions and Recommendations
- Section 6.0 — References

Figures and tables are found at the end of each section.

Appendix A provides supporting information necessary to evaluate the chemical analytical data, and it is presented in the form of the Data Quality Control Summary Report and accompanying laboratory reports. Appendix B presents field borehole logs. Current photographs and historical aerial photographs of DP-63 and the surrounding area are provided in Appendix C.

2.0 PA/SI FIELD INVESTIGATION

This section of the PA/SI Report explains the objectives and technical approach of each field activity performed for DP-63 investigation. This section also explains the sampling rationale, techniques, and locations for the PA/SI effort that were used to evaluate the extent of any soil and/or groundwater contamination in the area.

The PA/SI field activities were conducted in the following series of steps:

1. A records search was performed and Holloman AFB utility maps were reviewed to determine the areas of potential concern.
2. A geophysical survey was performed to locate and determine the extent of any buried metal debris in the area.
3. Four DPT sampling locations were selected to assess the presence and extent of any munitions along with the extent of any soil and/or groundwater contamination.

With this approach, information obtained from steps 1 and 2 was used to select the location of the four DPT borings (Step 3). The investigative steps and related activities are described in more detail in the following sections.

2.1 GEOPHYSICAL INVESTIGATION

The final work plan presented the procedures for conducting a geophysical investigation at two areas in the vicinity of DP-63. Geophysical surveys were conducted in the West and East Areas of the site as shown in Figure 2-1. The geophysical surveys at DP-63 took place March 13–16, 2000.

A supplemental geophysical investigation took place at DP-63 on September 25–27, 2000, to support the PA/SI. The objectives of the geophysical investigations at the two original sites included detecting, locating, and characterizing the extent of metal debris associated with a suspected munitions disposal site. The additional site, designated the North Area, is located approximately 200 ft from the Ammunition Storage Facility fence line, directly north of the area investigated during the PA/SI in April 2000. The supplemental geophysical survey area appears to have been cleared of vegetation and graded prior to the expansion of the Ammunition Storage

Facility and the installation of the northern perimeter fence. Spent munitions are currently present on the ground surface in the North Area that primarily consist of small arms casings, and is similar to the areas investigated during the PA/SI field program.

The objective of the Phase II geophysical investigation at DP-63 was to determine the location and extent of an abandoned ammunition disposal site. The geophysical method best suited and used for this type of characterization was electromagnetic induction (EMI). EMI instruments are sensitive to both ferrous and nonferrous metals and are able to detect a buried 55-gallon drum or a 10-inch pipe to depths approaching 10 ft.

2.1.1 Methodology

EMI techniques can also detect lateral changes in ground conductivity. Conductivity contrasts in the earth can be caused by natural phenomena such as lithologic changes, or by man-made phenomena such as disturbed ground, buried materials, or contaminants in the soil or groundwater.

EMI instrumentation operates on one of two principles, commonly referred to as time-domain EMI (EM61) or frequency-domain EMI (GEM 3, EM38, and EM31). The time-domain EMI system used during the PA/SI employs a coil that generates a pulsed (i.e., time-based) primary magnetic field in the earth, which induces eddy currents in conductive media. The decay of these eddy currents produces a secondary magnetic field measured by the same coil. If the secondary field is measured at a relatively long time after the start of the decay, the current induced in the relatively nonconductive ground will fully dissipate, while the current in the conductive media (usually metallic objects) continues to produce a secondary magnetic field. The measured response is reported in units of millivolts.

2.1.2 Data Acquisition, Processing, and Interpretation

Three areas at DP-63 were surveyed using geophysics as presented below:

- West Area — Survey grid was approximately 120 ft by 120 ft.
- East Area — Survey grid was approximately 275 ft by 150 ft.

- North Area — Survey grid was approximately 290 ft by 290 ft.

The EMI data were collected approximately every 0.5 ft (7 samples per second) along lines spaced 3 ft apart at each area. A Geonics EM61 Time-Domain electromagnetic instrument was used to collect EMI data at each area. Data were acquired using the procedures discussed in the work plan addendum (Foster Wheeler, 2000b). Site cultural features were mapped to achieve a more complete understanding of the relationships between the observed site characteristics and the geophysical data. The locations of the geophysical survey areas are presented in Figure 2-1.

Data files for the survey areas were checked for proper geometry and recording interval with internally developed software in conjunction with Geonics software. Relative X (east-west) and Y (north-south) location coordinates were assigned to each EMI data point. Data were then formatted for input into the Geosoft software package for analysis and interpretation. The objective of the data analysis and interpretation phase was to characterize the responses from the geophysical data in terms of their most probable sources (i.e., underground storage tank (UST), pipeline, debris trench or pit, etc.).

A color-coded map was generated for each area showing the Channel 2 EMI response (Figures 2-2 through 2-4). Two channels were recorded by the EM61 instrument, and both were used for the interpretation. However, for display purposes, the Channel 2 map was sufficient for presenting the geophysical data. Background values are colored green, and anomalies are colored blue, yellow, red, and pink, depending on the intensity (note color bar on figure). Many of the anomalies are due to surface features such as miscellaneous metal debris and fragments.

There was only one significant anomaly detected at the West Area, located at approximately 62E, 52N. This anomaly is shallow (less than 1 ft), not very large in area, and does not appear to contain a significant amount of buried metal (equivalent to the size and metallic content of a crushed 55-gallon drum). There are miscellaneous small arms (30-caliber and 50-caliber cartridges and bullets) scattered throughout the area.

At the East Area, there appears to be an area of subsurface disposal at approximately 50E to 90E and 75N to 100N. The depth of the anomaly is shallow (less than 2 ft) and contains the equivalent volume and metallic content of two or three 55-gallon drums. There are

miscellaneous small arms (30-caliber and 50-caliber cartridges and bullets) scattered throughout the area.

At the North Area, there were large amounts of scrap metal and exploded ordnance fragments scattered throughout the area. There are numerous EM61 anomalies within the survey area, some of which are due to surface scrap and/or exploded ordnance fragments and some due to subsurface metal. At the center of the survey area (140E, 150N), there was a higher concentration of scrap and exploded ordnance fragments that coincided with anomalous EM61 readings representative of significant amounts of buried metal (equivalent in volume and metallic content of five, or more, 55-gallon drums). Within the survey area, there is a low soil berm (approximately 6 inches high) that surrounds the area that may be related to previous open burning and open detonation activities.

2.2 DIRECT-PUSH TECHNOLOGY SOIL AND GROUNDWATER SAMPLING

Based on the results of the records search and geophysical surveys of the West and East Areas, four DPT boring locations (DP01, DP02, DP03, and DP04) were selected to assess the presence of any soil and/or groundwater contamination. The locations of these DPT locations are presented in Figure 2-1. Table 2-1 presents a summary of the DPT locations and the rationale for each location sampled during the PA/SI.

2.2.1 Direct-Push Technology Soil Sampling

Prior to drilling, the ground surface at all borehole locations was cleared for unexploded ordnance (UXO) by trained personnel. A downhole UXO clearance was then performed for every 2 ft of drilling to a depth of 12 ft. All UXO clearance activities were conducted in accordance with the final work plan (Foster Wheeler, 2000a). As a result of the UXO clearance, boring DP-63 was moved 4 ft south of its original location because subsurface metallic debris was detected at a depth of 3 to 4 ft.

Subsurface soil samples were collected at DPT locations DP01, DP02, DP03, and DP04. Three subsurface soil samples were collected at each of the DPT locations. A total of 12 subsurface soil samples, plus 1 field duplicate were collected from the four DPT locations. Soil samples were analyzed off site for volatile organic compounds (VOCs), semivolatile organic compounds

(SVOCs), pesticides, polychlorinated biphenyls (PCBs), total recoverable petroleum hydrocarbons (TRPH), and target analyte list (TAL) metals. The samples were analyzed in accordance with the Quality Assurance Project Plan (QAPP) presented in the final work plan (Foster Wheeler, 2000a).

Using the DPT drilling rig, subsurface soil cores (4-ft in length) were collected continuously from the ground surface to the water table at each DPT location. Soil contained within the core was used for lithologic description and subsequent sample collection. Sampling intervals were selected during drilling for off-site chemical analysis from soil that exhibited any noticeable odor, staining, or elevated photoionization detector (PID) readings based on field headspace screening. Soil samples were collected in 8-ounce glass jars and immediately placed on ice. Soil drilling logs containing a description of the soil encountered during drilling are presented in Appendix B.

During drilling, no odor, staining, or elevated PID readings were detected in the soil cores brought to the surface. Samples were collected at the following approximate depths: 7 ft, 20 ft, and at the water table. Samples were collected at approximately 7 ft because the disposal pits at DP-63 were noted by Base personnel as "being 6 to 10 feet in depth" (Cimino, 2000). Samples collected at 20 ft were selected because, at the time of sampling, this depth represented the approximate depth one-half of the distance to the water table. Samples were also collected at the water table to aid in evaluating the potential presence of contamination in saturated soil at the capillary fringe. Based on hydrogeologic information available for the area of Holloman AFB, the depth to groundwater at DP-63 was originally expected at 35 to 40 ft bgs; instead, groundwater was encountered at depths ranging from 41 to 46 ft bgs across this site.

An evaluation of the soil sample analytical results is presented in Section 4.2.

2.2.2 Direct-Push Technology Groundwater Sampling

The four DPT boreholes were converted to groundwater sampling points by extending the DPT drill rods approximately 3 to 5 ft below the water table. The DPT drill rods were then retracted from the borehole to the ground surface and a temporary 2-inch-diameter, schedule 40 polyvinyl chloride (PVC) well was installed. Each well consisted of 10-ft of screen with approximately 5

ft of screen below the water table and 5 ft of screen above the water table. The remaining length of the borehole consisted of 2-inch-diameter schedule 40 PVC blank PVC.

Three of the four temporary well points (DP02, DP03, and DP04) were sampled using a 1/2-inch-diameter disposable bailer, while the other well (DP01) was sampled using Teflon® tubing attached to a peristaltic pump. Prior to collection of each groundwater sample, a single volume of groundwater contained in the sampling device was purged.

During sampling, the groundwater was visually inspected for any sign of a petroleum sheen and checked for odor. There were no visual signs of free-phase product, or oily sheen, and no distinguishable odor was noted in the groundwater sampled at DP-63. After the groundwater samples were collected, the temporary well point was removed and the boreholes were abandoned with hydrated bentonite chips. The water table was initially encountered at approximately 45 to 47 ft bgs. After the well points were installed and groundwater was allowed to stabilize, the depth to groundwater ranged from 41 to 46 ft bgs.

A total of four DPT groundwater samples, including one field duplicate, were collected during the PA/SI field investigation. The groundwater samples were analyzed for explosives (EPA Method 8330). An evaluation of the groundwater sample analytical results is presented in Section 4.3.

2.4 LOCATION AND ELEVATION SURVEYING

Trained site personnel operated a portable global positioning system (GPS) unit to survey PA/SI sample locations, geophysical survey area corners, and the position of important site cultural features. These data were used to create an accurate map for the PA/SI Report. All survey data obtained with the GPS unit are reported in New Mexico state planar coordinates and are based on the 1983 North American Datum used by the Holloman AFB geographic information system. The survey data have been entered into the Environmental Resource Program Information Management System for data storage and reporting.

3.0 PHYSICAL SETTING

This section describes the environmental setting of Holloman AFB including detailed discussions of physiography, geology, hydrology, and hydrogeology. The information was compiled from existing Base records, published literature, previous reports, and the PA/SI field activities.

3.1 GEOGRAPHY

Holloman AFB is situated in south-central New Mexico, in the northwest-central part of Otero County (Figure 1-1). The Base occupies about 50,000 acres in the northeast quarter of Township 17S, Range 8E. The White Sands Missile Range testing facilities occupy additional land to the north. Private and public lands border the remainder of the Base. The major highway serving the Base is New Mexico Highway 70, which runs southwest from the City of Alamogordo and forms a boundary between the Base and public lands. The City of Alamogordo is located approximately 7 miles east of the Base. With a population of approximately 31,000, it is the only town of appreciable size within 40 miles of the Base. Holloman AFB has a population of approximately 5,500.

3.2 PHYSIOGRAPHY

The Base is located in the Tularosa Basin, which is bounded by the San Andres Mountains approximately 30 miles to the west and the Sacramento Mountains located approximately 10 miles to the east. The interior of the Tularosa Basin plain has low relief, with elevation ranging from about 4,000 ft above mean sea level (msl) in the southwest to about 4,400 ft above msl in the northeast. The surrounding mountains reach 7,000 to 12,000 ft in elevation.

The climate in the Tularosa Basin is arid with low annual rainfall and low relative humidity. The surrounding mountain ranges greatly influence local weather, since they modify approaching weather systems and provide orographic lifting, which produces summer thunderstorms. The mean annual precipitation is 7.9 inches, mostly from thunderstorm activity from May through October. Winter is generally dry and is characterized by clear skies and occasional snowfall. The period from March through May is characterized by strong southerly wind flow and periods of blowing dust and sand.

3.3 REGIONAL GEOLOGY

The Tularosa Basin is a bolson, or a basin that has no surface drainage outlet. Bolson deposits are sediments carried by water into a closed basin. The bolson fill in the Tularosa Basin is derived from the erosion of limestone, dolomite, and gypsum in the surrounding mountains. Coarser material is deposited at the base of the mountains; finer material is carried to the basin's interior. The near-surface bolson deposits consist of sediments that are of alluvial, eolian (wind-blown), and lacustrine (lake-bed), or playa origin.

Alluvial fan deposits are characteristically laterally discontinuous units of interbedded sand, silt, and clay; the eolian deposits consist primarily of gypsum sand. Alluvial and eolian deposits are often indistinguishable because of the reworking of alluvial sediments by eolian processes. Lacustrine, or playa, deposits in the area consist of clay containing gypsum crystals and are juxtaposed with alluvial fan and eolian deposits throughout the base (Foster Wheeler and Radian, 1994).

3.4 HYDROLOGY AND HYDROGEOLOGY

Both surface water and groundwater contribute to the hydrological and hydrogeological setting at Holloman AFB and are described in detail below, along with a discussion of the hydrology specific to DP-63.

3.4.1 Regional Surface Water Hydrology

Since the Tularosa Basin is a closed basin with no surface water outlet, water is lost to evaporation, transpiration, and infiltration. Water also collects in Lake Lucero, the lowest point in the basin, which is approximately 20 miles southwest of Holloman AFB.

Holloman AFB is crossed by several southwest-trending arroyos that control surface drainage in the undeveloped part of the Base (Figure 3-1). These arroyos consist of Hay Draw, in the far northern part of the Base; Malone Draw and Ritas Draw, which drain into Lost River; and Dillard Draw to the east, which runs in a southwesterly direction along the eastern and southern boundaries of the Base. Lost River, the largest arroyo, is dammed within the Base, near the western boundary, and runoff from Lost River, Malone Draw, and Ritas Draw collects in the dammed area. Drainage within the developed portions of the Base flows through ditches and

culverts to various outfall areas.

The mean annual lake evaporation rate, commonly used as an estimate of the mean annual evapotranspiration potential, is approximately 67 inches per year (Foster Wheeler and Radian, 1997). Therefore, the amount of precipitation that infiltrates the soil in this part of the basin is very low.

3.4.2 Regional Groundwater Hydrogeology

Groundwater occurs under unconfined conditions in the unconsolidated bolson deposits beneath Holloman AFB. The primary source of recharge for groundwater in the bolson aquifer is percolation of rainfall and stream runoff through the coarse, unconsolidated alluvial fan deposits along the western flank of the Sacramento Mountains. Water migrates downward into the alluvial sediment at the edge of the shallow bolson aquifer and flows downgradient through progressively finer-grained sediment into the basin. Beneath Holloman AFB, the depth to groundwater ranges from less than 5 ft to nearly 50 ft bgs.

In the vicinity of Holloman AFB, groundwater generally flows toward the west and southwest, following surface topography. In the southeastern portion of the Base, groundwater generally flows southwest toward the Dillard Draw surficial drainage system. In the northern and western portions of the Base, groundwater flows more to the west toward the Ritas Draw, Malone Draw, and Lost River drainages. Groundwater flow is affected by local topography in areas immediately adjacent to arroyos, where groundwater flows directly toward the drainages regardless of the regional flow pattern.

Water quality in the Tularosa Basin is relatively fresh near the recharge areas at the base of the mountains, but degrades as a result of an increase in dissolved solids as the groundwater flows toward the interior of the basin.

On the basis of New Mexico Water Quality Control Commission (WQCC) Regulations (New Mexico WQCC 82-1, as amended through August 18, 1991, Parts 3-100 through 3-103), the groundwater beneath Holloman AFB is designated as unfit for human consumption because it exceeds New Mexico human health standards for total dissolved solids (TDS) and sulfate. Using EPA guidelines (EPA, 1986), the groundwater is Class IIIB. Class III groundwater is

characterized by a TDS concentration greater than 10,000 milligrams per liter (mg/L) and is, therefore, not considered a source or a potential source of drinking water. Class IIIB groundwater is also characterized by a low degree of interconnection with adjacent surface waters or groundwater of a higher class. Groundwater does not discharge or connect to any adjacent aquifers because the Tularosa Basin is a closed basin. Adjacent surface waters include Lost River and Lake Holloman, which also have high concentrations of TDS, and are not considered potential drinking water sources.

3.4.3 Site-Specific Hydrology

The DP-63 area is underlain by silts, clays, and silty clays that contain an abundance of gypsum crystals within the unsaturated vadose zone. These lithologies are laterally discontinuous over the distance between the West and East Areas.

The depth to groundwater in the DP-63 area ranges from approximately 41 ft bgs in the Western Area to a maximum depth of 46 ft bgs in the Eastern Area.

Surface water features do not exist within the DP-63 area. The closest surface water features proximal to DP-63 are Ritas Draw, approximately 1 mile to the northwest, and Dillard Draw, an unnamed draw located due east within one-half mile. DP-63 is relatively flat and slopes toward the east. There are no culverts emanating from the site that flow directly into any of the draws in the vicinity.

3.5 CURRENT AND FUTURE LAND USE

The land surrounding Holloman AFB consists of residential areas to the east and northeast (City of Alamogordo), rangeland to the south, the White Sands National Monument to the west, and areas where military activities are conducted to the north. The desert terrain of the area immediately surrounding Holloman AFB has limited development, and there are no agricultural operations, residential communities, or large industrial operations located adjacent to the Base. Holloman AFB is an active military installation and is expected to remain active for the foreseeable future. No transfer of military property to the public is anticipated, and public access to the Base is restricted.

Residential development on the Base is limited by environmental and operational constraints imposed by the 100-year floodplain, historic sites, and areas identified under the Installation Restoration Program. Safety and noise zones also limit residential development on Holloman AFB. Future plans for residential development on the Base include renovation of existing structures, replacement of inefficient buildings, and expansion into open areas in the southeast corner of the Base (Horizons 2000 Facility Improvement Plan II, 1987). Future land use is not expected to differ significantly from current land use practices.

3.6 CURRENT AND FUTURE WATER USE

At present, the primary fresh water resource for the City of Alamogordo and Holloman AFB is Lake Bonita, 60 miles northeast of the Tularosa Basin. Currently, there are no potable supplies of groundwater or surface water located on the Base. Holloman AFB obtains its water supply from the City of Alamogordo and the Holloman AFB wells in the Boles, San Andres, and Douglas well fields at the base of the Sacramento Mountains. No water supply wells are located on or near the Base because of poor groundwater quality. The nearest production well downgradient from Holloman AFB is a livestock well located 3.5 miles west of the Base (Foster Wheeler and Radian, 1994). There are no potable or irrigation wells near to or downgradient of the Base.

4.0 CONTAMINATION ASSESSMENT

Sampling was conducted during the PA/SI in order to assess the impact of site activities on the soil and groundwater at DP-63. The assessment of contamination is based on the analytical results for samples collected during the PA/SI field investigation in April 2000. Sampling was conducted in accordance with the final work plan (Foster Wheeler, 2000a). A summary of the sample results is presented below for soil and groundwater.

4.1 GUIDELINES FOR CONTAMINANT CHARACTERIZATION

Analytical data for samples collected during the PA/SI must be evaluated in a manner consistent with previous investigations at Holloman AFB. Comparative baseline values are used to determine whether organic and inorganic constituents present in soil and groundwater at DP-63 present any potential risks and to support recommendations for the future status of the site. Comparative values appropriate for this evaluation include the following:

- Basewide background values for metals in soil
- Action-levels for TRPH in soil
- Risk-based screening levels for organic compounds in soil

In order to evaluate and assess detected analytes that occur naturally within soil comparisons were made against Holloman AFB Basewide background values. The background values were computed and reported in the Basewide Background Study—Sewage Lagoons and Lakes Investigation (Radian, 1993). Table 4-2 presents values from the Basewide background study (Radian, 1993) used for evaluating soil contamination in this report. The background value for each metal constituent was determined as the 95 percent upper tolerance limit for data collected in areas at the Base that have not been impacted by site activities. Background values for organic compounds and cyanide are considered the method detection limit. Therefore, it is assumed that any detected organic compounds exceed background.

Data presented in this report consist of results that have been validated using EPA protocol as presented in Appendix A. Only valid analytical results that were detected above method reporting limits are presented in the data summary tables (Tables 4-1 through 4-3). The data

presented in Figure 4-1 consist of detections of organic compounds and cyanide, and metals detections greater than Holloman AFB Basewide background values.

4.2 SOIL CHARACTERIZATION

The off-site laboratory analyzed 12 DPT soil samples and 1 field duplicate for the following constituents using EPA methods:

- VOCs—EPA SW-846 Methods 5030/8260B
- SVOCs—EPA SW-846 Method 8270C
- Pesticides/PCBs—EPA SW-846 Methods 8081A/8082
- TAL metals—EPA SW-846 Methods 6010B and 7471A
- Cyanide—EPA SW-846 Method 9013
- TRPH—EPA SW-846 Method 9071/418.1

A summary of the analytical results for soil samples collected at DP-63 is provided in Tables 4-1 and 4-2. The distribution of analytical constituents detected in soil at DP-63 is presented in Figure 4-1.

TRPH was detected in 9 of the 12 soil samples and in the field duplicate sample collected during the PA/SI. Soil concentrations of TRPH ranged from 37.7 to 263 mg/kg, and the highest concentration of TRPH was detected in a sample collected at the water table in the East Area at DP03. It is apparent that TRPH in soil is the result of past activities in the West and East Areas at DP-63.

VOCs were detected in five samples collected in the East Area at DP01 and DP03. The VOCs detected in these soil samples included carbon disulfide, 2-butanone, and toluene (Table 4-1). At DP01, VOCs were only detected in the soil samples (including the field duplicate) collected at the water table, within the capillary fringe (Figure 4-1). At DP03, VOCs were detected in all samples collected at depths ranging from 12 ft to the water table (Figure 4-1). The contaminants detected at DP01 and DP03 are most likely due to releases at DP-63 during site activities. The VOCs may be remnants of fuels used during burning operations.

SVOCs were only detected in two samples collected at DP-63. Diethylphthalate and bis(2-ethylhexyl)phthalate were the only SVOCs detected in soil samples, which were collected at a depth of 12 ft and at the water table within the capillary fringe (Table 4-1 and Figure 4-1). SVOCs were only detected in samples collected at DP03 and are likely present due to burning activities at the site.

No pesticides or PCBs were detected in any soil samples collected at DP-63 during the PA/SI field investigation.

Cyanide was only detected in one soil sample collected at DP-63, from DP03 at a depth of 21 ft.

Metals were detected in all 12 samples and in the field duplicate sample collected during the PA/SI field investigation. Seventeen metals were detected in soil samples and these metals include: aluminum, arsenic, barium, beryllium, calcium, chromium, cobalt, copper, iron, lead, potassium, magnesium, manganese, nickel, sodium, vanadium, and zinc. The analytical results for metals samples are presented in Table 4-2.

Of the 17 metals detected in soil, 14 metals occurred at concentrations above the Basewide background values. Based on evaluation criteria presented in EPA guidance for conducting site inspections (EPA 1992), only six metals (beryllium, cobalt, chromium, copper, manganese, and nickel) detected in soil were at concentrations greater than three times background values. There was no apparent pattern of metals contamination in soil at DP-63, and it is likely that the sporadic occurrence of metals greater than three times background represents natural variability in soil geochemistry.

4.3 GROUNDWATER CHARACTERIZATION

Five groundwater samples and one field duplicate sample were collected during the PA/SI field investigation and were analyzed for explosives using EPA method 8330. Explosives were not detected in any of the groundwater samples.

Free-phase fuel product was not observed in groundwater samples collected during the PA/SI field investigation.

5.0 CONCLUSIONS AND RECOMMENDATIONS

The PA/SI field program took place in April 2000. During the field investigation, geophysical surveys were conducted in the designated West and East Areas of the site. The geophysical surveys indicated that anomalies exist in these areas identified by Base EOD personnel as sites where burning and disposal of munitions took place in the past. DPT soil and groundwater samples were collected in the vicinity of the geophysical anomalies to determine whether past operations at the site have impacted soil and/or groundwater in the area.

DPT sample results indicated that TRPH, VOCs, SVOCs, cyanide, and metals were detected in soil samples. VOCs and SVOCs detected in soil samples in the East Area are likely due to the presence of fuels remaining in place since disposal operations ceased. TRPH concentrations detected in soil samples at the West and East Areas indicate a low-level presence of fuel remaining in soil at the site. Some of the soil samples that were collected at the water table, which were water-saturated, contained TRPH, VOCs, and SVOCs. Although explosives were not detected in groundwater at the site, the presence of organic constituents in saturated soil samples indicates that groundwater is potentially impacted by dissolved constituents. Oily sheens or free-phase product was not observed in water samples collected at DP-63 during the PA/SI field investigation.

As a result of the investigation in April 2000 and the discovery of a third potential disposal site, an additional geophysical survey took place in September 2000 in an area designated the North Area. An anomaly was identified in this area, and features identified at this site indicate that munitions disposal activities could have taken place similar to those identified for the West and East Areas.

Based on the results of the PA/SI field investigation, additional investigation and data evaluation is warranted. An additional investigation of DP-63 should include the following activities:

- Conduct soil and groundwater sampling in the North Area to determine whether past site operations have impacted the environment.
- Collect groundwater samples in the West and East Areas for analysis of VOCs and SVOCs to further characterize potential groundwater contamination in the area.

- Evaluate the risk to human health and the environment by conducting a screening-level risk assessment.

6.0 REFERENCES

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Tables

Table 2-1. Samples Collected during the PA/SI Field Investigation at DP-63

Site ID	Location	Sampling Rationale	Samples Collected	
			Groundwater	Soil
DP63-DP01	East Area of DP-63 at disposal pit Site 1	Determine impact to soil and groundwater	1	7 - 8 ft, 21 - 22 ft, 44 - 45 ft, 44 - 45 (D)
DP63-DP02	East Area of DP-63 at disposal pit Site 1	Determine impact to soil and groundwater	1 (plus field duplicate)	7 - 8 ft, 17 - 18 ft, 46 - 47 ft
DP63-DP03	East Area of DP-63 at disposal pit Site 1	Determine impact to soil and groundwater	1	12 - 13 ft, 21 - 22 ft, 45 - 46 ft
DP63-DP04	West Area of DP-63 at disposal pit Site 2	Determine impact to soil and groundwater	1	5 - 6 ft, 20 - 21 ft, 44 - 45 ft

* The following analyses were performed on groundwater and soil samples:

Groundwater: Explosives by EPA SW-846 Method 8330

Soil: VOCs by EPA SW-846 Methods 5035/8260B
SVOCs by EPA SW-846 Method 8270C
Pesticides/PCBs by EPA SW-846 Methods 8081A/8082
TRPH by EPA SW-846 Method 9071/418.1
Metals by EPA SW-846 Methods 6010B/7471A
Cyanide by EPA SW-846 Method 9013

D - field duplicate sample collected

ft - feet

Table 4-1. Analytical Results for Organic Compounds Detected in Soil Samples Collected at DP-63

Location	Depth Interval (ft)	TRPH (mg/kg)	Explosives (µg/kg)	VOCs (µg/kg)			SVOCs (µg/kg)		Pesticides/ PCBs (µg/kg)
				Carbon disulfide	2-Butanone	Toluene	Diethyl-phthalate	bis(2-Ethylhexyl) phthalate	
DP63-DP01	7 - 8	ND	NA	ND	ND	ND	ND	ND	ND
DP63-DP01	21 - 22	**62.5**	NA	ND	ND	ND	ND	ND	ND
DP63-DP01	44 - 45 *	**41.4**	NA	**4497**	**1526**	ND	ND	ND	ND
DP63-DP01 (dup)	44 - 45 *	**38.5**	NA	**8876**	**4356**	**440**	ND	ND	ND
DP63-DP02	7 - 8	ND	NA	ND	ND	ND	ND	ND	ND
DP63-DP02	17 - 18	**37.7**	NA	ND	ND	ND	ND	ND	ND
DP63-DP02	46 - 47 *	**71.4**	NA	ND	ND	ND	ND	ND	ND
DP63-DP03	12 -13	**38.5**	NA	**7904**	**2705**	**308**	**750**	**1500**	ND
DP63-DP03	21 - 22	**79**	NA	**7406**	**2752**	**328**	ND	ND	ND
DP63-DP03	45 - 46 *	**263**	NA	**7242**	**2946**	ND	**100**	ND	ND
DP63-DP04	5 - 6	ND	NA	ND	ND	ND	ND	ND	ND
DP63-DP04	20 - 21	**39.7**	NA	ND	ND	ND	ND	ND	ND
DP63-DP04	44 - 45 *	**70.7**	NA	ND	ND	ND	ND	ND	ND

* Sample collected below the water table

NOTE: Pesticides and PCBs were analyzed for but not detected

dup - field duplicate sample
ft - feet
mg/kg - milligrams per kilogram
µg/kg - micrograms per kilogram
NA - not analyzed
ND - analyte not detected above the method reporting limit
PCBs - polychlorinated biphenyls
SVOCs - semivolatile organic compounds
VOCs - volatile organic compounds

Table 4-2. Analytical Results for Cyanide and Metals Detected in Soil Samples Collected at DP-63

Location	Depth Interval (ft)	Cyanide (mg/kg)	TAL Metals (mg/kg)							
			Aluminum	Arsenic	Barium	Beryllium	Calcium	Cobalt	Chromium	Copper
DP63-DP01	7 - 8	ND	**2,070**	ND	ND	ND	**213,000**	ND	**2.3**	ND
DP63-DP01	21 - 22	ND	**4,240**	ND	**65.8**	ND	**88,300**	ND	**6.4**	ND
DP63-DP01	44 - 45 [1]	ND	**5,650**	ND	[illegible]	ND	**170,000**	ND	[illegible]	ND
DP63-DP01 (dup)	44 - 45 [1]	ND	**3,650**	ND	**52.8**	ND	**203,000**	ND	**4.9**	ND
DP63-DP02	7 - 8	ND	**1,360**	ND	ND	ND	**196,000**	ND	ND	ND
DP63-DP02	17 - 18	ND	**4,960**	ND	ND	ND	**190,000**	ND	[illegible]	ND
DP63-DP02	46 - 47 [1]	ND	**6,930**	**5.2**	[illegible]	ND	**108,000**	[illegible]	[illegible]	[illegible]
DP63-DP03	12 -13	ND	**4,560**	ND	**53.5**	ND	**142,000**	ND	**6.2**	ND
DP63-DP03	21 - 22	**0.26**	**5,970**	ND	**50.4**	ND	**190,000**	ND	**6.3**	[illegible]
DP63-DP03	45 - 46 [1]	ND	**1,940**	ND	ND	ND	**76,700**	ND	**3.9**	ND
DP63-DP04	5 - 6	ND	**4,090**	ND	ND	ND	**177,000**	ND	**4.4**	ND
DP63-DP04	20 - 21	ND	[illegible]	[illegible]	[illegible]	[illegible]	**135,000**	ND	[illegible]	[illegible]
DP63-DP04	44 - 45 [1]	ND	**7,970**	**2.6**	[illegible]	ND	**98,800**	ND	ND	[illegible]
Background Value [2]		NB	8,760	6.88	84.4	0.400	250,000	2.49	6.60	4.84

[1] Sample collected below the water table

[2] Background values are 95 percent upper tolerance limits as presented in the Basewide Background Study (Radian 1993)

Note: Metals detections above background values are shaded and are the only detections presented on Figure 4-1.

dup - field duplicate sample
ft - feet
mg/kg - milligrams per kilogram
NB - no background value established
ND - analyte not detected above the method reporting limit
TAL - target analyte list

Table 4-2. Analytical Results for Cyanide and Metals Detected in Soil Samples Collected at DP-63

Location	Depth Interval (ft)	TAL Metals (mg/kg)								
		Iron	Lead	Magnesium	Manganese	Nickel	Potassium	Sodium	Vanadium	Zinc
DP63-DP01	7 - 8	**1,940**	**0.69**	**1,260**	**25.7**	ND	ND	ND	ND	**5.1**
DP63-DP01	21 - 22	**6,140**	**3.6**	**4,410**	**91.7**	ND	ND	**1,500**	**14**	**14.7**
DP63-DP01	44 - 45 1	**5,510**	**3**	**3,270**	**77.8**	ND	ND	**2,600**	ND	**18.8**
DP63-DP01 (dup)	44 - 45 [1]	**3,200**	**2.1**	**2,290**	**36.9**	ND	ND	**2,240**	ND	**10.3**
DP63-DP02	7 - 8	**1,280**	**2.8**	**1,270**	**21**	ND	ND	ND	ND	ND
DP63-DP02	17 - 18	**4,920**	**3.5**	**2,970**	**74.5**	ND	**1,260**	**1,540**	ND	**15.1**
DP63-DP02	46 - 47 [1]	**8,890**	**10.5**	**4,340**	**[illegible]**	**[illegible]**	**1,270**	**2,480**	**[illegible]**	**[illegible]**
DP63-DP03	12 -13	**5,130**	**3.5**	**3,950**	**102**	ND	ND	**1,390**	**11.4**	**15.1**
DP63-DP03	21 - 22	**5,890**	**3.5**	**3,770**	**67.1**	ND	**1,520**	**2,290**	ND	**[illegible]**
DP63-DP03	45 - 46 [1]	**2,690**	**2.8**	**1,610**	**59.6**	ND	ND	**1,560**	ND	**9.5**
DP63-DP04	5 - 6	**3,640**	**1.8**	**2,300**	**62**	ND	**1,180**	ND	ND	**10.7**
DP63-DP04	20 - 21	**[illegible]**	**[illegible]**	**9,370**	**[illegible]**	**[illegible]**	**[illegible]**	**3,900**	**[illegible]**	**[illegible]**
DP63-DP04	44 - 45 [1]	**[illegible]**	**5.7**	**4,570**	**122**	**[illegible]**	**1,510**	**2,190**	**[illegible]**	**[illegible]**
Background Value [2]		6,360	8	14,700	165	5.61	2,500	5,000	15.5	20.2

[1] Sample collected below the water table

[2] Background values are 95 percent upper tolerance limits as presented in the Basewide Background Study (Radian 1993)

Note: Metals detections above background values are shaded and are the only detections presented on Figure 4-1.

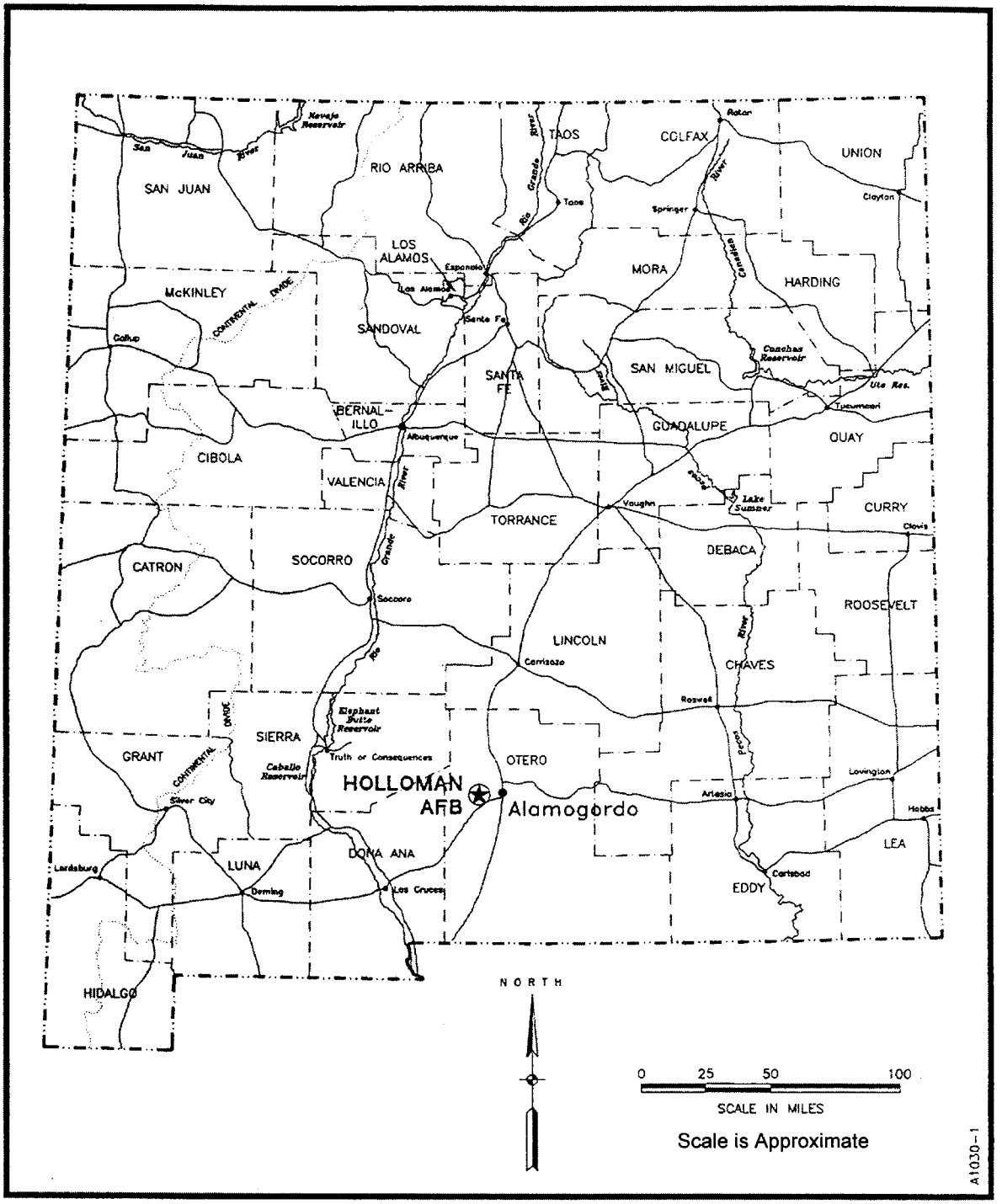
dup - field duplicate sample
ft - feet
mg/kg - milligrams per kilogram
NB - no background value established
ND - analyte not detected above the method reporting limit
TAL - target analyte list

Table 4-3. Analytical Results for Groundwater Water Samples Collected at DP-63

Location	Groundwater Depth (feet bgs)	TRPH (mg/L)	VOCs (µg/L)	SVOCs (µg/L)	Explosives (µg/L)	Pesticides/PCBs (µg/L)	TAL Metals (mg/L)
DP63-DP01	45	NA	NA	NA	ND	NA	NA
DP63-DP02	46	NA	NA	NA	ND	NA	NA
DP63-DP02 (dup)	46	NA	NA	NA	ND	NA	NA
DP63-DP03	46	NA	NA	NA	ND	NA	NA
DP63-DP04	41	NA	NA	NA	ND	NA	NA

bgs - below ground surface
dup - field duplicate sample
mg/L - milligrams per liter
NA - not analyzed
ND - analyte not detected above method reporting limit
PCB - polychlorinated biphenyl
SVOC - semivolatile organic compound
TAL - target analyte list
TRPH - total recoverable petroleum hydrocarbons
VOC - volatile organic compound
µg/L - micrograms per liter

Figures



DP-63 PA/SI REPORT

Holloman Air Force Base, New Mexico

U.S. Army Corps of Engineers, Omaha District

Figure 1-1

Location of Holloman Air Force Base

FOSTER WHEELER ENVIRONMENTAL CORPORATION