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



5 August 2016

ADAM M. KUSMAK, GS-13, USAF
Chief, Installation Management Flight (49 CES/CEI)
49th Civil Engineer Squadron (49 CES)
Holloman Air Force Base, NM

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

Dear Mr. Kieling,

Holloman AFB is pleased to submit the Technical Memorandum for LF029 Old Army Landfill/SWMU 104 at Holloman Air Force Base, NM for your review. This Technical Memorandum includes a summary of all groundwater and soil sampling results at LF029, as well as recommendation for No Further Action for media (surface and groundwater) sampling based on results from previous investigations. In addition, it is recommended that the potential presence of subsurface Munitions and Explosives of Concern (MEC)/practice chemical munitions at LF029 should be addressed through Land Use Controls and Long Term Management.

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

If you have any questions regarding this submittal, please contact me at (575) 572-6675.

Sincerely,

Digitally signed by
KUSMAK,ADAM.M.1263331806
DN: c=US, o=U.S. Government, ou=DoD,
ou=PKI, ou=USAF,
cn=KUSMAK,ADAM.M.1263331806
Date: 2016.08.22 08:16:30 -0600

ADAM M. KUSMAK, GS-13, USAF

Attachment (hard copy and CD):
Technical Memorandum LF029 Old Army Landfill/SWMU 104, Holloman Air Force Base, NM.

cc:

(w/Atch)

Mr. David Strasser
Hazardous Waste Bureau
121 Tijeras Dr. NE, Ste.1000
Albuquerque NM 87102-3400

(w/CD)

Mr. Chuck Hendrickson
U.S. Environmental Protection Agency
1445 Ross Avenue, Suite 1200
Dallas TX 75202-2733

(w/o Atch)

Mr. Cornelius Amindyas
Hazardous Waste Bureau
121 Tijeras Dr. NE, Ste. 1000
Albuquerque NM 87102-3400

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TECHNICAL MEMORANDUM

LF029 OLD ARMY LANDFILL/SWMU 104

**HOLLOMAN AIR FORCE BASE
NEW MEXICO
RCRA PERMIT No. NM6572124422**

**Performance Based Remediation
Contract Number: FA8903-13-C-0008**

Prepared for:



**AIR FORCE CIVIL ENGINEER CENTER
2261 Hughes Ave., Suite 163
Joint Base San Antonio Lackland, Texas 78236-9853**

August 2016

Prepared by:

FPM Remediations, Inc.

**181 Kenwood Avenue
Oneida, NY 13421**

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TABLE OF CONTENTS

SECTION	PAGE
1.0 INTRODUCTION.....	1
1.1 Site Location	1
1.2 LF029 Old Army Landfill/SWMU 104 Description.....	1
2.0 PREVIOUS INVESTIGATIONS.....	3
2.1 Records Search and Visual Site Inspection.....	3
2.2 Remedial Investigation.....	3
2.2.1 RI Results - Groundwater	3
2.2.2 RI Conclusions - Groundwater	4
2.3 Phase II RCRA Facility Investigation.....	4
2.4 Compliance Groundwater Monitoring.....	5
2.5 Supplemental RFI.....	6
2.5.1 Geophysical Survey	6
2.5.2 Passive Soil Gas Assessment.....	6
2.5.3 DPT Subsurface Soil Assessment.....	7
2.5.4 Groundwater Sampling.....	8
2.6 Munitions and Explosives of Concern, Practice Biological Warfare Bomblets and Practice Chemical Warfare Munitions.....	8
3.0 RECOMMENDATIONS.....	11
3.1 Land Use Controls.....	11
3.1.1 Engineering Controls at LF029.....	11
3.1.2 Institutional Controls at LF029 Old Army Landfill/SWMU 104.....	11
3.2 Long Term Management.....	11
4.0 REFERENCES.....	13

LIST OF FIGURES

Figure 1	Holloman Air Force Base Location
Figure 2	LF029 Old Army Landfill/SWMU 104 Location
Figure 3	LF029 Groundwater Monitoring Well Locations RI (1992)
Figure 4	LF029 Groudwater Monitoring Well Locations Phase II RFI (1994)
Figure 5	LF029 December 2005 1,2-DCA, TCE, and TDS Concentrations
Figure 6	LF-29 Magnetic Survey Map (Figure 5.5 from Supplemental RFI [2007])
Figure 7	LF-29 Soil Gas Survey Sample (Figure 5.6 from Supplemental RFI [2007])
Figure 8	LF-29 Soil Gas BTEX Concentrations (Figure 5.9 from Supplemental RFI [2007])
Figure 9	LF-29 Soil Boring Locations (Figure 5.7 from Supplemental RFI [2007])
Figure 10	LF029 Groundwatre Perchlorate Concentrations Supplemental RFI [2007]
Figure 11	Munitions and Explosives of Concern/Munitions Debris (Figure 5.8 from Supplemental RFI [2007])

LIST OF TABLES

Table 1	LF029 1992 Remedial Inevstigation Groundwater Analytical Results
Table 2	LF029 1994 Phase II RFI Groundwater Analytical Results
Table 3	LF029 Groundwater Compliance Long Term Monitoring Results (1997-2005)
Table 4	LF029 Soil Gas Survey VOC Analytical Results (2006)
Table 5	LF029 Supplemental RFI Soil Analytical Results (2006)
Table 6	LF029 Supplemental RFI Groundwater Perchlorate Analytical Results (2006)

LIST OF ABBREVIATIONS AND ACRONYMS

AFB	Air Force Base
CMA	Chemical Materials Agency
D-TPH	Diesel-Range Total Petroleum Hydrocarbons
DCA	1,2-dichloroethane
DPT	Direct-Push Technology
EC	Engineering Control
ERP	Environmental Restoration Program
EQ	Environmental Quotient
FPM	FPM Remediations, Inc.
ft	feet
FPM	FPM Remediations, Inc.
G-858	Geometrics G-858 Cesium Vapor Magnetometer
G-TPH	Gasoline-Range Total Petroleum Hydrocarbons
HGL	HydroGeoLogic, Inc.
IC	Institutional Control
LTM	Long Term Monitoring
LUC	Land Use Control
MARB	Materiel Assessment Review Board
MCL	Maximum Contaminant Level
MD	Munitions Debris
MEC	Munitions and Explosives of Concern
µg/kg	microgram per kilogram
µg/L	microgram per liter
mg/L	milligram per liter
MPPEH	Material Potentially Presenting an Explosive Hazard
NFA	No Further Action
NMED	New Mexico Environment Department
NMGWQ	New Mexico Groundwater Quality
NOD	Notice of Deficiency
PCB	Polychlorinated Biphenyl
PID	Photoionization Detector
PINS	Portable Isotopic Neutron Spectroscopy
RCRA	Resource Conservation and Recovery Act
RFA	RCRA Facility Assessment
RFI	RCRA Facility Investigation
RI	Remedial Investigation
SVOC	Semi-Volatile Organic Compound
SWMU	Solid Waste Management Unit
TCE	trichloroethene
TDS	Total Dissolved Solids
TE	Technical Escort
USEPA	United States Environmental Protection Agency
UXO	Unexploded Ordnance
VOC	Volatile Organic Compound

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1.0 INTRODUCTION

The purpose of this Technical Memorandum is to provide both a summary of previous investigations performed at the LF029 Old Army Landfill/Solid Waste Management Unit (SWMU) 104, herein referred to as LF029, and recommendations for the site based on this summary. The summary includes the results of the following field activities:

- Groundwater sampling performed during the Remedial Investigation (RI) (Radian Corporation, 1992a and 1992b), Phase II Resource Conservation and Recovery Act (RCRA) Facility Investigation (RFI) (Foster Wheeler/Radian, 1997), Compliance Groundwater Monitoring (between 1997 and 2005), and Supplemental RFI (HydroGeoLogic [HGL], Inc., 2007);
- Passive soil gas assessment performed during the Supplemental RFI;
- Geophysical survey conducted during the Supplemental RFI;
- Direct-Push Technology (DPT) subsurface soil assessment performed during the Supplemental RFI; and
- Visual surveys conducted during and after the Supplemental RFI identifying Munitions and Explosives of Concern (MEC) and Munitions Debris (MD), including practice biological warfare bomblets and practice chemical warfare munitions.

The Technical Memorandum is being completed by FPM Remediations, Inc. (FPM), under FPM's Air Force Civil Engineer Center Contract FA8903-13-C-0008, to support the Environmental Restoration Program (ERP) for the New Mexico Environment Department (NMED). ERP site LF029 is listed in Appendix 4-A Table A of the Holloman Air Force Base (AFB) RCRA Permit No. NM6572124422 (NMED, 2012) requiring the sites to be investigated, and undergo corrective action, if warranted.

1.1 Site Location

Holloman AFB is located in south-central New Mexico, 7 miles west of the city of Alamogordo in Otero County (**Figure 1**). Holloman AFB occupies approximately 50,763 acres of land and is adjacent to the much larger (2.2-million-acre) White Sands Missile Range. A portion of the Base to the south is bordered by Route 70, which also runs roughly north-south and parallel to the eastern boundary of the base. The southern portion of Holloman AFB contains the flight line, composed of a series of runways running north-south, east-west, and northeast southwest. The Main Base is located at the southeast corner of the Base, where Route 70 borders the site. The Main Base contains housing and administrative buildings. The West Area and the North Area refer to the improved areas around the original airfield (southeastern triangle formed by the runways). The High Speed Test Track runs north-south and is located northwest of the airfield. The track is the world's longest of its kind at 9.5 miles and has been used for an array of missile testing for decades and is still in use today. Access to Holloman AFB requires admittance through the security gate and there is a fence around the installation.

1.2 LF029 Old Army Landfill/SWMU 104 Description

LF029 is located in the south-central portion of Holloman AFB, north of the airfield and north of Building 1001 (**Figure 2**). Vehicle access is provided via Dezonía Road, an unpaved service

road. LF029 was used by the Army from the 1950s to 1975 for the disposal of spent munitions and construction debris (HGL, 2007). It is defined by a small berm that extends 400 feet (ft) north-south and 350 ft east-west, accounting for approximately 4.28 acres. Based on a visual inspection of the berm, it appears to be composed of reworked native soils and shows evidence of erosion and undermining by local wildlife. Some materials including munitions may also have been disposed of outside of this berm along the borders, so a buffer zone extending 45 ft to the north and south and 35 ft to the east and west of the berm has been included within the site boundary. The entire area of the LF029, including the buffer zone, encompasses approximately 6 acres. Site topography slopes very gently to the southwest and the site is moderately vegetated with shrubs, dwarf trees, and cacti.

2.0 PREVIOUS INVESTIGATIONS

2.1 Records Search and Visual Site Inspection

The Records Search for LF029 indicated that from the early 1950s to 1975, spent munitions and missiles were disposed of by the Army at this site located near the north base building area. Since no known hazardous waste materials were disposed of at the site, it was not rated using the Hazardous Assessment Ranking Method. The records search concluded no further investigation was warranted.

Based on a visual site inspection of the site, the RCRA Facility Assessment (RFA) concluded the purpose of the LF029 was the disposal of missiles and spent munitions. It established that the landfill is located north of the Test Group Headquarter Area, but the exact location was unknown. The visual site inspection indicated the potential for release to be low for air and surface water and high for soil/groundwater and subsurface gas generation if hazardous materials had been disposed in the landfill. The actual potential for release was unknown since it was not known whether hazardous constituents were disposed in this area. LF029 was placed on Table 1 of the 1991 RCRA permit.

2.2 Remedial Investigation

An RI was conducted at LF029 in 1992 (Radian Corporation, 1992a and 1992b). As illustrated in **Figure 3**, four monitoring wells were installed at LF029 to determine whether a release to groundwater had occurred at the site. Groundwater occurs in a shallow unconfined aquifer beneath the site approximately 15 to 20 ft below ground surface. The monitoring well network design was based on an assumed south-southwest groundwater flow direction. Three wells MW-29-02, -03, and -04 were located in assumed downgradient locations and one well, MW-29-01 in an assumed upgradient location with respect to the landfill. However, based on groundwater elevation measurements obtained during the RI, groundwater flows west-northwest toward the Lost River drainage basin. As shown in **Figure 3**, based on this groundwater flow direction, only MW-29-02 is downgradient of the landfill.

No soil samples were collected during the RI due to the dangers associated with sampling in an area potentially containing Unexploded Ordnance (UXO).

2.2.1 RI Results - Groundwater

One round of groundwater samples were collected and analyzed for:

- total metals
- Volatile Organic Compounds (VOCs),
- organophosphorus pesticides and Polychlorinated Biphenyl (PCB),
- explosives,
- chlorinated herbicides,
- anions, and
- Total Dissolved Solids (TDS).

Tables 1 summarizes the results of groundwater analyses for inorganic and organic constituents.

With the exception of total phosphorus concentration in MW-29-01 (upgradient well), all water quality parameters were detected at concentrations below statistical background levels (**Table 1**).

With the exception of antimony and beryllium, all metals were detected either below the corresponding statistical background levels or below the corresponding action levels (**Table 1**). However, both antimony and beryllium were detected in downgradient well at concentrations below the concentrations in upgradient well (MW-29-01). Chlorinated herbicides, explosives, and PCBs were not present in any of the samples. 4,4'-DDD was detected at a low concentration of 0.028 micrograms per liter ($\mu\text{g/L}$) in cross-gradient well MW-29-03. 4,4'-DDD was the only pesticide detected at the site. With respect to VOCs, methylene chloride and chloroform were detected. Methylene chloride was detected in all samples and is attributable to laboratory contamination. Chloroform was detected in wells MW-29-03 and -04 at concentrations of 22 $\mu\text{g/L}$ and 6.2 $\mu\text{g/L}$, respectively.

2.2.2 RI Conclusions - Groundwater

The only indication of a potential release of contaminants of concern in groundwater was detection of the pesticide, 4,4'-DDD, and the VOC, chloroform. The lack of other detected constituents, particularly explosives suggested that the effect of LF029 on groundwater is minimal. The site-specific risk assessment was the primary basis for the RI recommendations (Radian Corporation, 1992a and 1992b). The exposure evaluation for this site determined that there are no existing or potential human receptors for this site; therefore, human health risks were not calculated. Groundwater modeling indicated that the contaminants of concern would not reach nearest potential surface water stream at Malone Draw, located approximately 2.89 miles northwest of the site. Thus, the Environmental Quotient (EQ) for aquatic organisms was 0. The EQ for the black-tailed jackrabbit and for the White Sands pupfish indicated no adverse environmental effects. Therefore, the no action alternative was warranted.

Although the risks to human health and the environment were considered acceptable and the no action alternative was appropriate based on the data, the RI recommended that two monitoring wells be installed and geophysical surveys be performed for further characterization of the site.

2.3 Phase II RCRA Facility Investigation

During the Phase II RFI in 1994, three additional monitoring wells were installed downgradient of LF029 (MW-29-06, -07, and -08) and one additional well was installed upgradient of the site (MW-29-05) (**Figure 4**) (Foster Wheeler/Radian, 1997). Flow direction measured during the Phase II RFI was to the northwest-north. As part of the Phase II effort, all wells, with the exception of LF-29-01 were sampled and analyzed for:

- VOCs,
- metals,
- organochlorine pesticides,
- herbicides, and
- explosives.

The analytical results are presented in **Table 2**. As shown in this table, with the exception of aluminum and iron, the constituent concentrations in downgradient wells (MW-29-02, -06, -07, and -08) that were above the risk based levels were also either below the background values (Radan Corporation, 1993) or below the concentrations in site upgradient wells (MW-29-03, -04, and -05).

No explosives were present in the downgradient wells and VOCs were detected in downgradient wells at concentrations below site upgradient well concentrations. Site SS-61 (**Figure 4**), located

southeast and upgradient of LF029, where a benzene and 1,2-dichloroethane (DCA) plume has been confirmed, is the source of these compounds.

The Final Phase II RFI Report for Table 1 SWMUs, dated June 1997 and prepared by Foster Wheeler/Radian, recommended No Further Action (NFA) for the site with 10 years of Long Term Monitoring (LTM). Consequently, Holloman AFB added LF029 to the LTM program in 1997.

NMED correspondence of April 1998 concurred with this approach (from Supplemental RFI Work Plan, HGL, 2005).

2.4 Compliance Groundwater Monitoring

LTM has been conducted biennially at LF029 between 1997 and 2005 in conjunction with other landfill sites. As shown in **Table 3**, LTM activities included sampling the upgradient well (MW-29-01) and three downgradient wells (MW-29-06, -07, and -08) for 1997, 1999, 2001, and 2003 sampling events. A west-northwest groundwater flow path was observed during the 1997 event.

- After the 1999 event, analysis for Semi-Volatile Organic Compounds (SVOCs) was discontinued with NMED approval (NMED review dated May 09, 2001 of the Final Long-Term 1999 Groundwater Monitoring Report).
- Based on groundwater elevations measured during the September 2001 compliance LTM event, groundwater flows to the west-southwest. After the 2001 event, VOC analysis was limited to target VOCs 1,2-DCA and chloroform with NMED approval (NMED review dated February 24, 2003 of the Final Long-Term 2002 Groundwater Monitoring Report).
- The 2005 Supplemental RFI Work Plan proposed to expand the 2005 LTM event to include monitoring wells MW-29-03, -04, and -05. In addition, the full analyte target list was analyzed as well as expanded to include 5 additional VOCs (sec-butylbenzene, tert-butylbenzene, o-dichlorobenzene, isopropylbenzene, and trichloroethene [TCE]) and TDS. Based on groundwater elevations measured during the December 2005 compliance LTM event, groundwater flows in a northerly direction (**Figure 5**).

Table 3 shows LTM results from the Final 2005 LTM Groundwater Monitoring Report (Bhate, 2006). Historically, 1,2-DCA and chloroform have been detected with 1,2-DCA being the only VOC detected above background and applicable screening criteria.

During the December 2005 LTM event, benzene, sec- and tert-butylbenzene, o-dichlorobenzene, isopropylbenzene, and TCE were detected along with chloroform and 1,2-DCA. 1,2-DCA was detected above both New Mexico Groundwater Quality (NMGWQ) standard and United States Environmental Protection Agency (USEPA) Maximum Contaminant Level (MCL), while TCE was detected above the USEPA MCL only. However, all but 1,2-DCA and chloroform were detected only in the upgradient well MW-29-05, located between LF029 and SS-61. In addition, the highest 1,2-DCA concentration was also detected in upgradient well MW-29-05. Based on groundwater flow paths and contaminant distribution, the detected groundwater impacts appear to be related to ERP site SS-61, located approximately 600 feet southwest. ERP site SS-61 has a known benzene and 1,2-DCA groundwater plume. The LF029 December 2005 1,2-DCA, TCE, and TDS concentrations in groundwater are depicted on **Figure 5**.

The groundwater beneath Holloman AFB is designated as unfit for human consumption because it naturally exceeds TDS and sulfate thresholds. Using the *Guidelines for Groundwater*

Classification Under the Environmental Protection Agency Groundwater Protection Strategy (United States Environmental Protection Agency [USEPA], 1986), class IIIb groundwater is characterized as having a TDS concentration greater than 10,000 mg/L and a low degree of interconnection to adjacent surface waters or groundwater of a higher class. As shown in **Figure 5** the LF029 TDS ranges from 7,660 to 32,200 mg/L. The only well with TDS below 10,000 mg/L is cross-gradient well MW-29-03. Regulated water under the New Mexico Water Quality Control Commission regulations is also defined by this 10,000 mg/L TDS threshold.

NMED agreed to suspend LTM at the site in correspondence dated 4 October 2006 pending results of the Supplemental RFI to determine perchlorate concentration in the groundwater (correspondence received following Final 2005 Long-Term Groundwater Monitoring Report).

2.5 Supplemental RFI

Supplemental RFI activities were conducted at LF029 between September 2005 and July 2006 in accordance with the Supplemental RFI Work Plan (HGL, 2005) and Response to Notice of Deficiency (NOD) (HGL, 2006a). Field sampling activities included the following tasks:

- A non-invasive geophysical survey to delineate the extent of the disposal site and to identify potential contamination hotspots,
- A passive soil gas survey to identify potential contamination hotspots (analysis of VOCs),
- Subsurface soil investigation to assess the soil quality at potential hotspots and proximal to significant geophysical anomalies (analysis of VOCs, SVOCs, Gasoline-Range Total Petroleum Hydrocarbons [G-TPH], Diesel-Range Total Petroleum Hydrocarbons [D-TPH], RCRA metals, perchlorate and explosives), and
- Groundwater sampling to determine perchlorate concentration in the groundwater.

2.5.1 Geophysical Survey

A non-invasive magnetic survey was conducted at LF029 using a Geometrics G-858 Cesium Vapor Magnetometer (G-858) in a horizontal dual-sensor configuration to achieve a 1-meter line spacing so that all causative bodies would be surveyed at the site. The survey encompassed approximately 5 acres extending beyond the bermed boundary of the site on all 4 sides. Magnetically susceptible and non-magnetically susceptible aircraft debris was observed across the entire site. Seven distinct magnetic anomalies were identified at LF029, primarily within the central and north-central portion of the landfill (**Figure 6** - Figure 5.5 from Supplemental RFI [HGL, 2007]). However, this study was performed prior to the clearance of surface debris, so interference from this material precludes the use of this study to confirm or evaluate the presence or absence of subsurface munitions and/or debris.

2.5.2 Passive Soil Gas Assessment

A passive soil gas survey was conducted across LF029 in May 2006 using the EMFLUX® passive Soil Gas Method, a verified USEPA technology method under the USEPA Technology Verification Program. The method is described fully in USEPA Publication EPA/600/R-98/096 (USEPA, 1998). In accordance with the sampling scheme set forth in the Supplemental RFI Addendum – Passive Soil Gas and Geophysical Survey Results, Technical Memorandum (HGL,

2006c), soil gas samples were installed across LF029 on a 100-foot grid spacing to limit the amount of intrusive work within the area because of MEC concerns. In areas of significant geophysical anomalies, soil gas samples were installed on a 50-foot grid spacing. Due to the variation in the presence of surface debris and geophysical anomalies, the soil gas sampling grid was shifted slightly to the southeast to locate a higher number of soil gas samples around observed and/or identified debris. The locations of the soil gas samples shown along with the magnetic survey data are depicted on **Figure 7** (Figure 5.6 from Supplemental RFI [HGL, 2007]). A total of 73 soil gas samples were installed at LF029 and analyzed for VOCs.

The results of the VOC soil gas survey are presented in **Table 4**. VOCs detected in the LF029 soil gas samples include:

- ethylbenzene,
- toluene,
- xylenes-m&p,
- xylenes-o,
- 1,3,5-trimethylbenzene, and
- 1,2,4-trimethylbenzene.

Toluene and 1,2,4-trimethylbenzene were detected in nearly every soil gas sample and several trip blanks/method blanks. This suggests the reported toluene and 1,2,4-trimethylbenzene positive detections are suspect and possibly related to laboratory contamination, or artifacts of sampling. The remaining positively detected VOCs were detected sporadically across the site. The maximum concentrations of all of the positively detected VOCs, with the exception of 1,3,5-trimethylbenzene were detected in one sample, K3. K3 is located near an identified geophysical anomaly and surface debris. **Figure 8** (Figure 5.9 from Supplemental RFI [HGL, 2007]) presents the benzene, toluene, ethylbenzene, and total xylenes (BTEX) soil gas concentrations detected across LF029, although benzene was not detected and toluene results most likely reflect non-site-related sample contamination.

2.5.3 DPT Subsurface Soil Assessment

Eleven soil borings were completed in June 2006 in accordance with the procedures outlined in the Supplemental RFI Work Plan Addendum Response to NOD (HGL, 2006b). The borings were specifically located to characterize soils where significant geophysical anomalies were found, as well as where soil gas samples contained elevated VOCs. The locations of the LF029 soil borings shown along with the magnetic survey data are depicted on **Figure 9** (Figure 5.7 from Supplemental RFI [HGL, 2007]).

The 11 borings were advanced to the underlying water table, ranging between 18 and 26.5 ft below ground surface. During borehole advancement, continuous soil sampling was conducted for lithologic characterization, visual inspection, field screening with a Photoionization Detector (PID), and potential laboratory analysis. Seven soil samples and one duplicate were collected from the soil borings completed at LF029.

Of the 11 borings completed, two were advanced to the point at which debris were encountered and samples were taken. At 5 boring locations no debris was encountered at the expected anomaly depth, as a result the borings were advanced to the soil/groundwater interface (the

approximate depth 18 - 26.5 ft) where the samples were taken. There is no record of samples being collected in the remaining 4 borings.

All 7 soil samples and the duplicate were analyzed for VOCs, SVOCs, G-TPH, D-TPH, RCRA metals, explosives, and perchlorate. Carbon disulfide, diethyl phthalate, D-TPH, perchlorate, and six metals (barium, cadmium, chromium, lead, mercury, and silver) were detected in one or more of the LF029 soil samples. No explosives or G-TPH were detected in the soil samples. The soil analytical results are summarized in **Table 5**. Perchlorate was detected in six of the seven soil samples ranging from 0.31 micrograms per kilogram ($\mu\text{g}/\text{kg}$) to 1.8 $\mu\text{g}/\text{kg}$. All of the analytes detected in the LF029 soil samples were reported at concentrations well below applicable screening criteria (Note **Table 5** includes both screening criteria used in the Supplemental RFI Report [HGL, 2007] and the most recent NMED soil screening levels).

2.5.4 Groundwater Sampling

The Supplemental RFI groundwater sampling event was conducted in July 2006 to determine the presence or absence of perchlorate and, if present, the compound's concentration in the groundwater beneath the site. Historically, perchlorate has not been a target analyte of concern for LF029 during compliance LTM. TDS analysis was conducted during the December 2005 compliance LTM event as described in **Section 2.4**. Based on the groundwater elevations obtained during the July 2006 Supplemental RFI groundwater sampling event, groundwater beneath LF029 flows to the west (**Figure 10**).

Perchlorate was detected in 6 of the 8 groundwater samples collected from LF029 groundwater monitoring wells. The perchlorate analytical results are summarized in **Table 6** and presented on **Figure 10**. Detected perchlorate concentrations ranged from 0.29 $\mu\text{g}/\text{L}$ (MW-29-05) to 4.9 $\mu\text{g}/\text{L}$ (MW-29-01). The perchlorate concentrations in two wells MW-29-02 (1.9 $\mu\text{g}/\text{L}$) and MW-29-07 (2.1 $\mu\text{g}/\text{L}$) were above the USEPA screening level for Tapwater (1.4 $\mu\text{g}/\text{L}$). However both of these wells have TDS values above 10,000 mg/L and therefore it may be assumed that the pathway for groundwater ingestion is incomplete for these two wells (i.e., the wells are explicitly ruled out as USEPA Class IIIb aquifer based on TDS levels). Perchlorate was not detected in MW-29-03 (the only well with TDS value below 10,000 mg/L) and MW-29-04, two cross-gradient wells.

2.6 Munitions and Explosives of Concern, Practice Biological Warfare Bomblets and Practice Chemical Warfare Munitions

During a site reconnaissance for the Supplemental RFI project (HGL, 2007), construction and aircraft debris, MEC, and MD were observed on the surface and in the shallow subsurface of LF029 (**Figure 11** – Figure 5.8 from Supplemental RFI [HGL, 2007]). MEC items identified at the site included three parachute flare illumination devices. MD at the surface included two 5-inch Zuni Rocket Motors and small piles of tail boom and fin assemblies. Some MD discovered on the ground surface was tentatively identified as biological warfare bomblets. According to the Explosive Ordnance Incident Report prepared by the 110th Technical Escort (TE) (TE, 2007), the MD was identified as E61R4 and E99 biological warfare bomblets. It was determined by TE that none of these bomblets had biological agent, and decontamination of approximately 200-250 empty munitions E61R4s and 12 E99 bomblets was performed under command of 110th TE in June 2007. The MD and decontamination sumps were turned over to Holloman AFB for disposition as hazardous waste. Soil samples were also tested for the presence of

biological warfare materiel, and were confirmed as having no biological agent present (TE, 2007). According to TE's report, Fort Detrick Special Report 251 dated September 1955 indicated that the bomblets dropped over Holloman AFB were for fuze testing purposes and, therefore, the filler was likely water, or water/simulant slurry.

During a site reconnaissance in December 2007, it was discovered that not all MD was removed during the TE response. M125 10-pound gas bombs were also encountered on the surface of the site; some appeared to be intact while others appeared to have been detonated. In August 2009 Holloman AFB, 110th TE and the U.S. Army Chemical Materials Agency (CMA) evaluated the eight M125s using X-ray and the Portable Isotopic Neutron Spectroscopy (PINS) Chemical Assay System. Review of the x-rays determined these items contained a liquid filler, partial fuze remnants, and energetic material (burster). PINS analysis revealed that the M125s liquid filler was water/antifreeze filler. The CMA Materiel Assessment Review Board (MARB) met and evaluated the data. The MARB recommended local disposition of the M125s and Holloman Explosive Ordnance Disposal disposed of the M125s by detonation in September 2009 (personal communication, 2014).

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3.0 RECOMMENDATIONS

Based on Supplemental RFI investigation results, historic sampling results, and compliance monitoring, former disposal activities at the LF029 Old Army Landfill/SWMU 104 have not impacted soil and groundwater quality. Therefore, no additional soil or groundwater monitoring activities are recommended for the LF029 Old Army Landfill/SWMU 104.

Although MEC and MD including the practice biological warfare bomblets and practice chemical warfare munitions discovered at the surface of the site were removed, the potential for their presence in the subsurface exists. Holloman AFB currently classifies the LF029 as an ERP site with limited access (there is a fence around the site with a locked gate). Holloman AFB has no plans for any construction on or near the site and there are no anticipated future land use changes for the location. Therefore, FPM recommends that the potential presence of subsurface MEC/Material Potentially Presenting an Explosive Hazard (MPPEH) should be addressed through Land Use Controls (LUCs) and long term management.

3.1 Land Use Controls

In general, LUCs may consist of Engineering Controls (ECs) such as physical barriers (i.e., fences and security guards) and/or Institutional Controls (ICs), such as administrative and legal controls. ICs minimize the potential for human exposure to contamination by limiting land or resource use. ICs also take the form of methods to preserve information and data, and inform current and future generations of hazards and risks.

3.1.1 Engineering Controls at LF029

ECs are already imposed at LF029. There is a fence around LF029 and access to site is limited to authorized Base personnel and contractors. The gate is locked at all times except as necessary to provide access for authorized personnel. The fence enclosing the LF029 and associated gate and lock are features that are subject to the inspection, maintenance, and repair requirements.

3.1.2 Institutional Controls at LF029 Old Army Landfill/SWMU 104

ICs at LF029 will include the following:

- Government ownership (e.g., federal),
- Warning notices (e.g., no trespassing signs, notification signs for hazardous and sensitive areas,
- Resource-use management (e.g., land use and real property controls, excavation permits),
- Information packages, and
- Site information systems (e.g., information tracking systems on the location and nature of waste sites or geographic-based information archives).

3.2 Long Term Management

The long term management at LF029 will include inspection, maintenance, and repair processes for the perimeter security fence, gate, lock, and warning signs. The fence, gate, lock, and warning signs will be inspected annually. The inspections will document the condition of the fence, including fence wires, posts, gate, gate lock, and warning signs. In addition, excessive accumulations of wind-blown plants and debris that would obscure warning signs, or block

access to the LF029 site will be documented in the LUC Inspection Form. USAF is the lead agency responsible for ensuring the fence, gate, and the signs are maintained throughout the duration of the LUCs.

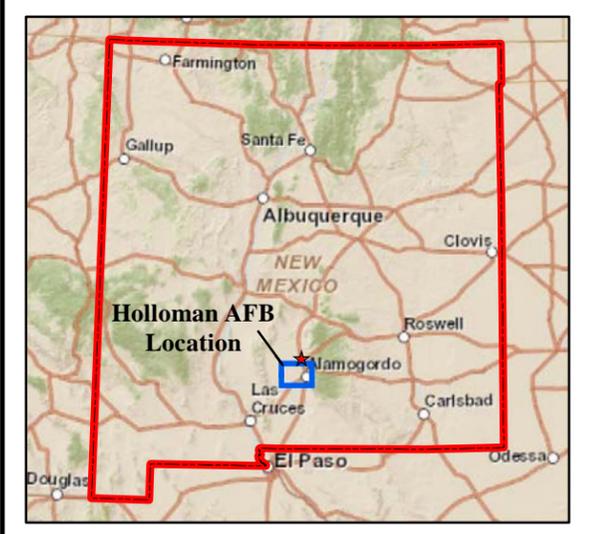
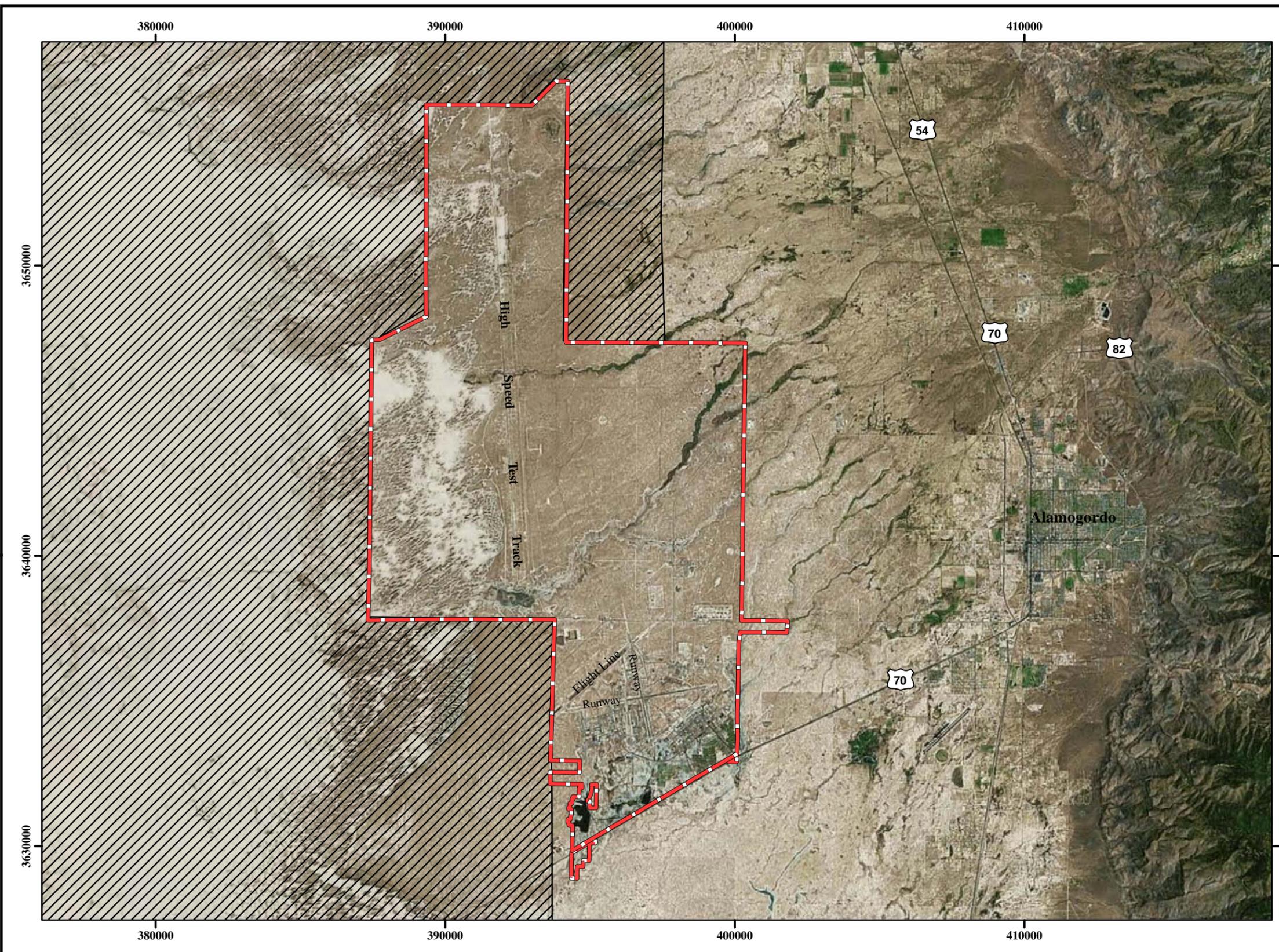
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USEPA. 2016. Regional Screening Levels for Chemical Contaminants at Superfund Sites.
May.

FIGURES

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- Legend**
- White Sands Missile Range
 - Installation Boundary

Performance Based Remediation
 New Mexico-Arizona
 Holloman Air Force Base
 Alamogordo, NM

AFCEC

FIGURE 1

**Holloman Air Force Base
 Location**

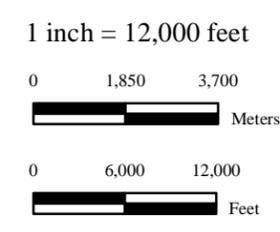


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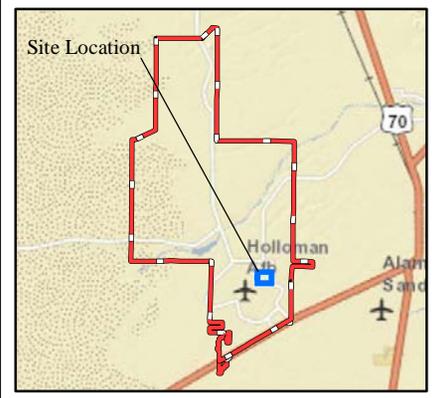
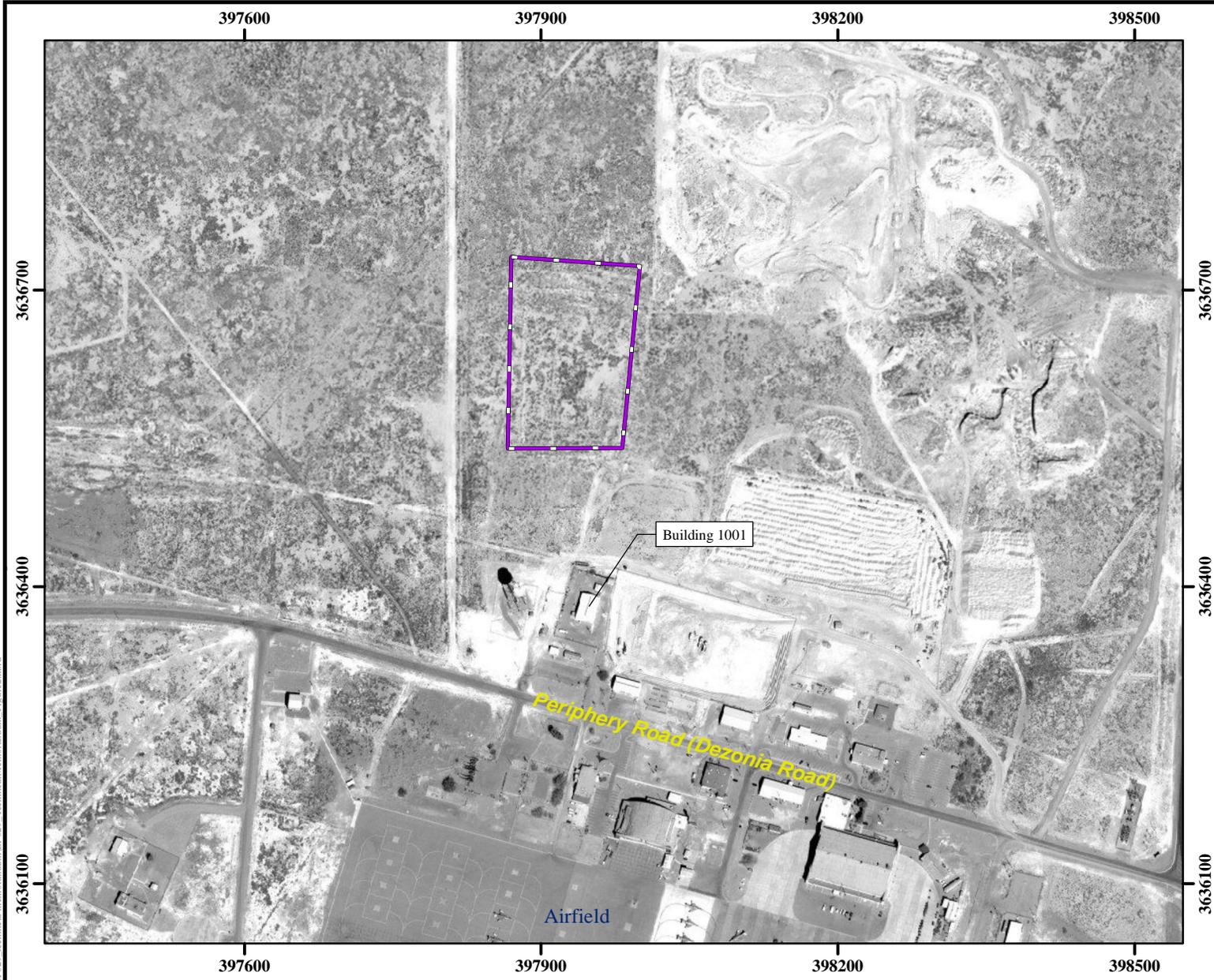
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- Legend**
-  LF029 Old Army Landfill (6 acres)
 -  Installation Boundary

Performance Based Remediation
 New Mexico-Arizona
 Holloman Air Force Base
 Alamogordo, NM

AFCEC

FIGURE 2

LF029 Old Army Landfill/SWMU
 104 Location

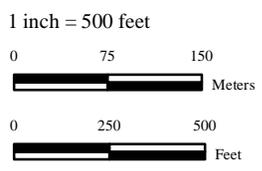


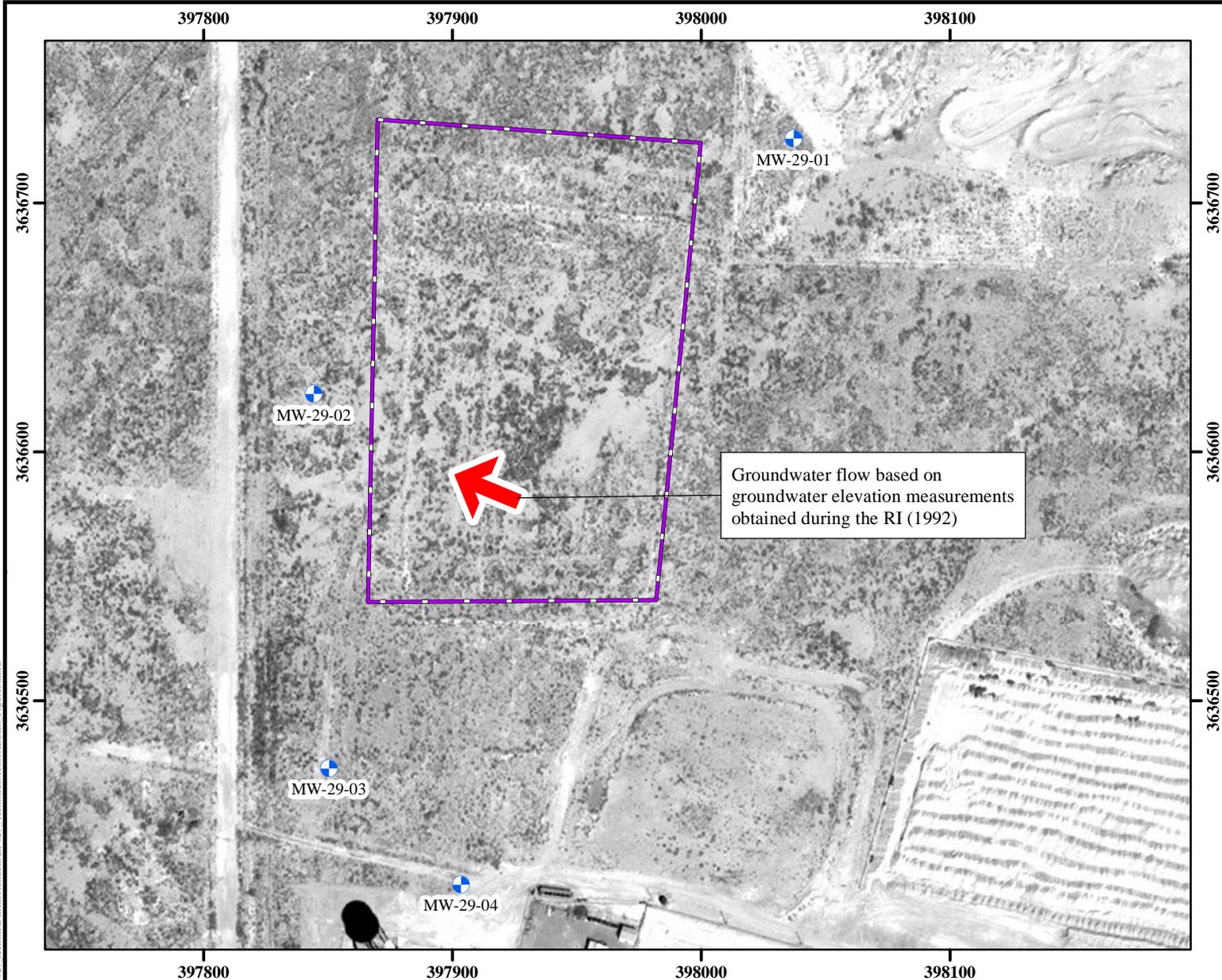
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- Legend**
- Monitoring Well
 - LF029 Old Army Landfill/SWMU 104 (6 acres)
 - Installation Boundary

Performance Based Remediation
 New Mexico-Arizona
 Holloman Air Force Base
 Alamogordo, NM

AFCEC

FIGURE 3

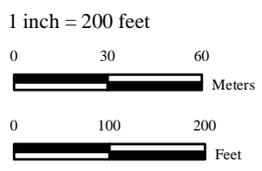
LF029 Groundwater Monitoring Well Locations RI (1992)



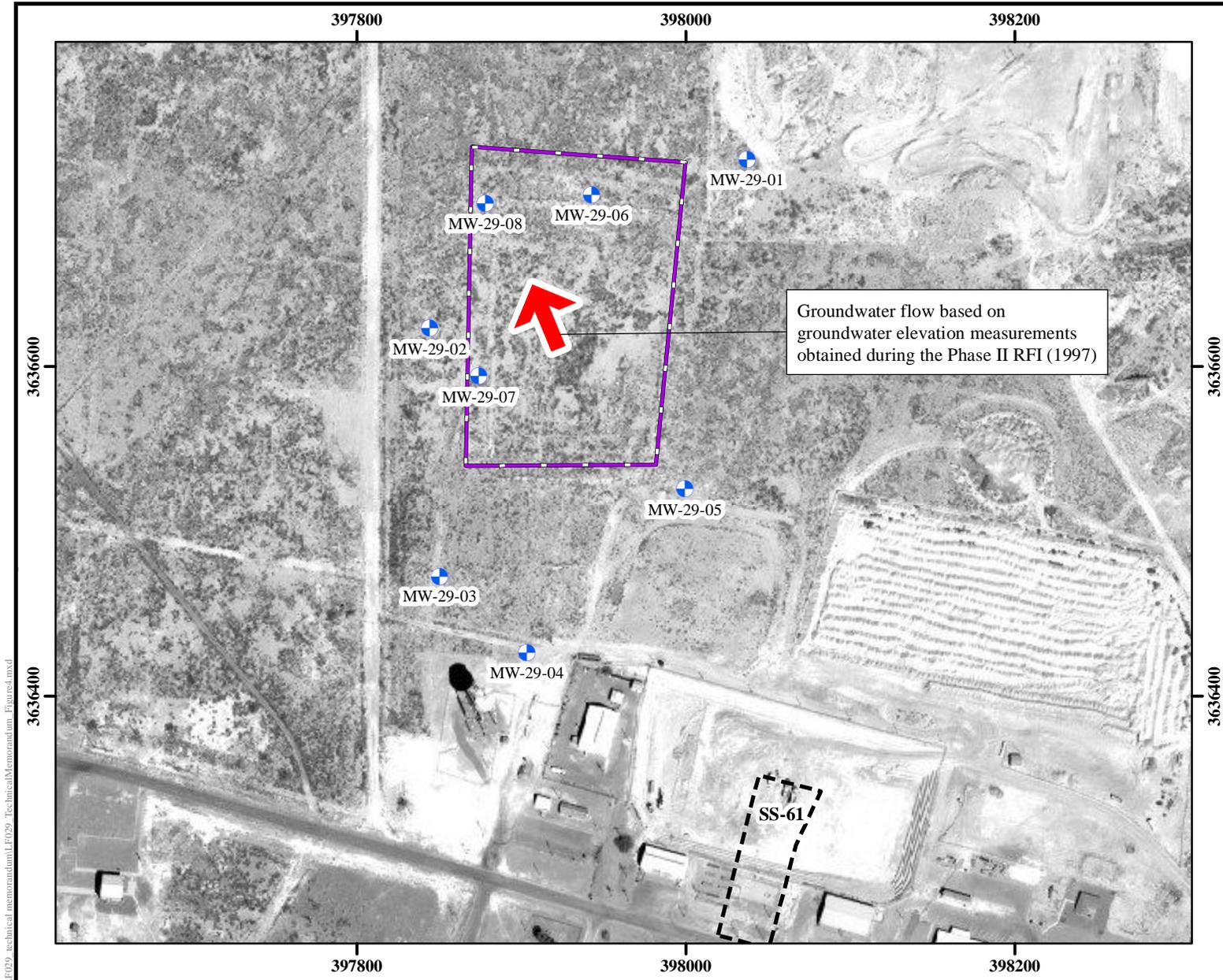
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- Legend**
- Monitoring Well
 - LF029 Old Army Landfill/SWMU 104 (6 acres)
 - Installation Boundary

Performance Based Remediation
 New Mexico-Arizona
 Holloman Air Force Base
 Alamogordo, NM

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FIGURE 4

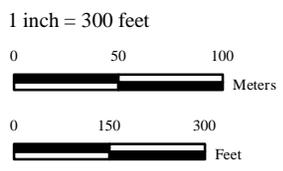
LF029 Groudwater Monitoring Well Locations Phase II RFI (1994)



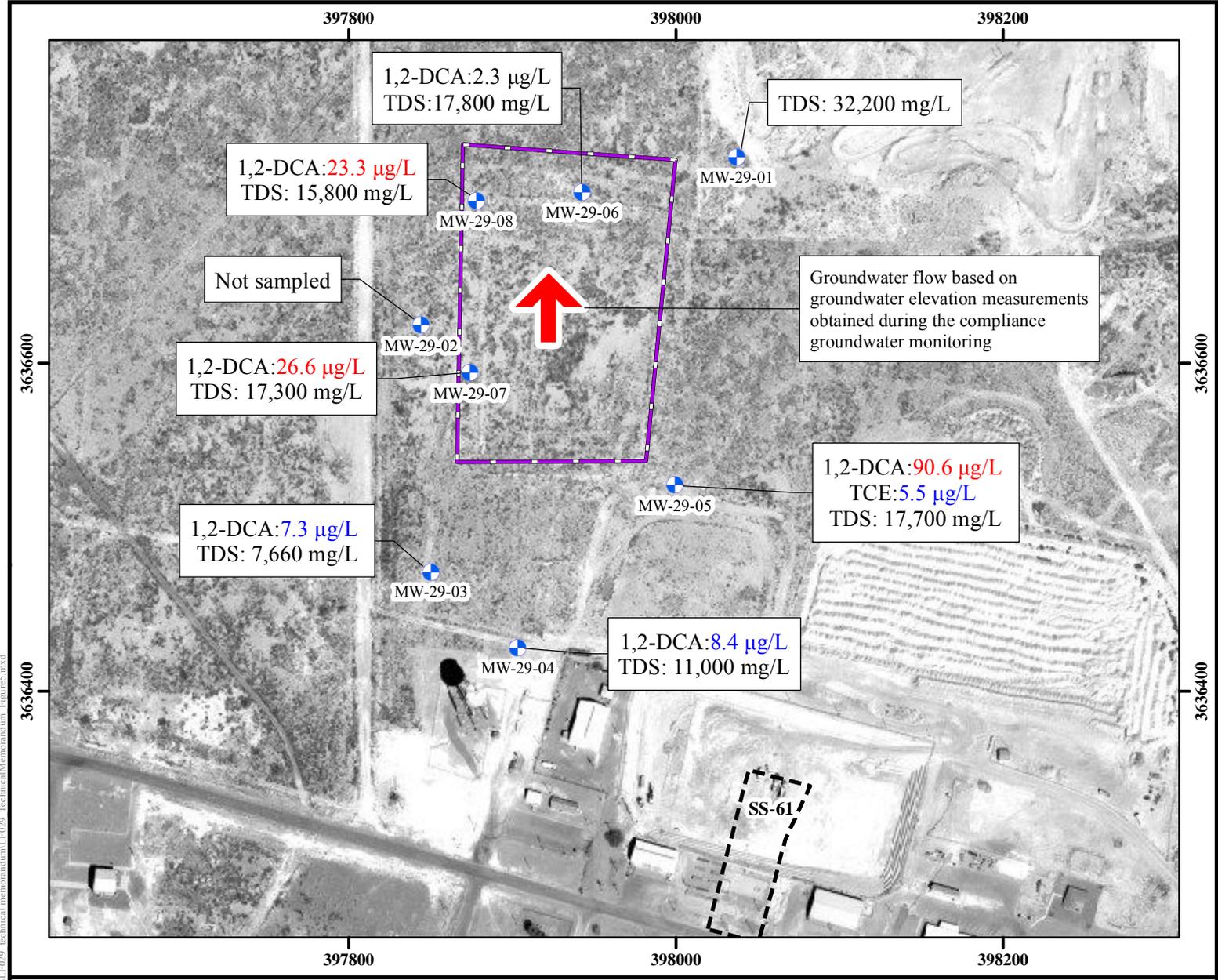
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- ### Legend
- Monitoring Well
 - LF029 Old Army Landfill/SWMU 104 (6 acres)
 - Installation Boundary
 - 90.6 Exceeding both NMGWQ standard and USEPA MCL
 - 5.5 Exceeding USEPA MCL

Performance Based Remediation
 New Mexico-Arizona
 Holloman Air Force Base
 Alamogordo, NM

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FIGURE 5

LF029 December 2005 1,2-DCA, TCE, and TDS Concentrations

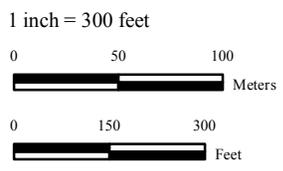


2016

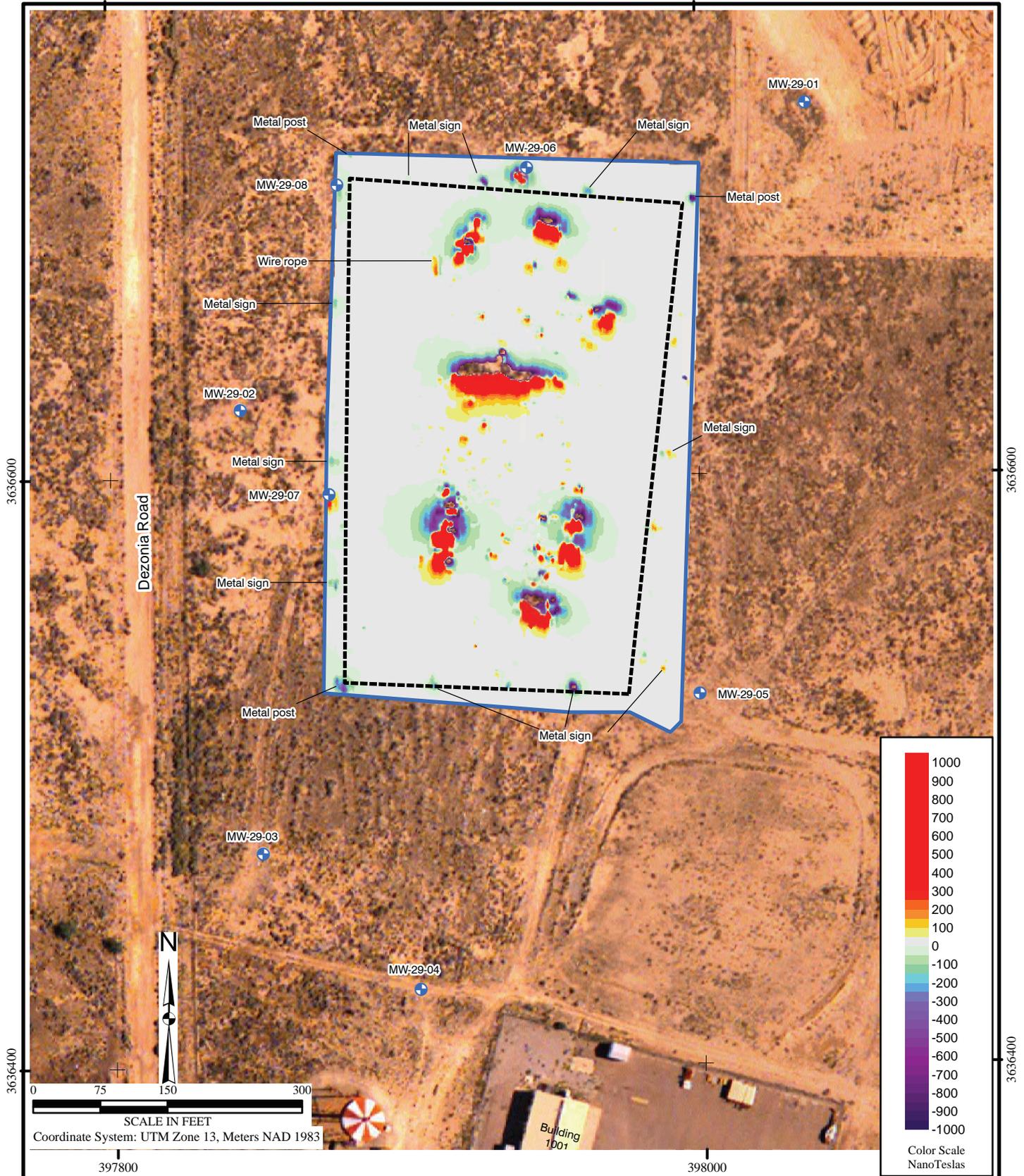
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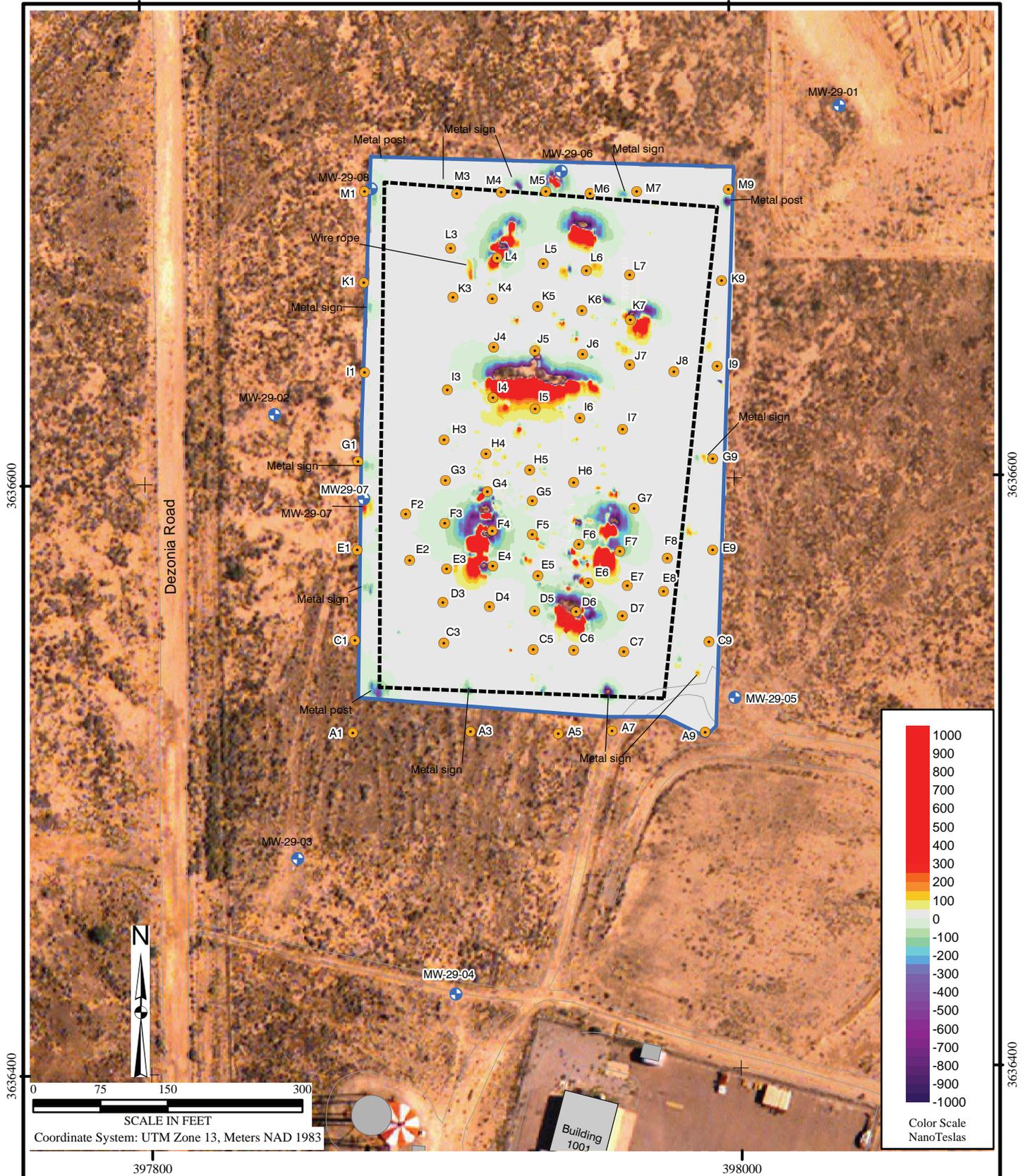


Legend

- Monitoring Well
- Operable Unit Boundary (Base GIS)
- Magnetic Survey Boundary

Figure 6

Figure 5.5
LF-29
Magnetic Survey Map



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 Revised: 05/11/07 PS
 Map Source: Holloman AFB



Legend

- Monitoring Well
- Soil Gas Sample
- Operable Unit Boundary (Base GIS)
- Magnetic Survey Boundary

Figure 7 **Figure 5.6**
LF-29
Soil Gas Survey Sample
Location Map



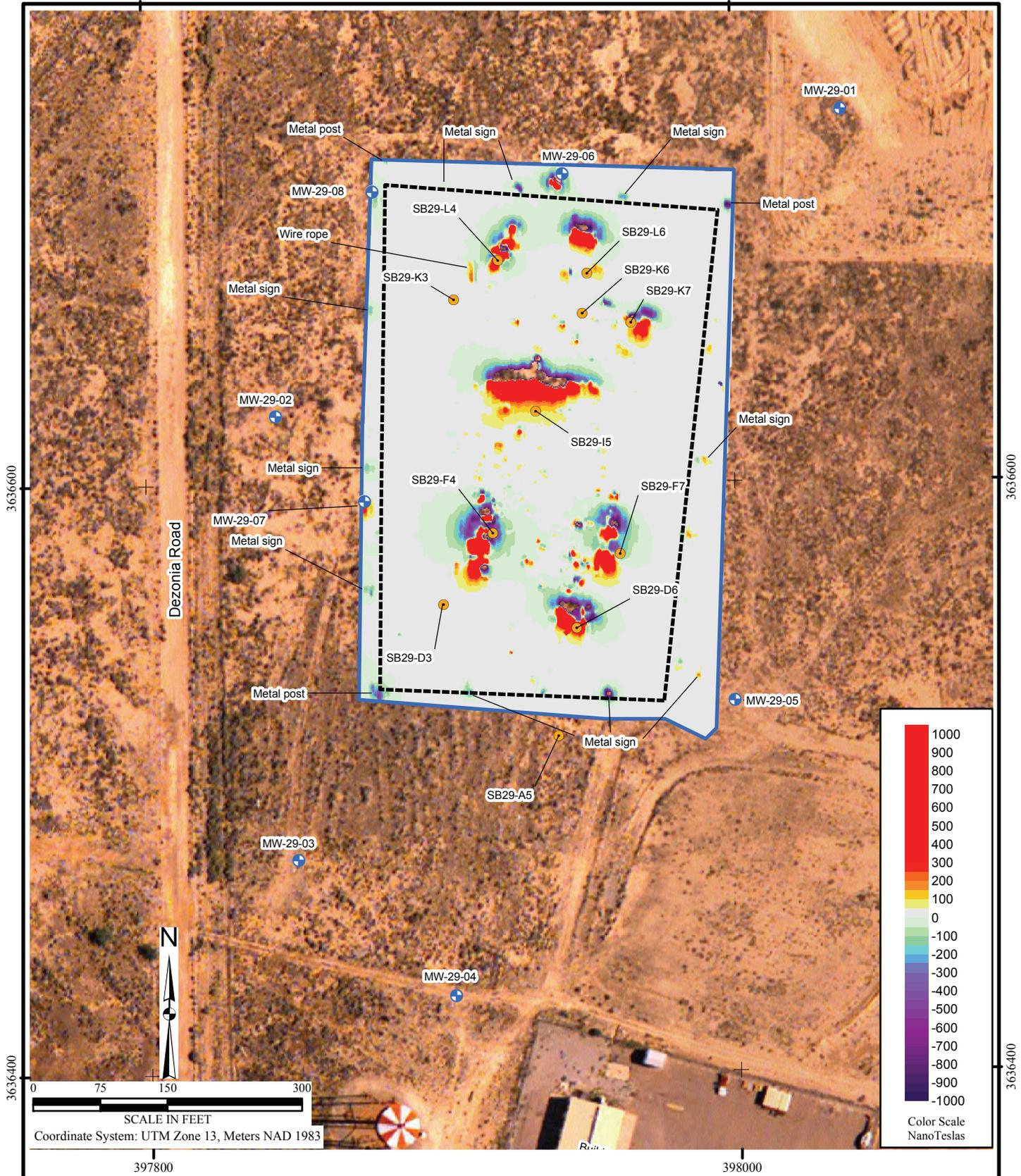
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 Revised: 05/14/07 PS
 Map Source: Holloman AFB



Legend

- Monitoring Well
- Soil Gas Sample
- Operable Unit Boundary (Base GIS)
- Magnetic Survey Boundary
- 185 BTEX Concentration in Nanograms per Trap

Figure 8 **Figure 5.9**
LF-29
Soil Gas BTEX
Concentrations

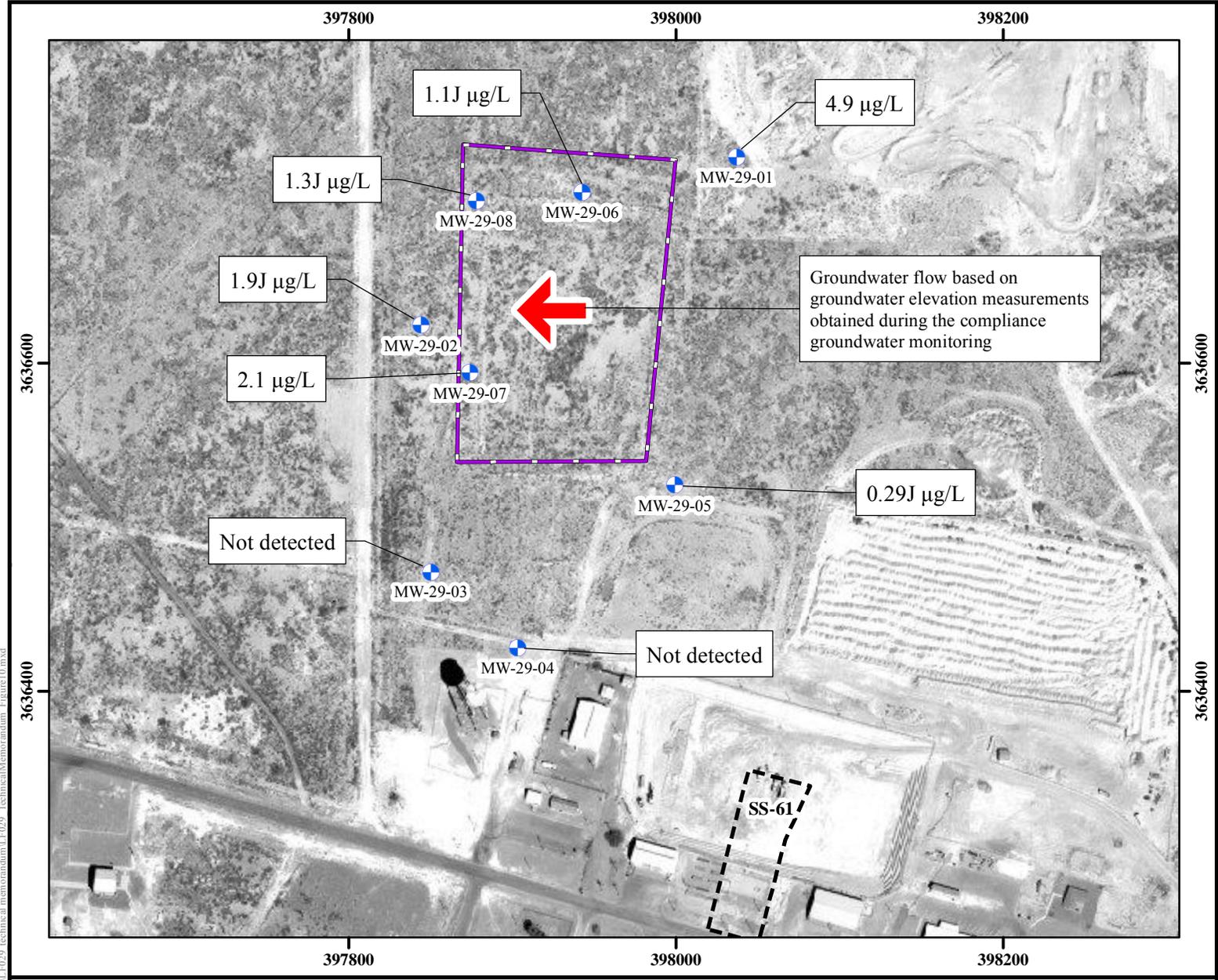


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 Map Source: Holloman AFB



- Legend**
- + Monitoring Well
 - Subsurface Soil Sample
 - Operable Unit Boundary (Base GIS)
 - Magnetic Survey Boundary

Figure 9
Figure 5.7
LF-29
Soil Boring Locations



Legend

- Monitoring Well
- LF029 Old Army
- Landfill/SWMU 104 (6 acres)
- Installation Boundary

Performance Based Remediation
 New Mexico-Arizona
 Holloman Air Force Base
 Alamogordo, NM

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FIGURE 10

LF029 Groundwater Perchlorate Concentrations Supplemental RFI (2007)

NOTES:
 Revision Date: 1/10/2016

Coordinate System: NAD 1983 UTM Zone 13N
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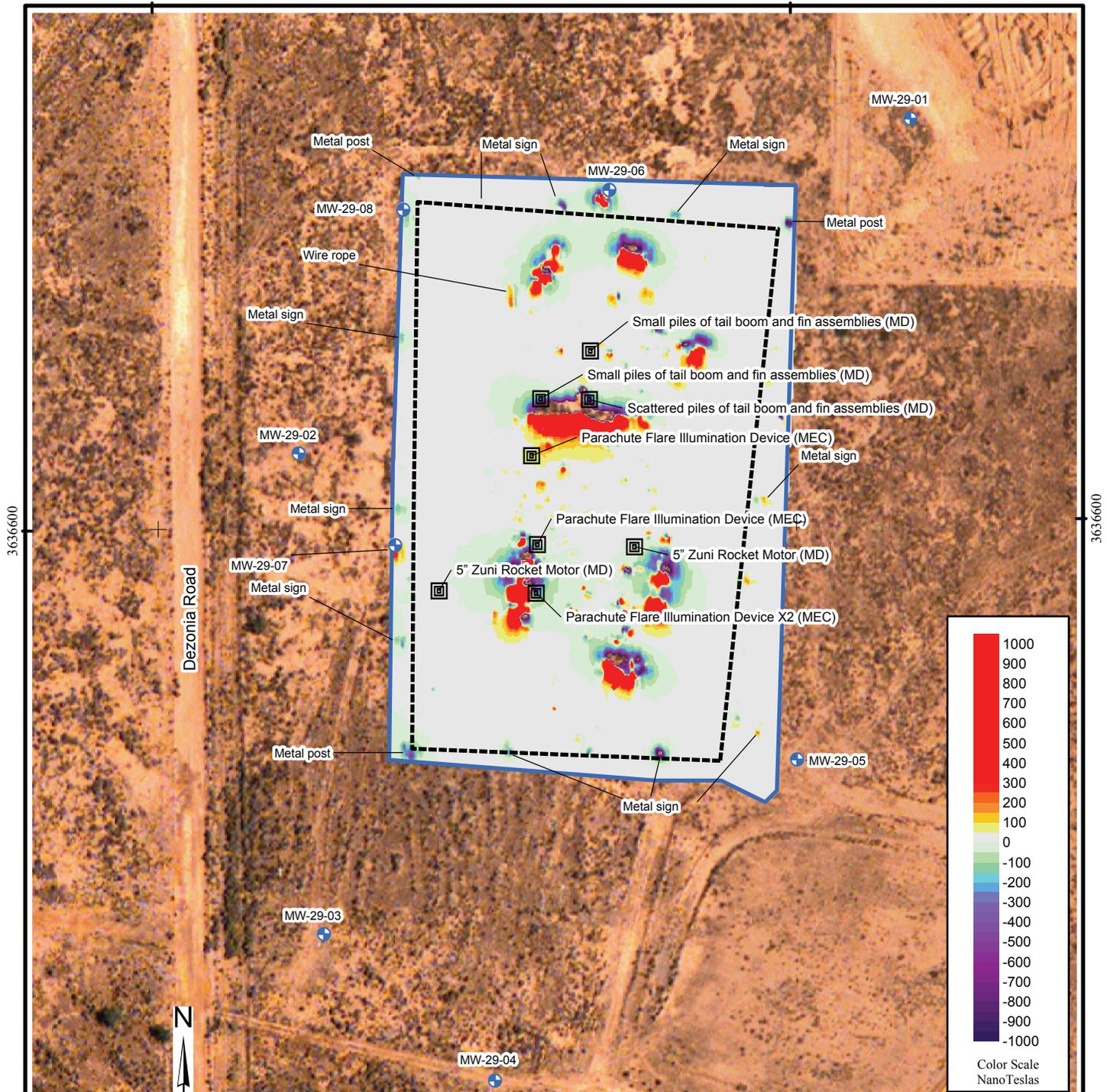
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1 inch = 300 feet

0 50 100 Meters

0 150 300 Feet

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Munitions and explosives of concern (MEC). This term, which distinguishes specific categories of military munitions that may pose unique explosives safety risks.

Munitions Debris. Remnants of munitions (e.g., fragments, penetrators, projectiles, shell casings, links, fins) remaining after munitions use, demilitarization, or disposal. Inert munitions-related material recovered during an MEC removal.

- Legend**
- + Monitoring Well
 - Subsurface Soil Sample
 - Munitions and Explosives of Concern (MEC)/ Munitions Debris (MD)
 - Operable Unit Boundary (Base GIS)
 - Magnetic Survey Boundary

Figure 11 **Figure 5.8**
LF-29
Munitions and Explosives of Concern / Munitions Debris

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Revised: 05/11/07 PS
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TABLES

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Table 1 LF029 1992 Remedial Investigation Groundwater Analytical Results

Analyses	Background ¹ (Radon 1992, 1993)	USEPA MCL ²	NMWQCC Standard ³	Monitoring Wells			
				MW-29-03	MW-29-04	MW-29-01	MW-29-02
EPA 160.1- Total Dissolved Solids (mg/L)	43,600	N/A	1,000	7,100	6,000	21,000	21,000
EPA 300.0- Chloride (mg/L)	19,600	N/A	250	1,100	1,000	7,800	6,900
EPA 300.0- Sulfate (mg/L)	7,470	N/A	600	3,200	2,800	4,900	5,800
EPA 340.2- Fluoride (mg/L)	4.7	4	1.6	1.1	<0.10	1.4	1.1
EPA 353.1- Nitrate-Nitrite (mg/L)	98	10	10	6.4	11	11	9.0
EPA 365.2- Total Phosphorous (mg/L)	0.75	N/A	N/A	0.07	0.063	0.77	0.49
SW6010- Metals (µg/L)							
Antimony	89.6	6	N/A	< 100	< 100	230	<100
Beryllium	3.8	4	N/A	< 2	< 2	4.9	4.5
Chromium	234	100	50	< 10	< 10	66	<10
Copper	38.6	1,300	1,000	< 20	< 20	110	73
Nickel	43.6	N/A	200	< 20	< 20	97	61
Zinc	253.4	N/A	10,000	< 20	< 20	180	130
SW7421- Lead	19.9	15	50	< 3	< 3	10 Z	15
SW7740 - Selenium	79.3	50	50	6.9	6.2	18	25
SW8080 - Organochlorine Pesticides and PCBs (µg/L)							
4,4'- DDD	N/A	N/A	N/A	0.028 C	< 0.0094	< 0.0096	< 0.010
SW8240 - Volatile Organics (µg/L)							
Chloroform	N/A	80	100	22	6.2	< 5.0	< 5.0
Methylene chloride	N/A	5	100	1.5 J	5.4	9.3 B	11

Notes:

C = Presence and quantitation of analyte confirmed by second column analysis.

J = Estimated concentration, analyte detected below the reported detection limit.

B = Analyte detected in laboratory blank analysis, no blank subtraction performed.

Z = SW6010, SW7421 - Analyte detected in method blank.

N/A = No value available

µg/L = micrograms per liter

MCL = Maximum Contaminant Level
mg/L = milligrams per liter
NMWQCC = New Mexico Water Quality Control Commission
USEPA = U.S. Environmental Protection Agency

- 1 – Source for Inorganic Results: Radian Corporation, 1992b, RI, Report, Volume II of III, Appendices A, B, C, and D, Investigation, Study and Recommendation for 29 Waste Sites. Source for Metals: Radian Corporation, 1993, Phase I Groundwater Assessment Monitoring Report, Sewage Lagoons and Lakes Investigation, Holloman AFB, New Mexico.
- 2 – USEPA Regional Screening Levels for Chemical Contaminants at Superfund Sites (USEPA, 2016).
- 3 – (NMWQCC Regulations and Standards, 2014). Ground and Surface Water Protection.
<https://www.env.nm.gov/gwb/documents/2062NMAC-Amended2014.pdf>

Results in italics exceed USEPA or NMWQCC standards but are below background levels.

Results in bold and italic exceed USEPA and NMWQCC standards, and background values but concentrations in upgradient well are above concentrations in downgradient wells.

Table 2 LF029 1994 Phase II RFI Groundwater Analytical Results

Analyte	Background ¹ (Radan 1993)	USEPA MCL ²	NMWQCC Standard ³	Monitoring Wells						
				MW-29-03*	MW-29-04*	MW-29-05*	MW-29-02	MW-29-06	MW-29-07	MW-29-08
SW6010 (µg/L)										
Aluminum	N/A	N/A	5,000	32	1,700	10,300	1,200	12,400	3,100	12,400
Barium	930	2,000	1,000	<DL	<DL	98	<DL	190	<DL	140
Calcium	N/A	N/A	N/A	540,000	659,000	1,010,000	690,000	191,190,000	637,000	985,000
Iron	N/A	N/A	1,000	240	1,400	9,600	1,600	12,300	3,400	17,400
Magnesium	N/A	N/A	N/A	310,000	539,000	1,100,000	1,070,000	931,000	806,000	829,000
Manganese	N/A	N/A	200	ND	<DL	8,900	ND	430	72	280
Nickel	43.6	N/A	200	ND	ND	ND	ND	<DL	ND	<DL
Potassium	N/A	N/A	N/A	<DL	26,200	<DL	<DL	<DL	<DL	<DL
Sodium	N/A	N/A	N/A	725,000	1,590,000	4,380,000	4,460,000	4,270,000	3,550,000	3,890,000
Thallium	94.3	2	N/A	ND	ND	ND	ND	ND	<DL	<DL
Vanadium	434.4	N/A	N/A	26	29	ND	<DL	<DL	<DL	<DL
Zinc	253.4	N/A	10,000	<DL	ND	ND	ND	ND	ND	ND
SW7060 (µg/L)										
Arsenic	72.3	10	100	<DL	<DL	15	<DL	<DL	<DL	9
SW7421 (µg/L)										
Lead	19.9	15	50	ND	<DL	<DL	<DL	<DL	<DL	<DL
SW7740 (µg/L)										
Selenium	79.3	50	50	<DL	<DL	<DL	<DL	<DL	<DL	<DL
SW8080 (µg/L)										
4,4'-DDE	N/A	N/A	N/A	ND	ND	0.0015 J	ND	ND	ND	ND
Endosulfan II	N/A	N/A	N/A	ND	ND	0.002	ND	ND	ND	ND
beta-BHC	N/A	N/A	N/A	ND	ND	0.024	ND	ND	ND	ND
delta-BHC	N/A	N/A	N/A	0.0046 J	0.0043 J	0.0091 J	0.0050 J	ND	ND	0.0048 Jb
SW8150 (µg/L)										
2,4,5-TP (Silvex)	N/A	N/A	N/A	ND	ND	0.0086 J	ND	ND	ND	ND
Dicamba	N/A	N/A	N/A	ND	ND	0.073 J	ND	ND	ND	ND
SW8240 (µg/L)										
1,2 Dichloroethane	N/A	5	10	ND	ND	350	9.3	9.6	0.82 J	8.7
2-Chloroethyl vinyl ether	N/A	N/A	N/A	ND	ND	ND	0.64 J	ND	ND	ND
Acetone	N/A	N/A	N/A	ND	ND	ND	ND	ND	ND	5.6 Jb
Benzene	N/A	5	10	0.18 Jb	0.19 Jb	3,100	0.20 Jb	ND	0.13 Jb	0.14 Jb
Bromodichloromethane	N/A	80	N/A	ND	ND	ND	ND	ND	0.41 J	ND
Chloroform	N/A	80	100	11	2.0 J	ND	1.4 J	ND	4.4 J	0.22 J
Methylene chloride	N/A	5	100	0.82 JB	1.0 JB	23 J	0.98 JB	1.1 JB	1.4 JB	1.2 Jb
Toluene	N/A	1,000	750	0.29 Jb	0.38 Jb	ND	0.37 Jb	ND	ND	0.20 Jb

Analyte	Background ¹ (Radon 1993)	USEPA MCL ²	NMWQCC Standard ³	Monitoring Wells						
				MW-29-03*	MW-29-04*	MW-29-05*	MW-29-02	MW-29-06	MW-29-07	MW-29-08
Total xylenes	N/A	10,000	620	0.49 Jb	1.3 Jb	35 J	0.61 Jb	0.75 JB	0.45 Jb	1.3 Jb
SW8330 (µg/L)										
1,3,5-Trinitrobenzene	N/A	N/A	N/A	ND	ND	2.6	ND	ND	ND	ND
2,4,6-Trinitrotoluene	N/A	N/A	N/A	ND	ND	0.23	ND	ND	ND	ND

Notes:

b = Reported analyte concentration cannot be distinguished from field blank concentrations.

B = Reported analyte concentration may be due to analytical background (or noise) from the laboratory.

J = Estimated concentration, analyte detected below the reported detection limit

N/A = No value available

ND = Not detected. No instrument response for analyte or result less than zero.

<DL = Analyte measured below the detection limit and below the background UTL.

µg/L = micrograms per liter

MCL = Maximum Contaminant Level

NMWQCC = New Mexico Water Quality Control Commission

USEPA = U.S. Environmental Protection Agency

*Upgradient wells

1 – Source for Metals: Radian Corporation, 1993, Phase I Groundwater Assessment Monitoring Report, Sewage Lagoons and Lakes Investigation, Holloman AFB, New Mexico.

2 – USEPA Regional Screening Levels for Chemical Contaminants at Superfund Sites (USEPA, 2016).

3 – (NMWQCC Regulations and Standards, 2014). Ground and Surface Water Protection.

<https://www.env.nm.gov/gwb/documents/2062NMAC-Amended2014.pdf>

Results in italics exceed USEPA or NMGWQ standards but are below upgradient or background levels.

Results in Bold and italics exceed USEPA Primary Drinking Water MCLs and are greater than the background and upgradient values.

Results underlined in Bold and italics exceed NMGWQ Ground Water Standards for Human Health and are greater than the background and upgradient values.

Table 3 LF029 Groundwater Compliance Long Term Monitoring Results (1997-2005)

Analyte	Background ¹ (Supplemental RFI)	USEPA MCL ³	NMWQCC Standard ⁴	Well MW-29-01 (upgradient)					Well MW-29-05 (upgradient)				
				Sept- 97	Sept- 99	Sept- 01	Apr- 03	Dec- 05	Sept- 97	Sept- 99	Sept- 01	Apr- 03	Dec-05
VOCs⁵ (µg/L)													
Benzene	N/A	5	10	0.54 J	< 3	< 5	NA	ND	NS	NS	NS	NS	3.6
Bromoform	N/A	80	N/A	0.64 J	< 3	< 5	NA	ND	NS	NS	NS	NS	ND
sec-Butylbenzene	N/A	N/A	N/A	NA	NA	NA	NA	ND	NS	NS	NS	NS	2.4
tert-Butylbenzene	N/A	N/A	N/A	NA	NA	NA	NA	ND	NS	NS	NS	NS	1.5
Chloroform	N/A	80	100	ND	< 3	< 5	< 1	ND	NS	NS	NS	NS	ND
1,2 Dichloroethane	N/A	5	10	ND	< 3	< 5	< 1	ND	NS	NS	NS	NS	90.6
o-Dichlorobenzene (Dichlorobenzene, 1,2-)	N/A	600	N/A	NA	NA	NA	NA	ND	NS	NS	NS	NS	0.85 J
Isopropylbenzene (Cumene)	N/A	N/A	N/A	NA	NA	NA	NA	ND	NS	NS	NS	NS	4.6
Methylene chloride	N/A	5	100	2.5 UB	< 3	< 5	NA	ND	NS	NS	NS	NS	ND
Naphthalene	N/A	N/A	N/A	ND	< 5	< 5	NA	ND	NS	NS	NS	NS	ND
Trichloroethylene (1,1,2- trichloroethylene [TCE])	N/A	5	100	NA	NA	NA	NA	ND	NS	NS	NS	NS	5.5
SVOCs (µg/L)													
Butyl benzyl phthalate	N/A	N/A	N/A	ND	< 5	NA	NA	ND	NS	NS	NS	NS	ND
Di-n-butyl phthalate (Dibutyl Phthalate)	N/A	N/A	N/A	ND	< 5	NA	NA	ND	NS	NS	NS	NS	ND
bis(2-Ethylhexyl) phthalate	N/A	6	N/A	ND	1 J	NA	NA	ND	NS	NS	NS	NS	ND
Phenol	N/A	N/A	5	ND	2 J	NA	NA	ND	NS	NS	NS	NS	ND
TDS (mg/L)	N/A	N/A	1,000	ND	2 J	NA	NA	32,200	NS	NS	NS	NS	17,700

Table 3 LF029 Groundwater Compliance Long Term Monitoring Results (1997-2005) (continued)

Analyte	Background ¹ (Supplemental RFI)	USEPA MCL ³	NMWQCC Standard ⁴	Well MW-29-03					Well MW-29-04				
				Sept- 97	Sept- 99	Sept- 01	Apr- 03	Dec- 05	Sept- 97	Sept- 99	Sept- 01	Apr-03	Dec-05
VOCs⁵ (µg/L)													
Benzene	N/A	5	10	NS	NS	NS	NS	ND	NS	NS	NS	NS	ND
Bromoform	N/A	80	N/A	NS	NS	NS	NS	ND	NS	NS	NS	NS	ND
sec-Butylbenzene	N/A	N/A	N/A	NS	NS	NS	NS	ND	NS	NS	NS	NS	ND
tert-Butylbenzene	N/A	N/A	N/A	NS	NS	NS	NS	ND	NS	NS	NS	NS	ND
Chloroform	N/A	80	100	NS	NS	NS	NS	6	NS	NS	NS	NS	1.8
1,2 Dichloroethane	N/A	5	10	NS	NS	NS	NS	7.3	NS	NS	NS	NS	8.4
o-Dichlorobenzene (Dichlorobenzene, 1,2-)	N/A	600	N/A	NS	NS	NS	NS	ND	NS	NS	NS	NS	ND
Isopropylbenzene (Cumene)	N/A	N/A	N/A	NS	NS	NS	NS	ND	NS	NS	NS	NS	ND
Methylene chloride	N/A	5	100	NS	NS	NS	NS	ND	NS	NS	NS	NS	ND
Naphthalene	N/A	N/A	N/A	NS	NS	NS	NS	ND	NS	NS	NS	NS	ND
Trichloroethylene (1,1,2- trichloroethylene [TCE])	N/A	5	100	NS	NS	NS	NS	ND	NS	NS	NS	NS	ND
SVOCs (µg/L)													
Butyl benzyl phthalate	N/A	N/A	N/A	NS	NS	NS	NS	ND	NS	NS	NS	NS	ND
Di-n-butyl phthalate (Dibutyl Phthalate)	N/A	N/A	N/A	NS	NS	NS	NS	ND	NS	NS	NS	NS	ND
bis(2-Ethylhexyl) phthalate	N/A	6	N/A	NS	NS	NS	NS	ND	NS	NS	NS	NS	ND
Phenol	N/A	N/A	5	NS	NS	NS	NS	ND	NS	NS	NS	NS	ND
TDS (mg/L)	N/A	N/A	1,000	NS	NS	NS	NS	7,660	NS	NS	NS	NS	11,000

Table 3 LF029 Groundwater Compliance Long Term Monitoring Results (1997-2005) (continued)

Analyte	Background ¹ (Supplemental RFI)	USEPA MCL ³	NMWQCC Standard ⁴	Well MW-29-06					Well MW-29-07				
				Sept- 97	Sept- 99	Sept- 01	Apr- 03	Dec-05	Sept- 97	Sept- 99	Sept- 01	Apr- 03	Dec-05
VOCs⁵ (µg/L)													
Benzene	N/A	5	10	ND	< 3	< 5	NA	ND	ND	< 3	< 5	NA	ND
Bromoform	N/A	80	N/A	ND	< 3	< 5	NA	ND	ND	< 3	< 5	NA	ND
sec-Butylbenzene	N/A	N/A	N/A	NA	NA	NA	NA	ND	NA	NA	NA	NA	ND
tert-Butylbenzene	N/A	N/A	N/A	NA	NA	NA	NA	ND	NA	NA	NA	NA	ND
Chloroform	N/A	80	100	ND	< 3	< 5	< 1	ND	3.6	4	2.7 J	1.9	1.8
1,2 Dichloroethane	N/A	5	10	ND	6	3.4 J	3	2.3	ND	11	18	15	26.6
o-Dichlorobenzene (Dichlorobenzene, 1,2-)	N/A	600	N/A	NA	NA	NA	NA	ND	NA	NA	NA	NA	ND
Isopropylbenzene (Cumene)	N/A	N/A	N/A	NA	NA	NA	NA	ND	NA	NA	NA	NA	ND
Methylene chloride	N/A	5	100	ND	< 3	< 5	NA	ND	ND	< 3	< 5	NA	ND
Naphthalene	N/A	N/A	N/A	ND	< 5	< 5	NA	ND	ND	< 5	< 5	NA	ND
Trichloroethylene (1,1,2- trichloroethylene [TCE])	N/A	5	100	NA	NA	NA	NA	ND	NA	NA	NA	NA	ND
SVOCs (µg/L)													
Butyl benzyl phthalate	N/A	N/A	N/A	ND	< 5	NA	NA	ND	ND	1 J	NA	NA	ND
Di-n-butyl phthalate (Dibutyl Phthalate)	N/A	N/A	N/A	1.6 UB	< 5	NA	NA	ND	ND	< 5	NA	NA	ND
bis(2-Ethylhexyl) phthalate	N/A	6	N/A	ND	1 J	NA	NA	ND	ND	1 J	NA	NA	ND
Phenol	N/A	N/A	5	ND	< 5	NA	NA	ND	ND	< 5	NA	NA	ND
TDS (mg/L)	N/A	N/A	1,000	ND	< 5	NA	NA	<i>17,800</i>	ND	< 5	NA	NA	<i>17,300</i>

Table 3 LF029 Groundwater Compliance Long Term Monitoring Results (1997-2005) (continued)

Analyte	Background ¹ (Supplemental RFI)	USEPA MCL ³	NMWQCC Standard ⁴	Well MW-29-08				
				Sept-97	Sept-99	Sept-01	Apr-03	Dec-05
VOCs⁵ (µg/L)								
Benzene	N/A	5	10	ND	< 3	< 5	NA	ND
Bromoform	N/A	80	N/A	ND	< 3	< 5	NA	ND
sec-Butylbenzene	N/A	N/A	N/A	NA	NA	NA	NA	ND
tert-Butylbenzene	N/A	N/A	N/A	NA	NA	NA	NA	ND
Chloroform	N/A	80	100	ND	< 3	< 5	0.25 J	ND
1,2 Dichloroethane	N/A	5	10	ND	15	18	16	23.3
o-Dichlorobenzene (Dichlorobenzene, 1,2-)	N/A	600	N/A	NA	NA	NA	NA	ND
Isopropylbenzene (Cumene)	N/A	N/A	N/A	NA	NA	NA	NA	ND
Methylene chloride	N/A	5	100	ND	< 3	< 5	NA	ND
Naphthalene	N/A	N/A	N/A	ND	< 5	< 5	NA	ND
Trichloroethylene (1,1,2-trichloroethylene [TCE])	N/A	5	100	NA	NA	NA	NA	ND
SVOCs (µg/L)								
Butyl benzyl phthalate	N/A	N/A	N/A	ND	< 5	NA	NA	ND
Di-n-butyl phthalate (Dibutyl Phthalate)	N/A	N/A	N/A	ND	< 5	NA	NA	ND
bis(2-Ethylhexyl) phthalate	N/A	6	N/A	ND	1 J	NA	NA	ND
Phenol	N/A	N/A	5	ND	< 5	NA	NA	ND
TDS (mg/L)	N/A	N/A	1,000	ND	< 5	NA	NA	<i>15,800</i>

Notes:

b = Reported analyte concentration cannot be distinguished from field blank concentrations.

B = Reported analyte concentration may be due to analytical background (or noise) from the laboratory.

J = Estimated concentration, analyte detected below the reported detection limit

UB = Qualifies as non-detect due to presence of analyte in associated laboratory blank

NA = not analyzed

N/A = No value available

ND = Not detected. No instrument response for analyte or result less than zero.

NS = not sampled

µg/L = micrograms per liter

MCL = Maximum Contaminant Level

mg/L = milligrams per liter

NMWQCC = New Mexico Water Quality Control Commission

SVOC = Semi-Volatile Organic Compounds

USEPA = U.S. Environmental Protection Agency

VOC = Volatile Organic Compounds

1 – Supplemental RFI – no background values were available.

2 – Final Basewide Background Study Report Holloman Air Force Base, New Mexico, Approved Background Levels for Unfiltered (Total) Constituents in Groundwater (NationView/Bhate JV III, LLC, 2012).

3 – USEPA Regional Screening Levels for Chemical Contaminants at Superfund Sites (USEPA, 2016).

4 – (NMWQCC Regulations and Standards, 2014). Ground and Surface Water Protection.

<https://www.env.nm.gov/gwb/documents/2062NMAC-Amended2014.pdf>

5 - Unless otherwise reported, no VOCs were detected prior to 2001 using EPA Method 8260B.

(EPA Method 8260A was used to analyze for VOCs in the 1995 and 1997 programs.)

Unless otherwise reported, no metals were detected using EPA Methods 6010B Trace & 7470A.

Unless otherwise reported, no organochlorine pesticides were detected prior to '99 using EPA Method 8081A.

(EPA Method 8080A was used to analyze for organochlorine pesticides in the 1995 and 1997 programs.)

Results in italics exceed USEPA or NMGWQ standards but are below upgradient or background levels.

Results in Bold and italics exceed USEPA Primary Drinking Water MCLs and are greater than the background and upgradient values.

Results underlined in Bold and italics exceed NMGWQ Ground Water Standards for Human Health and are greater than the background and upgradient values.

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Table 4 LF029 Soil Gas Survey VOC Analytical Results (2006)

Client Sample ID:	Method Blank	Trip-1	A1	A3	A5	A7	A9	C1	C3	C5	C6	C7
Project Number:	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lab File ID:	06053103.D	06053104.D	06053105.D	06053106.D	06053107.D	06053108.D	06053109.D	06053110.D	06053111.D	06053112.D	06053113.D	06053114.D
Received Date:	5/31/2006	5/30/2006	5/30/2006	5/30/2006	5/30/2006	5/30/2006	5/30/2006	5/30/2006	5/30/2006	5/30/2006	5/30/2006	5/30/2006
Analysis Date:	5/31/2006	5/31/2006	5/31/2006	5/31/2006	5/31/2006	5/31/2006	5/31/2006	5/31/2006	5/31/2006	5/31/2006	5/31/2006	5/31/2006
Analysis Time:	10:41	11:12	11:43	12:14	12:45	13:16	13:47	14:18	14:49	15:19	15:50	16:21
Units:	ng	ng	ng	ng	ng	ng	ng	ng	ng	ng	ng	ng
COMPOUNDS												
1,1-Dichloroethene	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
1,1,2-Trichlorotrifluoroethane	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
trans-1,2-Dichloroethene	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
Methyl-t-butyl ether	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
1,1-Dichloroethane	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
cis-1,2-Dichloroethene	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
Chloroform	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
2,2-Dichloropropane	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
1,2-Dichloroethane	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
1,1,1-Trichloroethane	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
1,1-Dichloropropene	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
Carbon Tetrachloride	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
Benzene	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
1,2-Dichloropropane	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
Trichloroethene	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
cis-1,3-Dichloropropene	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
trans-1,3-Dichloropropene	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
1,1,2-Trichloroethane	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
Toluene	<25	27	75	81	173	147	120	90	109	131	103	114
1,3-Dichloropropane	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
1,2-Dibromoethane (EDB)	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
Tetrachloroethene	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
1,1,1,2-Tetrachloroethane	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
Chlorobenzene	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
Ethylbenzene	<25	<25	<25	<25	45	44	27	<25	28	25	<25	<25
p & m-Xylene	<25	<25	<25	<25	45	39	28	<25	45	35	31	31
Bromoform	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
1,1,2,2-Tetrachloroethane	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
o-Xylene	<25	<25	<25	<25	33	27	<25	<25	35	27	<25	<25
1,2,3-Trichloropropane	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
Isopropylbenzene	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
1,3,5-Trimethylbenzene	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
1,2,4-Trimethylbenzene	<25	<25	<25	31	96	57	58	42	70	53	53	56
1,3-Dichlorobenzene	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
1,4-Dichlorobenzene	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
1,2-Dichlorobenzene	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
n-Butylbenzene	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
1,2,4-Trichlorobenzene	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
Naphthalene	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
1,2,3-Trichlorobenzene	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25

Notes:
 ng = Nanogram
 B = Detected in method blank
 J = Positive detection with reported concentration between the method detection limit and the reporting limit
 < = Reported value less than method detection limit

Table 4 LF029 Soil Gas Survey VOC Analytical Results (2006) (continued)

Client Sample ID:	C9	D3	D4	D5	D6	D7	E1	E2	E3	E4	Trip-2	E5
Project Number:	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lab File ID:	06053115.D	06053116.D	06053117.D	06053118.D	06053119.D	06053120.D	06053121.D	06053122.D	06053123.D	06053124.D	06053125.D	06053126.D
Received Date:	5/30/2006	5/30/2006	5/30/2006	5/30/2006	5/30/2006	5/30/2006	5/30/2006	5/30/2006	5/30/2006	5/30/2006	5/30/2006	5/30/2006
Analysis Date:	5/31/2006	5/31/2006	5/31/2006	5/31/2006	5/31/2006	5/31/2006	5/31/2006	5/31/2006	5/31/2006	5/31/2006	5/31/2006	5/31/2006
Analysis Time:	16:52	17:23	17:54	18:25	18:55	19:27	19:57	20:29	21:00	21:31	22:02	22:33
Units:	ng											
COMPOUNDS												
1,1-Dichloroethene	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
1,1,2-Trichlorotrifluoroethane	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
trans-1,2-Dichloroethene	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
Methyl-t-butyl ether	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
1,1-Dichloroethane	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
cis-1,2-Dichloroethene	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
Chloroform	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
2,2-Dichloropropane	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
1,2-Dichloroethane	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
1,1,1-Trichloroethane	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
1,1-Dichloropropene	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
Carbon Tetrachloride	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
Benzene	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
1,2-Dichloropropane	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
Trichloroethene	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
cis-1,3-Dichloropropene	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
trans-1,3-Dichloropropene	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
1,1,2-Trichloroethane	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
Toluene	147	143	127	98	105	62	155	96	71	129	35	97
1,3-Dichloropropane	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
1,2-Dibromoethane (EDB)	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
Tetrachloroethene	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
1,1,1,2-Tetrachloroethane	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
Chlorobenzene	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
Ethylbenzene	40	<25	<25	<25	<25	<25	27	<25	<25	<25	<25	<25
p & m-Xylene	43	32	32	<25	25	<25	31	34	<25	<25	<25	<25
Bromoform	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
1,1,1,2-Tetrachloroethane	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
o-Xylene	33	25	26	<25	<25	<25	<25	30	<25	<25	<25	<25
1,2,3-Trichloropropane	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
Isopropylbenzene	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
1,3,5-Trimethylbenzene	32	<25	<25	<25	<25	<25	<25	27	<25	<25	<25	<25
1,2,4-Trimethylbenzene	94	35	71	53	37	<25	48	86	52	26	33	32
1,3-Dichlorobenzene	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
1,4-Dichlorobenzene	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
1,2-Dichlorobenzene	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
n-Butylbenzene	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
1,2,4-Trichlorobenzene	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
Naphthalene	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
1,2,3-Trichlorobenzene	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25

Notes:
 ng = Nanogram
 B = Detected in method blank
 J = Positive detection with reported concentration between the method detection limit and the reporting limit
 < = Reported value less than method detection limit

Table 4 LF029 Soil Gas Survey VOC Analytical Results (2006) (continued)

Client Sample ID:	E6	E7	E8	E9	F2	F3	F4	F5	F6	F7	F8	G1
Project Number:	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lab File ID:	06053127.D	06053128.D	06053129.D	06053130.D	06053131.D	06053132.D	06053133.D	06053134.D	06053135.D	06053136.D	06053137.D	06053138.D
Received Date:	5/30/2006	5/30/2006	5/30/2006	5/30/2006	5/30/2006	5/30/2006	5/30/2006	5/30/2006	5/30/2006	5/30/2006	5/30/2006	5/30/2006
Analysis Date:	5/31/2006	5/31/2006	6/1/2006	6/1/2006	6/1/2006	6/1/2006	6/1/2006	6/1/2006	6/1/2006	6/1/2006	6/1/2006	6/1/2006
Analysis Time:	23:04	23:35	23:35	0:37	1:08	1:39	2:10	2:41	3:12	3:43	4:14	4:45
Units:	ng											
COMPOUNDS												
1,1-Dichloroethene	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
1,1,2-Trichlorotrifluoroethane	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
trans-1,2-Dichloroethene	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
Methyl-t-butyl ether	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
1,1-Dichloroethane	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
cis-1,2-Dichloroethene	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
Chloroform	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
2,2-Dichloropropane	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
1,2-Dichloroethane	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
1,1,1-Trichloroethane	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
1,1-Dichloropropene	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
Carbon Tetrachloride	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
Benzene	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
1,2-Dichloropropane	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
Trichloroethene	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
cis-1,3-Dichloropropene	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
trans-1,3-Dichloropropene	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
1,1,2-Trichloroethane	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
Toluene	75	119	139	155	109	82	131	123	43	81	72	59
1,3-Dichloropropane	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
1,2-Dibromoethane (EDB)	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
Tetrachloroethene	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
1,1,1,2-Tetrachloroethane	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
Chlorobenzene	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
Ethylbenzene	<25	25	30	31	<25	<25	<25	<25	<25	<25	<25	<25
p & m-Xylene	<25	28	37	34	<25	<25	27	27	<25	<25	<25	<25
Bromoform	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
1,1,1,2,2-Pentachloroethane	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
o-Xylene	<25	<25	29	26	<25	<25	<25	<25	<25	<25	<25	<25
1,2,3-Trichloropropane	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
Isopropylbenzene	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
1,3,5-Trimethylbenzene	<25	<25	27	<25	<25	<25	<25	<25	<25	<25	<25	<25
1,2,4-Trimethylbenzene	42	54	78	73	44	38	46	60	<25	41	26	<25
1,3-Dichlorobenzene	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
1,4-Dichlorobenzene	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
1,2-Dichlorobenzene	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
n-Butylbenzene	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
1,2,4-Trichlorobenzene	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
Naphthalene	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
1,2,3-Trichlorobenzene	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25

Notes:
 ng = Nanogram
 B = Detected in method blank
 J = Positive detection with reported concentration between the method detection limit and the reporting limit
 < = Reported value less than method detection limit

Table 4 LF029 Soil Gas Survey VOC Analytical Results (2006) (continued)

Client Sample ID:	G3	G4	G5	G7	G9	H3	H4	H5	H6	Method Blank	Trip-3	I1
Project Number:	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lab File ID:	06053139.D	06053140.D	06053141.D	06053142.D	06053143.D	06053144.D	06053145.D	06053146.D	06053147.D	06060103.D	06060108.D	06060109.D
Received Date:	5/30/2006	5/30/2006	5/30/2006	5/30/2006	5/30/2006	5/30/2006	5/30/2006	5/30/2006	5/30/2006	6/1/2006	5/30/2006	5/30/2006
Analysis Date:	6/1/2006	6/1/2006	6/1/2006	6/1/2006	6/1/2006	6/1/2006	6/1/2006	6/1/2006	6/1/2006	6/1/2006	6/1/2006	6/1/2006
Analysis Time:	5:16	5:47	6:18	6:49	7:20	7:51	8:22	8:53	9:25	11:34	14:10	14:41
Units:	ng	ng	ng									
COMPOUNDS												
1,1-Dichloroethene	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
1,1,2-Trichlorotrifluoroethane	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
trans-1,2-Dichloroethene	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
Methyl-t-butyl ether	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
1,1-Dichloroethane	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
cis-1,2-Dichloroethene	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
Chloroform	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
2,2-Dichloropropane	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
1,2-Dichloroethane	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
1,1,1-Trichloroethane	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
1,1-Dichloropropene	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
Carbon Tetrachloride	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
Benzene	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
1,2-Dichloropropane	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
Trichloroethene	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
cis-1,3-Dichloropropene	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
trans-1,3-Dichloropropene	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
1,1,2-Trichloroethane	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
Toluene	82	107	114	113	140	96	67	119	134	<25	<25	140
1,3-Dichloropropane	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
1,2-Dibromoethane (EDB)	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
Tetrachloroethene	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
1,1,1,2-Tetrachloroethane	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
Chlorobenzene	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
Ethylbenzene	<25	<25	<25	<25	27	<25	<25	<25	<25	<25	<25	32
p & m-Xylene	<25	30	26	26	25	<25	<25	28	27	<25	<25	28
Bromoform	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
1,1,2,2-Tetrachloroethane	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
o-Xylene	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
1,2,3-Trichloropropane	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
Isopropylbenzene	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
1,3,5-Trimethylbenzene	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
1,2,4-Trimethylbenzene	36	76	60	49	40	35	32	67	57	<25	<25	51
1,3-Dichlorobenzene	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
1,4-Dichlorobenzene	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
1,2-Dichlorobenzene	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
n-Butylbenzene	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
1,2,4-Trichlorobenzene	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
Naphthalene	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
1,2,3-Trichlorobenzene	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25

Notes:
 ng = Nanogram
 B = Detected in method blank
 J = Positive detection with reported concentration between the method detection limit and the reporting limit
 < = Reported value less than method detection limit

Table 4 LF029 Soil Gas Survey VOC Analytical Results (2006) (continued)

Client Sample ID:	I3	I4	I5	I6	I7	I9	J4	J5	J6	J7	J8	K1
Project Number:	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lab File ID:	06060110.D	06060111.D	06060112.D	06060113.D	06060114.D	06060115.D	06060116.D	06060117.D	06060118.D	06060119.D	06060120.D	06060121.D
Received Date:	5/30/2006	5/30/2006	5/30/2006	5/30/2006	5/30/2006	5/30/2006	5/30/2006	5/30/2006	5/30/2006	5/30/2006	5/30/2006	5/30/2006
Analysis Date:	6/1/2006	6/1/2006	6/1/2006	6/1/2006	6/1/2006	6/1/2006	6/1/2006	6/1/2006	6/1/2006	6/1/2006	6/1/2006	6/1/2006
Analysis Time:	15:12	15:43	16:14	16:45	17:15	17:46	18:17	18:48	19:19	19:51	20:22	20:53
Units:	ng											
COMPOUNDS												
1,1-Dichloroethene	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
1,1,2-Trichlorotrifluoroethane	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
trans-1,2-Dichloroethene	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
Methyl-t-butyl ether	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
1,1-Dichloroethane	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
cis-1,2-Dichloroethene	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
Chloroform	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
2,2-Dichloropropane	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
1,2-Dichloroethane	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
1,1,1-Trichloroethane	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
1,1-Dichloropropene	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
Carbon Tetrachloride	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
Benzene	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
1,2-Dichloropropane	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
Trichloroethene	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
cis-1,3-Dichloropropene	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
trans-1,3-Dichloropropene	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
1,1,2-Trichloroethane	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
Toluene	76	46	55	72	113	60	121	80	125	134	97	170
1,3-Dichloropropane	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
1,2-Dibromoethane (EDB)	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
Tetrachloroethene	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
1,1,1,2-Tetrachloroethane	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
Chlorobenzene	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
Ethylbenzene	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	36
p & m-Xylene	<25	<25	<25	<25	25	<25	29	<25	25	27	<25	39
Bromoform	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
1,1,2,2-Tetrachloroethane	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
o-Xylene	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	29
1,2,3-Trichloropropane	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
Isopropylbenzene	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
1,3,5-Trimethylbenzene	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	28
1,2,4-Trimethylbenzene	34	27	32	30	47	30	52	35	48	40	44	85
1,3-Dichlorobenzene	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
1,4-Dichlorobenzene	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
1,2-Dichlorobenzene	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
n-Butylbenzene	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
1,2,4-Trichlorobenzene	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
Naphthalene	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
1,2,3-Trichlorobenzene	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25

Notes:
 ng = Nanogram
 B = Detected in method blank
 J = Positive detection with reported concentration between the method detection limit and the reporting limit
 < = Reported value less than method detection limit

Table 4 LF029 Soil Gas Survey VOC Analytical Results (2006) (continued)

Client Sample ID:	K3	K4	K5	K6	K7	K9	L3	L4	L5	L6	L7	M1
Project Number:	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lab File ID:	06060122.D	06060123.D	06060124.D	06060125.D	06060126.D	06060127.D	06060128.D	06060129.D	06060130.D	06060131.D	06060132.D	06060133.D
Received Date:	5/30/2006	5/30/2006	5/30/2006	5/30/2006	5/30/2006	5/30/2006	5/30/2006	5/30/2006	5/30/2006	5/30/2006	5/30/2006	5/30/2006
Analysis Date:	6/1/2006	6/1/2006	6/1/2006	6/1/2006	6/1/2006	6/2/2006	6/2/2006	6/2/2006	6/2/2006	6/2/2006	6/2/2006	6/2/2006
Analysis Time:	21:24	21:56	22:27	22:58	23:29	0:00	0:31	1:03	1:34	2:05	2:36	3:07
Units:	ng											
COMPOUNDS												
1,1-Dichloroethene	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
1,1,2-Trichlorotrifluoroethane	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
trans-1,2-Dichloroethene	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
Methyl-t-butyl ether	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
1,1-Dichloroethane	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
cis-1,2-Dichloroethene	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
Chloroform	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
2,2-Dichloropropane	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
1,2-Dichloroethane	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
1,1,1-Trichloroethane	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
1,1-Dichloropropene	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
Carbon Tetrachloride	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
Benzene	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
1,2-Dichloropropane	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
Trichloroethene	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
cis-1,3-Dichloropropene	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
trans-1,3-Dichloropropene	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
1,1,2-Trichloroethane	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
Toluene	193	137	126	173	122	143	154	90	100	143	117	116
1,3-Dichloropropane	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
1,2-Dibromoethane (EDB)	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
Tetrachloroethene	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
1,1,1,2-Tetrachloroethane	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
Chlorobenzene	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
Ethylbenzene	50	25	24	35	<25	29	30	<25	<25	28	<25	<25
p & m-Xylene	55	30	28	42	<25	29	31	<25	<25	31	25	<25
Bromoform	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
1,1,2,2-Tetrachloroethane	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
o-Xylene	43	<25	<25	32	<25	<25	<25	<25	<25	<25	<25	<25
1,2,3-Trichloropropane	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
Isopropylbenzene	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
1,3,5-Trimethylbenzene	<25	<25	<25	25	<25	<25	<25	<25	<25	<25	<25	<25
1,2,4-Trimethylbenzene	129	41	38	71	33	46	59	59	43	54	37	38
1,3-Dichlorobenzene	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
1,4-Dichlorobenzene	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
1,2-Dichlorobenzene	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
n-Butylbenzene	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
1,2,4-Trichlorobenzene	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
Naphthalene	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
1,2,3-Trichlorobenzene	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25

Notes:
 ng = Nanogram
 B = Detected in method blank
 J = Positive detection with reported concentration between the method detection limit and the reporting limit
 < = Reported value less than method detection limit

Table 4 LF029 Soil Gas Survey VOC Analytical Results (2006) (continued)

Client Sample ID:	M3	M4	M5	M6	M7	M9
Project Number:	1900	1900	1900	1900	1900	1900
Lab File ID:	06060134.D	06060135.D	06060136.D	06060137.D	06060138.D	06060139.D
Received Date:	5/30/2006	5/30/2006	5/30/2006	5/30/2006	5/30/2006	5/30/2006
Analysis Date:	6/2/2006	6/2/2006	6/2/2006	6/2/2006	6/2/2006	6/2/2006
Analysis Time:	3:38	4:10	4:41	5:13	5:44	6:15
Units:	ng	ng	ng	ng	ng	ng
COMPOUNDS						
1,1-Dichloroethene	<25	<25	<25	<25	<25	<25
1,1,2-Trichlorotrifluoroethane	<25	<25	<25	<25	<25	<25
trans-1,2-Dichloroethene	<25	<25	<25	<25	<25	<25
Methyl-t-butyl ether	<25	<25	<25	<25	<25	<25
1,1-Dichloroethane	<25	<25	<25	<25	<25	<25
cis-1,2-Dichloroethene	<25	<25	<25	<25	<25	<25
Chloroform	<25	<25	<25	<25	<25	<25
2,2-Dichloropropane	<25	<25	<25	<25	<25	<25
1,2-Dichloroethane	<25	<25	<25	<25	<25	<25
1,1,1-Trichloroethane	<25	<25	<25	<25	<25	<25
1,1-Dichloropropene	<25	<25	<25	<25	<25	<25
Carbon Tetrachloride	<25	<25	<25	<25	<25	<25
Benzene	<25	<25	<25	<25	<25	<25
1,2-Dichloropropane	<25	<25	<25	<25	<25	<25
Trichloroethene	<25	<25	<25	<25	<25	<25
cis-1,3-Dichloropropene	<25	<25	<25	<25	<25	<25
trans-1,3-Dichloropropene	<25	<25	<25	<25	<25	<25
1,1,2-Trichloroethane	<25	<25	<25	<25	<25	<25
Toluene	105	117	177	119	124	155
1,3-Dichloropropane	<25	<25	<25	<25	<25	<25
1,2-Dibromoethane (EDB)	<25	<25	<25	<25	<25	<25
Tetrachloroethene	<25	<25	<25	<25	<25	<25
1,1,1,2-Tetrachloroethane	<25	<25	<25	<25	<25	<25
Chlorobenzene	<25	<25	<25	<25	<25	<25
Ethylbenzene	<25	<25	35	<25	<25	31
p & m-Xylene	<25	<25	36	26	26	33
Bromoform	<25	<25	<25	<25	<25	<25
1,1,2,2-Tetrachloroethane	<25	<25	<25	<25	<25	<25
o-Xylene	<25	<25	29	<25	<25	25
1,2,3-Trichloropropane	<25	<25	<25	<25	<25	<25
Isopropylbenzene	<25	<25	<25	<25	<25	<25
1,3,5-Trimethylbenzene	<25	<25	<25	<25	<25	25
1,2,4-Trimethylbenzene	35	47	59	57	49	77
1,3-Dichlorobenzene	<25	<25	<25	<25	<25	<25
1,4-Dichlorobenzene	<25	<25	<25	<25	<25	<25
1,2-Dichlorobenzene	<25	<25	<25	<25	<25	<25
n-Butylbenzene	<25	<25	<25	<25	<25	<25
1,2,4-Trichlorobenzene	<25	<25	<25	<25	<25	<25
Naphthalene	<25	<25	<25	<25	<25	<25
1,2,3-Trichlorobenzene	<25	<25	<25	<25	<25	<25

Notes:

ng = Nanogram

B = Detected in method blank

J = Positive detection with reported concentration between the method detection limit and the reporting limit

< = Reported value less than method detection limit

Table 5 LF029 Supplemental RFI Soil Analytical Results (2006)

Analyte	NMED Soil Screening Levels ² (2006)			NMED Soil Screening Levels ⁴ (2015)			SB29-D6		SB29-F4		SB29-F7		SB29-I5		SB29-K3		SB29-L4		SB29-L6			
	Res	Ind	Con	Res	Ind	Con	20-June-2006		16-June-2006													
							24 – 26 ft.		18 – 20 ft.		20 – 22 ft.		14 – 17 ft.		14 – 16 ft.		2 – 4 ft.		1 – 3 ft.			
							Val	Q	Val	Q												
Volatile Organic Compounds (µg/kg)																						
1,4-Dichloro benzene	39,500	1.02E+05	1.96E+06	32,800	1.59E+05	7.46E+05	0.64	J	0.55	J	0.387	U	0.387	U								
Carbon disulfide	4.60E+05	4.60E+05	4.60E+05	1.55E+06	8.54E+06	1.62E+06	0.37	J	0.346	U	0.346	U	0.44	J	0.346	U	0.346	U	0.52	J	0.346	U
Naphthalene	79,500	3.0E+05	2.62E+05	49,700	2.41E+05	1.59E+05	37.7	U	11.4	J	37.7	U										
Semi-Volatile organic Compounds (µg/kg)																						
Diethyl phthalate	4.89E+07	1.0E+08	1.0E+08	4.93E+07	7.33E+08	2.15E+08	64.3	U	256		236	J										
Other Compounds (mg/kg)																						
D-TPH	520 ^{2a}	1,120 ^{2a}	N/A	1,000 ^{4a}	3,000 ^{4a}	N/A	10.7	U	21.9	J	11.7	J										
Perchlorate (µg/kg)																						
Perchlorate	55,000 ³	1.40E+06 ³	7.90E+05 ³	54,800	9.08E+05	2.48E+05	1	U	0.99	J	0.31	J	1.8		0.5	J	1.6		0.98	J	1.3	
Metals (mg/kg)																						
Barium	15,600	1.0E+05	60,200	15,600	2.55E+05	4,390	66		42		45.2		18.5		26		50.2		24.1		19	
Cadmium	39	564	154	70.5	1,110	72.1	0.692		0.238	J	0.757		0.704		0.0795	U	0.384	J	0.0795	U	0.0795	U
Chromium, total	210 ^{2b}	450 ^{2b}	500 ^{2b}	96.6	505	134	5.68		1.74		7.33		7.19		7.11		2.57		1.18		0.683	J
Lead	400	800	800	400	800	800	3.05		0.65	U	3.8		4.71		0.65	U	0.65	U	0.65	U	0.65	U
Mercury	6.11 ^{2c}	68.4 ^{2c}	23.8 ^{2c}	23.8	112	20.7	0.0075	J	0.0029	U	0.0029	U	0.0063	J	0.0029	U	0.0056	J	0.0407		0.0029	U
Silver	391	5,680	1,550	391	6,490	1,770	0.476		0.86		0.653		0.359		0.0444	U	0.911		1.38		1.33	

Notes:
 NMED = New Mexico Environment Department
 Res = Residential
 Ind = Industrial
 Con = Construction
 µg/kg = micrograms per kilogram
 mg/kg = milligrams per kilogram
 ft = feet
 Val = validated result
 Q = qualifier
 dup = duplicate
 N/A = No value available
 NA = not applicable
 D-TPH = diesel-range total petroleum hydrocarbons
 J = positive detection with reported concentration between the method detection limit and the reporting limit
 U = non-detect result, value presented indicates reporting limit

1 – Final Basewide Background Study Report Holloman Air Force Base, New Mexico, Approved Background Levels for Unfiltered (Total) Constituents in Groundwater (NationView/Bhate JV III, LLC, 2012).
 2 – NMED Technical Background Document for Development of Soil Screening Levels, Revision 4.0. June (NMED, 2006a). Obtained from Table A-1 unless specified otherwise.
 2a – NMED TPH Screening Guidelines. October (NMED, 2006b). Obtained from Table 2a
 2b - Screening criteria for chromium VI used as a surrogate for chromium
 2c - Screening criteria for methyl mercury used as a surrogate for mercury
 3 - USEPA Region VI Human Health Medium Specific Screening Levels (USEPA Reg VI, 2007)

4 – NMED, Risk Assessment Guidance for Site Investigations and Remediation. July (NMED, 2015). Obtained from Table A-1 unless specified otherwise.
4a – (NMED, 2015). Obtained from Table 6-2

Table 6 LF029 Supplemental RFI Groundwater Perchlorate Analytical Results (2006)

Analyte	Background ¹	USEPA Tap Water ²	USEPA MCL ²	NMWQCC Standard ³	MW-29-03		MW-29-02		MW-29-03		MW-29-04		MW-29-05		MW-29-06		MW-29-07		MW-29-08			
					11-Jul-2006		11-Jul-2006		11-Jul-2006		11-Jul-2006		11-Jul-2006		11-Jul-2006		11-Jul-2006		11-Jul-2006			
					Val	Q	Val	Q														
Perchlorate (µg/L)	N/A	14	15	N/A	4.9		1.9	J	2	U	2	U	0.29	J	1.1	J	2.1		1.3	J	1.1	J

Notes:

Q = qualifier

Val = validated result

J = positive detection with reported concentration between the method detection limit and the reporting limit

dup = duplicate

U = non-detect result, value presented indicates reporting limit

N/A = No value available

µg/L = micrograms per liter

MCL = Maximum Contaminant Level

NMWQCC = New Mexico Water Quality Control Commission

USEPA = U.S. Environmental Protection Agency

1 – Final Basewide Background Study Report Holloman Air Force Base, New Mexico, Approved Background Levels for Unfiltered (Total) Constituents in Groundwater (NationView/Bhate JV III, LLC, 2012).

2 – USEPA Regional Screening Levels for Chemical Contaminants at Superfund Sites (USEPA, 2016).

3 – (NMWQCC Regulations and Standards, 2014). Ground and Surface Water Protection.

<https://www.env.nm.gov/gwb/documents/2062NMAC-Amended2014.pdf>