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RESPONSIVENESS – INTEGRITY - TEAMWORK

November 30, 2006

New Mexico Environment Department
Hazardous Waste Bureau
Permits Management Program
2905 Rodeo Park Drive East, Building 1
Santa Fe, NM 87505-6303

Attention: Mr. John E. Kieling
Program Manager

Subject: Multiple Sites Accelerated Corrective Measures Work Plan, Holloman Air Force Base, New Mexico

Dear Mr. Kieling,

Bhate Environmental Associates, Inc. (Bhate) is pleased to submit the above referenced document for your review and comment.

If you have any questions, please feel free to call me at 303-815-1762.

Sincerely,
Bhate Environmental Associates, Inc.

Frank Gardner, PG
Program Manager

cc w/ enclosure:

Cornelius Amindyas (NMED HWB)
James Harris (US EPA 6)

G:\ACTIVE PROJECTS\2005\HOLLOMAN AFB PROJECTS 2005\9050361 HAFB TO#21\MULTIPLE SITES ACM WP (NOV 2006)\BHATE COVER LETTER FOR MULTIPLE SITES ACM WORK PLAN.DOC

ACCELERATED CORRECTIVE MEASURES WORK PLAN MULTIPLE SITES HOLLOMAN AFB, NEW MEXICO

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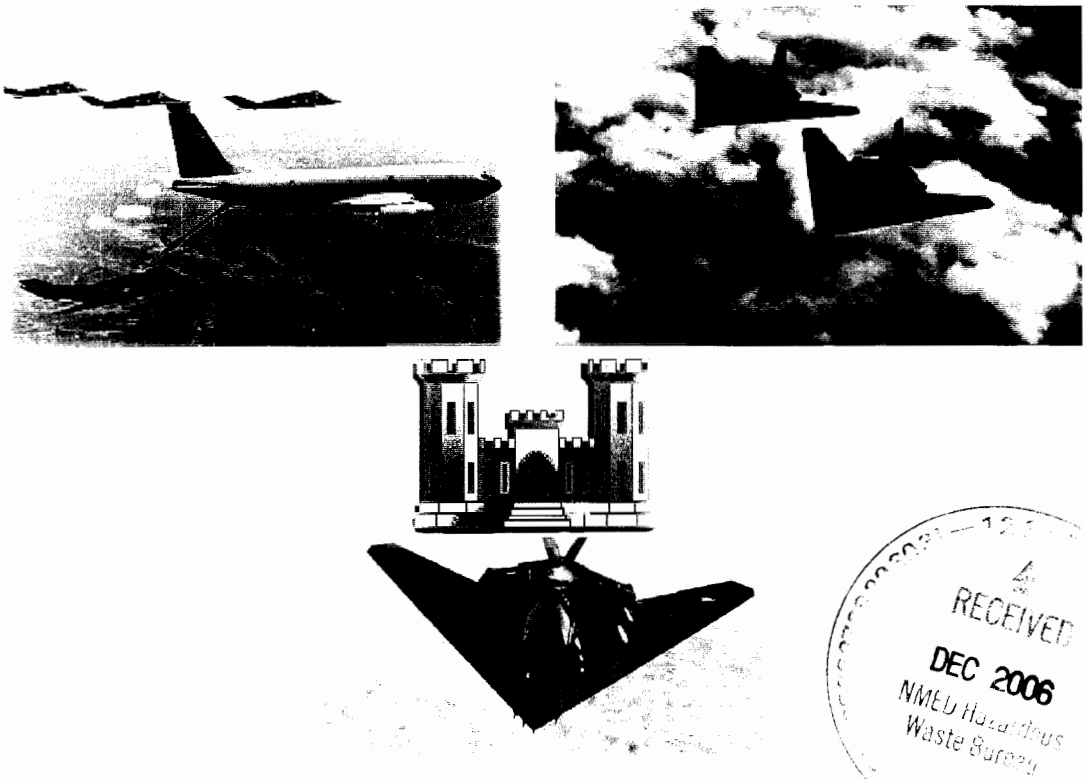

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Headquarters, Air Combat Command
Langley Air Force Base, Virginia

49 CES/CEV
Holloman Air Force Base, New Mexico

FINAL ACCELERATED CORRECTIVE MEASURES WORK PLAN

MULTIPLE SITES

HOLLOMAN AFB, NEW MEXICO

Prepared for:

49 CES/CEV
Holloman Air Force Base
New Mexico

Under Contract To:

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

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Task Order No. 021

November 2006

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Bhate Project No. 9050361.03

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FINAL ACCELERATED CORRECTIVE MEASURES WORK PLAN

MULTIPLE SITES

HOLLOMAN AFB, NEW MEXICO

REVIEW SHEET

This Work Plan has been reviewed and approved by:

John Hymer Site Manager	Signature	Date
Jim Moore, P.G. Project Manager	Signature	Date
Frank Gardner, P.G. Program Manager	Signature	Date

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FINAL ACCELERATED CORRECTIVE MEASURES WORK PLAN

MULTIPLE SITES

HOLLOMAN AFB, NEW MEXICO

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Appendix D UFGS Section 02111 *Excavation and Handling of Contaminated Material*, September 2003

Appendix E SiteLAB® UVF-3100 Operating Manual, 2006

Appendix F *New Mexico Environment Department TPH Screening Guidelines,* October 2006

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Appendix H UFGS Section 02770A *Concrete Sidewalks and Curbs and Gutters*, March 2004

Appendix I Severn Trent Laboratories, USACE Laboratory Validation Approval, US Department of Army

Appendix J NMED Soil Screening Levels, Revision 4.0, June 2006

ACRONYMS AND ABBREVIATIONS

AAF	Army Air Field
ACM	Accelerated Corrective Measure
AFB	Air Force Base
AFCESA	Air Force Civil Engineer Support Agency
AF Fm	Air Force Form
AGE	Aerospace ground equipment
amsl	Above mean sea level
ANSI	American National Standards Institute
AOC	Area of Concern
ASTM	American Society for Testing and Materials
AVGAS	Aviation gasoline
bgs	Below ground surface
Bhate	Bhate Environmental Associates, Inc.
BNA	Acid/Base/Neutral Extractable Organics
BTEX	Benzene, toluene, ethylbenzene, and xylenes
CES/CEV	Civil Engineering Squadron/Combat Engineer Vehicle
CIH	Certified Industrial Hygienist
CFR	Code of Federal Regulations
cm/sec	Centimeters per second
COC	Chain-of-custody
COPC	Chemicals of potential concern
CrVI	Hexavalent chromium
CRZ	Contamination reduction zone
CSM	Conceptual Site Model
cu yds	Cubic yards
DPT	Direct push technology
DQO	Data quality objective
DRO	Diesel range organics
DRMO	Defense Reutilization and Marketing Office
EP	Extraction procedure
ERP	Environmental Restoration Program
ERPIMS	Environmental Restoration Program Information Management System
EZ	Exclusion zone
°F	Degrees Fahrenheit
FID	Flame ionization detector
ft	Feet or foot
ft/ft	Foot per foot
GC	Gas chromatogram
GPS	Global positioning system
GRO	Gasoline range organics
HAFB	Holloman Air Force Base
HASP	Health and Safety Plan
IDW	Investigation-Derived Waste

ACRONYMS AND ABBREVIATIONS (CONTINUED)

IRP	Installation Restoration Program
ISEA	International Safety Equipment Association
JP-4	Jet propulsion fuel, Type 4
ln ft	Linear feet
µg/g	Micrograms per gram
µg/kg	Micrograms per kilogram
µg/L	Micrograms per liter
mg/kg	Milligrams per kilogram
mg/L	Milligrams per liter
mL	Milliliter
MS	Matrix spike
MSD	Matrix spike duplicate
NAD	North American Datum
NAVFAC	Naval Facilities Engineering Command
NFA	No Further Action
NMAC	New Mexico Administrative Code
NMED	New Mexico Environment Department
NMWQCC	New Mexico Water Quality Control Commission
ORO	Oil range organics
OSHA	Occupational Safety and Health Administration
OVA	Organic vapor analyzer
PA	Preliminary Assessment
PCBs	Polychlorinated biphenyls
pCi/g	Picocuries per gram
PCS	Petroleum contaminated soil
P.G.	Professional Geologist
PID	Photo ionization detector
POL	Petroleum, Oil, and Lubricants
PPE	Personal protective equipment
ppm	Parts per million
PRI	Primate Research Institute
PVC	Polyvinyl chloride
QA	Quality assurance
QAPP	Quality Assurance Project Plan
QC	Quality control
RA-C	Remedial Action-Construction
RCRA	Resource Conservation and Recovery Act
RI	Remedial Investigation
SI	Site Investigation
SOP	Standard Operating Procedure
SSL	Soil screening level

ACRONYMS AND ABBREVIATIONS (CONTINUED)

SVOC	Semi-volatile organic compound
SWMU	Solid Waste Management Unit
SWPPP	Storm Water Pollution Prevention Plan
SZ	Support zone
TAL	Target Analyte List
TEL	Tetraethyl lead
TCLP	Toxicity Characteristic Leaching Procedure
TDS	Total dissolved solids
TFH	Total fuel hydrocarbons
TOC	Total organic carbon
TOX	Total organic halogens
TPH	Total petroleum hydrocarbons
TRPH	Total recoverable petroleum hydrocarbons
TSCA	Toxic Substances Control Act
UFGS	Unified Facilities Guide Specifications
USACE	United States Army Corps of Engineers
USCS	Unified Soil Classification System
USEPA	United States Environmental Protection Agency
UST	Underground Storage Tank
UTL	Upper tolerance limit
UVF	Ultra violet flourometer
VOC	Volatile organic compound
WRCC	Western Regional Climate Center
WSMR	White Sands Missile Range
WWTP	Wastewater Treatment Plant

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1 INTRODUCTION

Bhate Environmental Associates, Inc., (Bhate) has been retained by the U.S. Army Corps of Engineers (USACE), under contract DACA45-03-D-0023, Task Order No. 021, to conduct Accelerated Corrective Measures (ACM) at several of the Solid Waste Management Units (SWMUs) and Areas of Concern (AOCs) at Holloman Air Force Base (HAFB), New Mexico. This document provides a Work Plan that will serve as the primary working document for the additional investigations and excavation of petroleum contaminated soil (PCS) and hazardous constituents including sludge grit and radionuclides at 11 previously investigated sites.

The Omaha District USACE Scope of Services for the Remedial Action-Construction (RA-C) – Project # KWRD20067080 dated November 9, 2005 (Attachment A) generally defines the additional characterization for 11 SWMU/Environmental Restoration Program (ERP) sites that have been identified by the New Mexico Environment Department (NMED) as requiring further investigation prior to source removal excavation or no further action. These SWMUs/AOCs include the following ERP sites: OT-03 (SWMU 114), OT-20 (SWMU 113A), OT-32 (AOC PRI-A), OT-35 (AOC PRI-2 and PRI-5), OT-38 (SWMU 137), OT-45 (AOC-O), SS-06 (AOC R), SS-12 (AOC K), SS-18 (AOC H), RW-42 (SWMU 111), and OT-37 (AOC L).

Review of historical data collected at SS-06 and OT-35 indicates that these sites have been sufficiently characterized during previous investigations. At a meeting on May 5, 2006, attended by NMED and HAFB personnel it was proposed that these two sites qualify for No Further Action (NFA) status. Under separate cover and pending NMED approval, HAFB will submit a Statement of Basis requesting NFA for Sites SS-06 and OT-35. The historical characterization data and chronology of previous investigations for these two sites has been included in Section 2 of this ACM Work Plan. In addition, during the referenced meeting it was determined that due to the small size of the OT-03 source area, additional characterization would not be required. The ACM approach for OT-03 will consist of removing the contaminated soil until site risk-based closure goals are met as determined by confirmation sampling.

The objective of the additional characterizations at the remaining eight sites (OT-20, OT-32, OT-38, OT-45, SS-12, SS-18, RW-42, and OT-37) is to fill in the data gaps to completely identify and define the presumed PCS and/or hazardous constituent source areas. Once the source areas have been delineated, the primary objective of this ACM is to remove, through excavation, and properly dispose the PCS and/or hazardous constituent source areas. Groundwater conditions surrounding the various source areas will also be evaluated in this ACM Work Plan. During this process, required data will be collected to support risk based evaluations of these sites based on guidance from the NMED. The ultimate objective is to achieve approval for site closure(s) in accordance with the HAFB Resource Conservation Recovery Act (RCRA) permit (number NM6572124422).

This ACM Work Plan is organized into 11 sections; Section 1 presents the introductory material, ACM Work Plan objectives, and HAFB background information. Section 2 details the site-specific background and historical environmental data. Section 3 summarizes the site-specific additional investigation actives for each site to determine the location of the source areas.

Excavation procedures and excavation soil sampling and analysis are presented in Sections 4 and 5, respectively. The risk-based clean up approach is described in Section 6. Section 7 presents the excavation waste management procedures. Project quality assurance and health and safety requirements are discussed in Sections 8 and 9. Section 10 presents the organization and schedule and Section 11 contains the references used throughout this report. Three sets of comments received from USACE Omaha with associated responses are included in Attachment B.

This document has been written to provide relevant information on the geologic, hydrologic, and other environmental conditions for the 11 sites and the procedures by which this ACM will be completed. Information is provided for the entire Base and its surrounding environ as well as the 11 sites. This ACM calls for the removal of all PCS and/or hazardous constituents (above the NMED soil screening levels) at sites OT-03, OT-20, OT-32, OT-38, OT-45, SS-12, SS-18, RW-42, and OT-37 through excavation with verification of complete removal via confirmation sampling from the excavation.

1.1 Base Description

HAFB is situated in south central New Mexico, in the northwest central part of Otero County, approximately 75 miles north-north-east of El Paso, Texas (Figure 1-1). HAFB has a population of 6,000 and occupies about 50,000 acres in the northeast quarter of Section 1, Township 17 South, Range 8 East. The White Sands Missile Range testing facilities occupy additional land extending northward from the Base. Private and public owned lands border the remainder of HAFB. The major highway servicing HAFB is Highway 70, which runs southwest from the town of Alamogordo and separates HAFB from publicly owned lands to the south. Alamogordo which has a population of approximately 35,000 is located approximately 7 miles east of the base.

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

1.2 Physiography and Topography

HAFB is located within the Sacramento Mountains Physiographic Province on the western edge of the Sacramento Mountains. HAFB is approximately 59,600 acres in area, and is located at a mean elevation of 4,093 feet above mean sea level (amsl). The region is characterized by high tablelands with rolling summit plains; cuesta-formed mountains dipping eastward and of west-facing escarpments with the wide bracketed basin forming the basin and range complex. The

Base is located in the Tularosa Sub-basin which is part of the Central Closed Basins. The bordering mountains rise abruptly to altitudes of 7,000 to 12,000 feet amsl. The San Andres Mountains bound the basin to the west (about 30 miles) with the Sacramento Mountains approximately 10 miles to the east (Figure 1-1). At its widest, the basin is about 60 miles east to west and stretches approximately 150 miles north to south.

1.3 Surface Water and Hydrology

The Tularosa Basin contains all of the surface flow in its boundaries. The nearest inflow of surface waters to the Base comes from the Lost River, located in the north-central region of the Base. The upper reaches of the Three Rivers and the Sacramento River are perennial in the basin. HAFB is dissected by several southwest trending arroyos that control the surface drainage. Hay Draw arroyo is located in the far north. Malone and Rita's Draw, which drain into the Lost River and Dillard Draw arroyos, are located along the eastern perimeter of the Base. Approximately 10,000 years ago, indications are of a much wetter climate. The present day Lake Otero encompassed a much larger area, possibly upwards of several hundred square miles. Its remains are the Alkali Flat and Lake Lucero. Lake Lucero is a temporary feature of merely a few inches in depth during the rainy season.

Ancient lakes and streams deposited water bearing deposits over the older bedrock basement material. Fractures, cracks, and fissures in the Permian and Pennsylvanian bedrock yield small quantities of relatively good quality water in the deeper peripheral. Potable water is only found in wells near the edges of the basin with more saline water towards the center. Two of the principal sources of potable water are a long narrow area on the upslope sides of Tularosa and Alamogordo with the other in the far southwestern part of the basin. A portion of Alamogordo's water, as well as the Base's, is supplied from Lake Bonito (which is in the Pecos River Basin).

1.4 Regional Geology

The sedimentary rocks which make up the adjacent mountain ranges are between 500 and 250 million years old (White Sands Missile Range (WSMR), 2003). During the period when the area was submerged under the shallow intra-continental sea, the layers of limestone, shale, gypsum, and sandstone were deposited. In time, these layers were pushed upward through various tectonic forces forming a large bulge on the surface. Approximately 10 million years ago the center began to subside resulting in a vertical drop of thousands of feet leaving the edges still standing (the present day Sacramento and San Andres mountain ranges). In the millions of years following, rainfall, snowmelt, and wind eroded the mountain sediments depositing them in the valley (i.e. Tularosa Basin). Water carrying eroded gypsum, limestone, dolomite, gravel, and other alluvial matter continues to flow into the basin with no route of exit.

The Tularosa Sub-basin is geologically described as a bolson, which is an extensive flat alluvium-floored depression, into which drainage from the surrounding mountains flows toward a central playa. The overlying alluvium generally consists of unconsolidated gravels (limestone, dolomite, and gypsum), sands, and clays. A fining sequence from the San Andreas and Sacramento Ranges towards the basin's center characterizes the area with the near surface soils as alluvial, eolian, and lacustrine deposits. The alluvial fan deposits are laterally discontinuous

units of interbedded sand, silt, and clay while the eolian deposits consist primarily of gypsum sands. The eolian and alluvial deposits are usually indistinguishable due to the reworking of the alluvial sediment by eolian processes. The playa, or lacustrine deposits, consist of silty clay containing gypsum and are contiguous with the alluvial fan and eolian deposits.

Mesozoic rocks in the northwest mark the Colorado Plateau, topped by younger Tertiary strata. Quaternary age sediments have washed off the Southern Rockies into the open basins and the Rio Grande Rift, a failed spreading center or aulacogen. This would-be ocean basin runs up the center of the state with the Rio Grande flowing down its middle, exposing the Paleozoic and Precambrian rocks on its uplifted flanks. Later Cenozoic volcanic intrusions of Quaternary and Tertiary age are also associated with the rifting.

The great Permian Basin of Texas continues into the state from the southeast with younger Quaternary-Tertiary sediments of the Great Plains cover the whole eastern edge. Basin-and-range terrain of Tertiary sediments and volcanics appear in the extreme southwest coupled with wide dry basins choked with Quaternary coarse sediments eroded from the blocks of uplifted older rocks.

1.5 Regional Hydrogeology

The predominance of the groundwater occurs as an unconfined aquifer in the unconsolidated deposits of the central basin, with the primary source of recharge as rainfall percolation and minor amounts of stream run-off along the western edge of the Sacramento Mountains. Surface water/rainfall migrates downward into the alluvial sediments at the edge of the shallow aquifer near the ranges, and flows downgradient through progressively finer-grained sediments towards the central basin. Because the Tularosa Basin is a closed system, water that enters the area only leaves either through evaporation or percolation. This elevated amount of percolation results in a fairly high water table. Beneath HAFB, groundwater ranges from 5 to 50 feet. Flow for the Base is generally towards the southwest with localized influences from the variations in the topography of the Base. Near the arroyos, groundwater flows directly toward the surface drainage feature.

Groundwater quality in the Tularosa Basin is of potable quality at the recharge areas in close proximity to the Sacramento Mountains and becomes increasingly mineralized toward the central portion of the basin and discharge areas (Radian, 1993c). The majority (over 70 %) of the ERP Sites / SWMUs / AOCs located across HAFB, have groundwater monitoring wells containing water with an average total dissolved solids (TDS) concentration greater than 10,000 milligrams per liter (mg/L). This TDS data supports the hypothesis that TDS concentrations below 10,000 mg/L at HAFB are caused by dilution of natural groundwater from leaking water lines and surface irrigation from the domestic water supply. TDS concentrations greater than 10,000 mg/L exceed the New Mexico Water Quality Control Commission (NMWQCC) limit as potable water and thus, the groundwater beneath HAFB has been designated as unfit for human consumption. Likewise, U.S. Environmental Protection Agency (USEPA) guidelines have identified the groundwater as a Class IIIB water source, characterized by TDS concentrations exceeding 10,000 mg/L.

In addition, there are no potable water wells on HAFB. Potable water for the base and the city of Alamogordo is derived from the nearby Sacramento Mountains. The only production water well, used for livestock irrigation, is located approximately 7 miles southwest of HAFB.

1.6 Climate

As a whole, New Mexico has a mild, arid to semi-arid continental climate characterized by light precipitation totals; abundant sunshine, relatively low humidity and relatively large annual and diurnal temperature range (Western Regional Climate Center [WRCC], 2003). The climate of the Central Closed Basins varies with elevation. The Base is found in the low areas and is characterized by warm temperatures and dry air. Daytime temperatures often exceed 100 degrees Fahrenheit (°F) in the summer months and middle 50s in the winter. A preponderance of clear skies and relatively low humidity permits rapid night time cooling resulting in average diurnal temperature ranges of 25 to 35°F. Potential evapotranspiration, at 67 inches per year, significantly exceeds annual precipitation, usually less than 10 inches. The very low rainfall amounts resulting in the arid conditions, which with the topographically induced wind patterns combining with the sparse vegetation, tend to cause localized "dust devils". Much of the precipitation falls during the mid-summer monsoonal period (July and August) as brief, yet frequent, intense thunderstorms culminating to 30 – 40% of the annual total rainfall.

1.7 Water Use

HAFB is located in the Tularosa Sub-basin. Potable water is available from municipal wells along the margins of the basin with more saline water towards the center. The principle sources of potable water are located in a long narrow north-south trending area east of Alamogordo and Tularosa and in the far southern part of the basin. HAFB is also supplied potable water from Lake Bonito, which is in the Pecos River Basin.

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2 SITE-SPECIFIC BACKGROUND AND HISTORICAL DATA REVIEW

Since 1983, the 11 sites addressed in this ACM Work Plan have been the subject of a series of environmental investigations related to evaluating the soil and groundwater conditions to determine the various site-specific sources of volatile organic compounds (VOCs), semi-volatile organic compounds (SVOCs), petroleum hydrocarbons, pesticides, herbicides, polychlorinated biphenyls (PCBs), metals, and radionuclide contamination. This section provides the site background and overview of the previous investigations conducted at each of the 11 sites from 1983 through 1996. Most of the site-specific information presented in this section was obtained from the following historical reports:

- *Installation Restoration Program Records Search for Holloman Air Force Base, New Mexico,* August 1983, CH_2M Hill.
- *Installation Restoration Program, Phase II – Confirmation/Quantification Stage 1, Report (April 1984 to March 1985) For Holloman Air Force Base, New Mexico 88330,* March 1987, Dames & Moore.
- *Final Remedial Investigation Report, Holloman Air Force Base, New Mexico,* December 1989, Walk, Haydel & Associates, Inc.
- *Draft Final Remedial Investigation (RI) Report, Investigation, Study and Recommendation for 29 Waste Sites, Holloman Air Force Base, NM,* June 1992, Radian Corporation.
- *Draft Final Preliminary Assessment and Site Investigation Report, Investigation of Four Waste Sites, Holloman Air Force Base, NM,* November 1993, Radian Corporation.
- *Draft Final Site Investigation Report Waste Sites SS-06, SD-15, AOC-RR, and AOC-BBMS, Holloman Air Force Base, New Mexico,* October 1995, Ebasco Services, Inc. and Groundwater Technology.
- *Technical Memorandum Installation Restoration Sites SS-12, SD-27, and OT-45,* June 1996, Foster Wheeler Environmental Corporation and Radian International LLC.

The analytical results and sample locations for the surface soil, subsurface soil and groundwater samples collected during the previous investigations for the 11 sites are included in Appendix A.

2.1 OT-03 POL Tank Burial Site

2.1.1 Site Description and Background

This site is a SWMU and is listed on Table A of the HAFB RCRA Permit as the Tetraethyl Lead (TEL) Disposal Site, SWMU 114. This former land disposal site is located outside the east perimeter fence of the petroleum, oil, and lubricants (POL) storage facilities (Figure 2-1). It has been utilized in the past to dispose of the bottom sludge from fuel storage tanks (aviation gasoline [AVGAS], and jet propulsion fuel, Type 4 [JP-4]). From 1955 to 1975, wastes such as leaded fuel tank sludge, rusted metal fragments, rags, and hand tools were disposed of in the pit. The approximate extent of the disposal pit was thought to be 10 feet (ft) by 6 ft with an assumed depth of 4 ft.

2.1.2 Previous Investigations

In January 1980, the HAFB Bioenvironmental Engineering Department collected and analyzed eight soil samples from the OT-03 pit and surrounding area. The highest total lead concentrations (3,750 parts per million [ppm] and 1,500 ppm) were detected in the samples collected from within the pit. Lead was also detected at concentrations ranging from 157 to 550 ppm, in samples collected from 6 to 30 ft outside the pit (Andreoli, 1980). The analytical results and sample locations for the surface and subsurface soil samples collected during this sampling event are included in Appendix A-1-1.

A record search for Site OT-03 was conducted by CH_2M Hill in 1982 (CH_2M Hill, 1983). The record search concluded that the site was not considered to present a significant concern for adverse effects on health or the environment. The site was reinvestigated in November 1991 during a Remedial Investigation (RI) conducted by Radian Corporation (Radian). The following information was obtained from the *Draft Final Remedial Investigation (RI) Report, Investigation, Study and Recommendation for 29 Waste Sites, Holloman Air Force Base, NM* (Radian, 1992). The scope of work for the OT-03 RI included the following field activities:

- Prior to soil and monitoring well installation, two 120-ft long trenches were dug with a back hoe to confirm the location and determine the extent of the burial pit. The trenches were approximately 1-ft wide and extended no more than 4 ft below ground surface.

- Collection of 16 surface soil samples (HA-03-01 through HA-03-16) from the 0 to 2 ft interval using stainless steel augers at approximately 15-ft intervals. All surface soil samples were analyzed in the laboratory for organolead and total lead.

- One soil boring (SB-03-01) was drilled inside the pit. A composite soil sample was collected of the waste material (0 to 6 ft below ground surface [bgs]) and a second sample was collected from the undisturbed native material below the pit (6 to 9 ft bgs). Both of these subsurface soil samples were analyzed for volatile organic compounds (VOCs), petroleum hydrocarbons, organolead, and total metals.

- The soil boring was completed as a monitoring well (MW-03-01) to determine whether a release to groundwater had occurred. The well was developed, sampled, and slug tested. One groundwater sample was collected and analyzed for VOCs, anions, TDS, organolead, and total metals.

Organolead was not detected in any of the 16 surface soil samples; however, total lead was detected in all the samples at concentrations ranging between 1.7 to 38 milligrams per kilogram (mg/kg). In the two subsurface soil samples that were collected for analysis; lead was detected in the 0 to 6 ft bgs waste interval at 50 mg/kg and at 48 mg/kg in the underlying soil. These concentrations are both well below the current NMED soil screening level (SSL) (NMED, 2006) for lead (400 mg/kg). All other metals detected in the waste and underlying undisturbed interval were measured at values less than their respective base wide upper tolerance limit (UTL). Petroleum hydrocarbons were detected in the waste at 1,160 mg/kg and in the underlying soil at a higher concentration of 2,020 mg/kg. Two VOCs were also detected in both the waste and underlying soil sample, with the higher concentrations (1,600 micrograms/kilogram [µg/kg] of ethylbenzene and 3,300 µg/kg of xylenes) detected in the waste sample.

One monitoring well was installed through the waste pit to determine whether a release had occurred to the groundwater. The groundwater quality parameters (chloride, sulfate, fluoride, and total phosphorus) and metals were all below their respective UTLs for background. Several VOCs were detected in the groundwater at Site OT-03. Benzene (4,500 micrograms per liter [µg/L]), ethylbenzene (1,600 µg/L), and xylenes (700 µg/L) had the highest concentrations of detected VOCs.

The analytical results and sample locations for the surface soil, subsurface soil, and groundwater samples collected during the OT-03 RI are included in Appendix A-1-2. The RI Report (Radian, 1992) determined that the site should proceed to implementation of an Installation Restoration Program (IRP) remedial action/RCRA corrective action remedy.

2.1.3 Geology and Hydrogeology

The subsurface geology for Site OT-03 was obtained from the RI Report (Radian, 1992). The report utilized borings and wells from both Site SS-02/05 and Site OT-03, because of their close proximity to each other. The drilling log from the boring at Site OT-03 indicates a silty/fill from 0-6 feet which transitions to a clay layer from 6-13 feet. The clay layer steadily increases in sand content from 13-17 feet and from 17-25 feet the stratigraphy is mostly sand. The drilling log and monitoring well construction diagram for this site can be found in Appendix A-1-2.

The RI Report (Radian, 1992) made several observations about the local hydrogeology. The report stated that groundwater occurs in a shallow confined aquifer approximately 10 feet bgs in the silty sand deposits. The investigation found the hydraulic conductivity to be approximately 2.52×10^{-3}. Groundwater on the north side of the site flows northeast and groundwater on the southern side of the site flows to the southeast. The general trend of the site's groundwater flow was toward Dillard Draw, to the east.

2.2 OT-20 Sewage Lagoons Disposal Trenches

2.2.1 Site Description and Background

This site is a SWMU and is listed on Table A of the HAFB RCRA Permit as the Sludge Disposal Trenches near Lagoons, SWMU 113A. From the beginning of Base operations to approximately 1984, all settled solids from the grit chamber located at the headworks of the wastewater treatment plant were buried in three distinct pits just east of Pond B in the southwest corner of HAFB (Figure 2-1). The pits were reported to be approximately 2 feet wide, 5 feet deep, and 40 feet long and were dug perpendicular to the pond and reportedly covered an area approximately 200 to 300 feet north-south. Evidence of the pits can be observed on the surface as slight depressions. The *Installation Restoration Program, Records Search for Holloman Air Force Base, New Mexico* (CH_2M Hill, 1983) indicated that small amounts of solvents and heavy metals may have been associated with the grit material. Additionally, PCBs have been identified at the adjacent sewage lagoons and in the grit disposal material.

2.2.2 Previous Investigations

The OT-03 record search concluded that the site was not considered to present any significant concern for adverse effects on health or the environment. The site was investigated in September 1991 during a RI conducted by Radian. The following information was obtained from the *Draft Final Remedial Investigation (RI) Report, Investigation, Study and Recommendation for 29 Waste Sites, Holloman Air Force Base, NM* (Radian, 1992). The scope of work for the OT-20 RI included the following field activities:

- Several trenches were excavated with a backhoe in order to locate the grit burial sites. Two trenches were dug approximately 40 ft apart in a north-south direction parallel to the fence, extending approximately 300 ft. Several smaller trenches were dug at the southern end of the site to investigate small mounds of soil and other signs of disturbance.

- One soil boring was drilled into each of the three identified waste disposal pits SB-20-01 through SB-20-03). Two subsurface soil samples were collected (one discrete interval from within the grit waste and one composite sample of the native undisturbed soil below the waste) from each borehole. These soil samples were analyzed for VOCs, total metals, herbicides, pesticides, and PCBs.

Identifiable grit waste was observed at three locations within the eastern 300 ft transect trench. The upper surfaces of the three identified grit disposal pits were all within 1.0 ft bgs. The southern most pit (containing SB-20-01) began at 0.4 ft and extended to 1.9 ft bgs, the middle pit (containing SB-20-02) began at 0.2 ft and extended to 1.3 ft bgs and the northern most pit began at 0.9 ft and extended to 8 ft bgs. The grit burial pits were all approximately 2 to 3 ft wide and less than 20 ft long, none of the grit disposal pits were identified within the western 300 ft transect trench.

Based on subsurface soil samples the grit waste placed into the disposal pits contained a variety of organic constituents. The organochlorine pesticides 4,4'-DDE, aldrin, endosulfan II, endrin

aldehyde, heptachlor epoxide, and gamma-BHC were detected in the waste samples collected from SB-20-01 and SB-20-03. All of these pesticides were detected below their respective SSLs (NMED, 2006) except for the concentration of heptachlor (5,000 µg/kg) detected in the sample from SB-20-03. The only herbicide that was detected was dicamba (220 µg/kg) which was found in the SB-20-03 sample. The PCB aroclor 1254 was detected in the samples collected from each soil boring. The concentrations of aroclor 1254 exceeded the SSL (1,120 µg/kg) in the samples collected from SB-20-02 (2,200 µg/kg) and SB-20-03 (4,800 µg/kg). All other PCBs were not detected. Four VOCs (benzene, methylene chloride, toluene, and xylenes) were detected in each of the samples. Methylene chloride and toluene were both detected in the laboratory blank samples; therefore the presence of these constituents is suspect. Additionally, the detections of benzene and xylenes contained in the sample from SB-20-03 are estimated (concentrations are below the detection limit). All metals detected in the subsurface soil samples were below their respective SSLs.

The analytical results and sample locations for the subsurface soil samples collected during the OT-20 RI are included in Appendix A-2-1. The RI Report (Radian, 1992) recommended no further action for Site OT-20.

2.2.3 Geology and Hydrogeology

The subsurface geology of Site OT-20 was characterized by trenching observations, geological soil analysis, and logging of the soils through the trenches made by Radian during the RI Report (Radian, 1992). The drilling logs for OT-20 are included in Appendix A-2-1. The soils are primarily low plasticity sandy soils with 39% total porosity. Constant head permeability tests have found the soil permeability to be about 5×10^{-6} centimeters per second (cm/sec). The RI report stated that no further hydrogeologic tests were performed; however groundwater was encountered at 7.5 ft bgs in borehole SB-20-03.

2.3 OT-32 Collapsed Former Primate Research Area Sewer Lines

2.3.1 Site Description and Background

This site is an AOC and is listed on Table A of the HAFB RCRA Permit as PRI-A, Primate Research Lab Sewer Line. The former Primate Research Institute (Buildings 1200 through 1208) is located on Douglas Road near the intersection with Vandergrift Road, approximately two miles north of the Main Base Area (Figure 2-1). The Primate Research Institute (PRI) has been relocated in a new facility located approximately one mile north off Vandergrift Road.

It was reported that approximately 3,000 to 4,000 feet of sewer line leading from the former PRI were suspected of being corroded, with certain portions thought to be totally collapsed during the early 1960s until the late 1970s. In 1981, a segment of the sewer line from the former Primate Research Lab was repaired. During the period when the sewer lines were badly corroded/collapsed, small quantities of carbon-14, iodine-125, tritium tracers and solvents may

have entered the lines at the research center and are suspected to have leaked into the subsurface at the collapsed section. Based on recent interviews with the current HAFB Utility Manager, another sewer line collapse occurred in the early 1990s. This collapsed segment of sewer line was located along the main north-south line approximately 500 to 1,000 ft south of the sewer line that connects with the former Primate Research Area. It was reported that a 20 ft by 40 ft by 16 ft deep pit was dug which received sewage waste for one year until the sewer line was repaired. The quantities of solvents and radioactive tracers utilized by the former Primate Research Area was reportedly small, however, no specific information was available as to the amounts of these that could have entered the shallow groundwater (CH_2M Hill, 1983).

2.3.2 Previous Investigations

A records search for Site OT-32 was conducted by CH_2M Hill in 1982 (CH_2M Hill, 1983). Information from the OT-32 record search is included in Appendix A-3-1. The site was not considered to present a significant risk and further investigation of the site was not recommended at that time. A Phase II, Stage 1 investigation was conducted at Site OT-32 in September 1984 by Dames & Moore. Four soil borings (32B1 through 32B4) were drilled along the sewer line approximately 1.5 miles southwest of where the corroded/collapsed sewer line was identified during the *IRP Records Search* (CH_2M Hill, 1983). Eight soil samples were sampled for oil and grease, total organic halogens (TOX), tritium, and carbon-14. The majority of the samples were below the detection limits for these parameters. Carbon-14 was detected in only one sample at a concentration of 240 ± 194 picocuries per gram (pCi/g). The analytical results and sample locations for the subsurface soil samples collected during the OT-32 Phase II Stage 1 investigation (Dames & Moore, 1987) are included in Appendix A-3-2.

Based on the site description and history presented in the *IRP Records Search* (CH_2M Hill, 1983), it appears that the Phase II investigation for OT-32 was conducted at the wrong location. The Records Search and recent interviews conducted with Charles Price Jr. (Manager of the HAFB Utilities Group) indicate that the segment of corroded/collapsed sewer line (Site OT-32) was actually located approximately 1.5 miles southwest of the former Primate Research Institute (Buildings 1200 through 1208). The original OT-32 site location as identified in the IRP Records Search is also included in Appendix A-3-1. Misidentification of the source area (corroded/collapsed sewer line) would explain the lack of significant data from the Phase II investigation. Since soil samples collected during the Phase II investigation were mislocated, the data from this investigation will not be discussed further.

2.3.3 Geology and Hydrogeology

The location of OT-32 was misidentified during the Phase II investigation; therefore the subsurface lithology described in the Phase II report is not accurate for the actual location of Site OT-32. Based on the subsurface conditions reported for OT-35, located approximately one mile north of OT-32 the stratigraphy should consist of interbedded layers of sand, silt and clay lenses, with groundwater approximately 20 to 30 ft bgs.

2.4 OT-35 Spent Solvent Disposal Area

2.4.1 Description and Site Background

This site is an AOC and is listed on Table A of the HAFB RCRA Permit as PRI-2, Building 1264 Solvent Burn Area, and as PRI-5 Building 1264 Solvent Burn Area. The Spent Solvent Disposal Area (OT-35) is located immediately south of the new Primate Research Laboratory (Buildings 1264 and 1265) approximately 2 miles north of the Main Base Area (Figure 2-1). The Site topography is relatively flat, and the area is sparsely vegetated.

Spent solvents had reportedly been disposed of intermittently on the ground and ignited in an area south of Building 1264 during the 1950s and 1960s. The spent solvents were generated as part of the on-site laboratory operations and consisted of xylenes, methanol, toluene, and acetone. Spent solvents may also have contained small quantities of radioactive tracers (carbon-14, iodine-125, and tritium). Based on interviews and site visits with longtime Primate Research Laboratory employees, three potential solvent disposal areas were identified. The disposal sites include an area of stressed vegetation immediately north of Building 1264 where scintillation cocktails were reportedly disposed of on the ground, a slightly vegetated area north of Building 1269 where stained soils were observed, and an area several hundred yards south of Building 1269 that was identified as the former solvent evaporation area where solvents were set out in evaporation pans for disposal (Radian, 1993a).

2.4.2 Previous Investigations

A record search for Site OT-35 was conducted by CH_2M Hill in 1982 (CH_2M Hill, 1983). The record search concluded that the site did not present any significant concern for adverse effects on health or the environment. The site was investigated in December 1992 and February 1993 during a Site Investigation (SI) conducted by Radian Corporation. The following information was obtained from the *Chemical Data Acquisition Plan Investigation of Four Waste Sites* (Radian, 1993a) and the *Draft Final Preliminary Assessment and Site Investigation Report for Four Waste Sites* (Radian, 1993b). The scope of work for the OT-35 SI included the following field activities:

- A passive soil gas survey using the PETREX sampling technique was conducted at the site using 15 samplers. Five samplers were installed at each of the three potential disposal sites (Radian, 1993a).

- One soil boring was drilled into each of the three potential disposal sites (BH-35-01 through BH-35-03). Two subsurface soil samples were collected from each borehole and submitted for chemical analysis: the surface sample (0 to 4.5 ft bgs) and a subsurface sample with the most visible contamination or the highest photoionization detector (PID) reading. These soil samples were analyzed for VOCs, gross alpha and beta radioactivity, and gamma radioactivity (Radian 1993b).

- One surface soil background sample (BH-35-04) was collected from 0 to 2 ft bgs approximately 500 ft northeast of the site and was analyzed for alpha, beta, and gamma radioactivity (Radian 1993b).

Elevated levels of chloroform were detected in the passive soil-gas samples collected in the two disposal areas near Building 1269. Chloroform is a common chemical used in scintillation cocktails. The results and locations of the three passive soil gas surveys conducted at OT-35 are included in Appendix A-4-1.

Gross alpha and beta radioactivity levels detected in the six soil samples were slightly above the background levels established in the background sample (7.87 pCi/g) and 5.95 pCi/g, respectively) collected at BH-35-04. Gamma radiation was not detected in the background sample. The maximum concentrations of gross alpha (21.21 pCi/g) and gross beta (19.51 pCi/g) were detected in the soil samples collected from BH-35-01. Gamma radiation was detected below the reporting limit in one sample collected from BH-35-01 at a concentration of 0.33 pCi/g. In addition, the NMED *Technical Background Document for Development of Soil Screening Levels, Revision 4.0* (NMED, 2006) does not provide SSLs for gross alpha and beta or speciated radionuclides. Additionally, VOCs were not detected in any of the six soil samples collected form the three boreholes drilled at OT-35.

The analytical results and sample locations for the subsurface soil samples collected during the OT-35 SI are included in Appendix A-4-2. The *Preliminary Assessment and Site Investigation Report for Four Waste Sites* (Radian 1993b) determined that there are no risks to human health or the environment and recommended no further action for OT-35.

Review of gross alpha, gross beta, and gamma radiation results for the six soil samples collected during the OT-35 SI indicates that detected radioactivity levels are comparable to background levels found at HAFB. Concentrations of gross alpha and gross beta ranged from not detected to 21.21 pCi/g and not detected to 19.51 pCi/g, respectively. Using one half of the detection limit for the not detected data, the average concentrations of gross alpha and gross beta for these soil samples is 10.1 pCi/g and 11.3 pCi/g, respectively. These average concentrations are within and below the background ranges for gross alpha (4.6 to 15.4 pCi/g) and gross beta (18.0 to 21.1 pCi/g) detected in the background samples collected during the Preliminary Assessment (PA) conducted at Site 42 (Radian, 1992). In addition, the single detection of gamma radiation (0.33 pCi/g) is estimated and is well below the reporting limit (100 pCi/g).

It is also important to mention that the Iodine-125 and Tritium-3 radioactive tracers historically used at OT-35 have relatively short half-lives. The half-lives of Iodine-125 and Tritium-3 are 60 days and 12.3 years, respectively. As the OT-35 disposal sites have be inactive for over 30 years there has been approximately an eighty percent (80%) degradation (decay) of Tritium-3 and 99% decay of Iodine-125. Although Carbon-14 has a half life of 5,730 years, Carbon-14 has never been considered a carcinogen. Furthermore, these radioactive tracers are not alpha emitters. Iodine-125 emits gamma particles while Carbon-14 and Tritium-3 emit beta particles, therefore the gross alpha levels found at OT-35 are naturally occurring (International Commission on Radiological Protection, 2002). Under separate cover and pending NMED approval, HAFB will submit a Statement of Basis requesting NFA for Site OT-35.

2.4.3 Geology and Hydrogeology

The subsurface conditions at Site OT-35 were defined by direct sampling and observation of the drill cuttings for the three soil borings conducted by Radian during the Site Investigation (Radian, 1993b). The OT-35 site stratigraphy consists primarily of two broadly defined lithologic units. The upper most unit consists of 10 ft of silt and silty sand that is underlain by 25 ft of clay. Interbedded lenses of sand and silt, ranging in thickness from 1 to 6 ft, occur within the clay layer. The clay layer grades into a clayey sand in the southern portion of the site. The drilling logs for OT-35 are included in Appendix A-4-2. Based on the HAFB base-wide potentiometric surface, groundwater is estimated to be approximately 35 to 40 ft bgs in the vicinity of OT-35.

2.5 OT-38 Test Sled Maintenance Area

2.5.1 Site Description and Background

This site is a SWMU and is listed on Table A of the HAFB RCRA Permit as Building 1166 Test Track Drain Field, SWMU 137. The Test Sled Maintenance Area (OT-38) is located near the Building 1166 Test Track Drain Field (Figure 2-1). From 1951, when the test track became operational, until 1979, waste oils, solvents, and paint strippers used in the sled industrial maintenance area (Building 1166) were suspected of being discharged to a cesspool behind the building. Since 1979, all wastes have been accumulated in 55-gallon drums and turned over to the Defense Reutilization and Marketing Office (DRMO) for disposal or recycling. Personnel from the Exterior Plumbing Department indicated that the cesspool consisted of an unlined cavity below surface that was about 6 ft deep and 10 ft long. In the late 1980s, the cesspool was replaced with a septic tank and leach field (approximately 150 ft of perforated polyvinyl chloride [PVC] pipe) that was installed at the former cesspool location. The personnel that installed the septic tank reported that wastes were not apparent in the former cesspool location (personal conversation with Charles Price, Jr., July 1991).

2.5.2 Previous Investigations

A record search for Site OT-38 was conducted by CH_2M Hill in 1982 (CH_2M Hill, 1983). The site was investigated in September 1991 during a Remedial Investigation conducted by Radian Corporation. The following information was obtained from the *Draft Final RI Report Investigation, Study and Recommendation for 29 Waste Sites* (Radian, 1992). The scope of work for the OT-38 RI included the following field activities:

- Two soil borings (SB-38-01 and SB-38-02) were drilled adjacent to the septic tank where the former cesspool was located. Samples were collected at 2.5 ft intervals. Two composite samples were collected: one from the sample intervals in the first 10 feet and another from the remainder of the sample intervals below 10 feet to groundwater. Samples were analyzed for VOCs (discrete intervals), metals, and petroleum hydrocarbons.

- Three monitoring wells were installed at OT-38 to determine whether a release had occurred. The monitoring well network was based on groundwater flowing to the south. Two wells (MW-38-02 and MW-38-03) were located downgradient and one (MW-38-01) was located upgradient of the former cesspool. One round of samples were collected and analyzed for VOCs, TDS, metals, and water quality parameters.

- Two subsurface soil samples collected from the monitoring well borings were analyzed for geotechnical properties.

The metals detected in the soil samples collected from the two soil borings at OT-38 were all below their respective SSLs (NMED, 2006). Petroleum hydrocarbons were detected in each of the four soil samples. The highest concentration (1,540 mg/kg) was detected in the soil sample collected from the 0 to 10 ft bgs interval in SB-38-02. This concentration exceeds the NMED SSL for total recoverable petroleum hydrocarbons (TRPH) for unknown oil (800 mg/kg). The only VOCs detected were estimated concentrations of methylene chloride and toluene which were all below the NMED SSLs (NMED, 2006) for these compounds. In addition, methylene chloride was detected in the laboratory blank analysis.

The VOCs and metals detected in the groundwater samples collected from the three monitoring wells installed at OT-38 during this investigation were all below the NMWQCC Groundwater Standards (New Mexico Administrative Code [NMAC] 20.6.2). The NMWQCC Regulations are published groundwater quality standards for aquifers with TDS concentrations less than or equal to 10,000 mg/L (20.6.2.301 NMAC). TDS concentrations ranged from 5,500 to 15,000 mg/L for each well. The average TDS concentration for these wells (11,833 mg/L) exceeds the allowable limits for TDS (10,000 mg/L) for the groundwater to be considered a viable drinking water source. In addition the concentrations for chloride, sulfate, fluoride, and nitrate (anions) also exceeded their respective NMWQCC standards in all of the OT-38 monitoring wells. However, these anions (TDS constituents) were detected at concentrations below their established background ranges for HAFB (Tetra Tech Foster Wheeler, 2004). Chloride, sulfate, fluoride, and nitrate ranged in concentration from 900 to 3,800 mg/L, 1,900 to 4,900 mg/L, 1.4 to 2.1 mg/L and 110 to 130 mg/L, respectively.

The analytical results and sample locations for the subsurface soil and groundwater samples collected during the OT-38 RI are included in Appendix A-5-1. The *Draft Final RI Report Investigation, Study and Recommendation for 29 Waste Sites* (Radian, 1992) determined that there are no risks to human health or the environment and recommended no further action for OT-38.

2.5.3 Geology and Hydrogeology

The subsurface conditions at OT-38 were defined by direct sampling and observation during the drilling operations for the two soil borings and three monitoring wells conducted by Radian during the RI (Radian, 1992). The drilling and monitoring well construction logs for this investigation are included in Appendix A-5-1. Site stratigraphy consists mostly of silt and sand. A low to medium plasticity silt extends across the site in the near surface deposits. From the north to south end of the site, the silt increases in thickness from 2 to 15 ft thick. A well sorted,

very fine to fine grained sand underlies the silt deposits and extends across the entire site. Small clay lenses (2 ft thick) were encountered in the borehole for MW-38-03 and a silty sand lens was seen in MW-38-01.

Groundwater occurs in a shallow unconfined aquifer beneath the site approximately 20 feet bgs in the fine grained sand deposits. Based on monitoring well water level measurements taken in November 1991, groundwater flows south towards the Lost River at a rate between 11 to 45 ft/year and the hydraulic gradient is approximately 3.43×10^{-3}.

2.6 OT-45 Old AGE Refueling Station

2.6.1 Site Description and Background

This site is an AOC and is listed on Table A of the HAFB RCRA Permit as Building 296 Old AGE Refueling Station, AOC-O. Site OT-45 (formerly Site 51) the Old Aerospace Ground Equipment (AGE) Refueling Station is located near the intersection of West Delaware Avenue and West Fourth Street, south of the Building 296 parking lot (Figure 2-1). The Old AGE Refueling Station consisted of three underground storage tanks (USTs) (two 12,500 gallon tanks and one 10,000 gallon tank) that stored gasoline, diesel, and JP-4. The site was also equipped with a pump island and fuel dispensing station. The Refueling Station including the three USTs were removed in the 1980s during the renovation of Building 296 and were replaced with a parking lot and landscaped area. The condition of the USTs when removed is unknown.

The Site was not identified in the *IRP Phase I Records Search* (CH_2M Hill, 1983). However, during the excavation of a utility trench at the site, liquid hydrocarbons were discovered floating on the water table. Subsequently, the site was added to the IRP and also became known as an Area of Concern and is listed on Table A of the HAFB RCRA Permit as the Building 296 Old AGE Refueling Station, AOC-O.

2.6.2 Previous Investigations

Since 1984, the Old AGE Refueling Station (OT-45) has been the subject of two environmental investigations involving the evaluation of the soil and groundwater conditions and a remedial action excavation. The first investigation (Phase II – Confirmation/Quantification Stage 1) was conducted by Dames & Moore in 1984 (Dames & Moore, 1987). A follow-on Remedial Investigation was conducted by Walk, Haydel & Associates, Inc. in 1988-89. As a result of contaminated soils delineated during the Remedial Investigation, IT Corporation conducted a remedial action excavation of the PCS due to the leaking underground storage tanks and fuel lines in 1991. During these investigations and remedial action the Old AGE Refueling Station was referred to as Site 51; however in 1992 the site was renamed OT-45. In 1992 a confirmation sampling event was conducted around the perimeter of the PCS excavation at OT-45 to determine that TRPH concentrations were not above 1,000 mg/kg (Foster Wheeler and Radian, 1996).

The chronology and findings of the previous investigations, remedial action, and confirmation sampling event conducted at the Old AGE Refueling Station are presented below.

2.6.2.1 IRP Phase II – Stage 1 Investigation

The site was investigated in September 1984 during the Phase II - Stage 1 investigation conducted by Dames & Moore. The following information was obtained from the *IRP Phase II – Confirmation/Quantification Stage I* report (Dames & Moore, 1987). The scope of work for the Phase II – Stage 1 investigation included the following field activities:

- Two soil borings (51-B1 and 51-W1) were drilled to determine if a release had occurred at the site. A total of five soil samples were collected from the two boreholes and analyzed for oil and grease, TOX, and phenolics.

- A monitoring well was installed in the 51-W1 soil boring. A groundwater sample collected from this well was analyzed for oil and grease, TOX, total organic carbon (TOC), and phenolics.

The soil had a strong fuel odor that decreased in intensity at depth. TOX concentrations (6.4 to 50 mg/kg) were above the detection limit in all samples. All of the samples were negative for phenolics and only one sample (51-B1, 5 to 6.5 ft bgs) contained oil and grease (39 mg/kg). The water sample collected from 51-W1 showed moderate levels of TOC (68,000 µg/L) and relatively high levels of oil and grease (85,000 µg/L), phenolics (290 µg/L), and TOX (27,000 µg/L).

The analytical results and sample locations for the subsurface soil and groundwater samples collected during the Phase II Stage 1 are included in Appendix A-6-1. The *IRP Phase II – Stage 1* (Dames & Moore, 1987) recommended further investigation to define the nature and extent of contamination.

2.6.2.2 Remedial Investigation

Walk, Haydel & Associates, Inc. performed a Remedial Investigation at the Old AGE Refueling Station in March 1988 and January 1989. The RI was performed in two stages. The following information was obtained from the *Final IRP Remedial Investigation Report* (Walk, Haydel & Associates, 1989). The scope of work for the RI included the following field activities:

- During the RI - Stage I, five monitoring wells were installed (MW1 through MW5). Soil samples collected from the five monitoring well borings (B1 through B5) were analyzed for volatile organics, acid/base/neutral extractable organics (BNA), TRPH, and lead.

- A sixth soil boring (B6) was drilled near the sewer line southeast of Building 284 however no soil samples were collected for laboratory analysis.

- A round of groundwater samples were collected from the Phase II - Stage 1 well (51-W1) and the five new wells (MW1 through MW5). Groundwater samples were analyzed for volatile organics, BNA, TRPH, and lead.

- During the RI - Stage II, two additional monitoring wells (MW7 and MW8) were installed. Soil samples were collected from the two additional monitoring well borings (B7 and B8) were analyzed for volatile organics, BNA, TRPH, and lead.

- A second round of groundwater samples were collected from the previously installed well (51-W1) and the seven new wells (MW1 through MW5, MW7, and MW8). Groundwater samples were analyzed for volatile organics, TRPH, and BNA.

Low levels of petroleum related compounds and volatile organics were detected in the soil samples collected in B1, B2, B3, and B8 to depths of 15 ft bgs. The highest levels of VOC contamination (benzene, chlorobenzene, ethylbenzene, styrene, toluene and 1,1,2,2-tetrachloroethane) were detected in B2 at 5 ft bgs with concentrations ranging from 2,010 to 62,300 µg/kg. BNA results for soil were all below the detection limits except for the 5 ft sample at B2 where 2-methylnaphthalene (5,200 µg/kg) and naphthalene (26,000 µg/kg) were found. The highest concentrations of TRPH (1,265 mg/kg) and lead (6 mg/kg) were detected in soil samples collected from B2 and B5 respectively.

Six inches of floating product was found in the RI Stage II sample from MW2. Analysis of the floating product showed solvents (chlorobenzene and 2-hexanone), benzene, ethylbenzene, toluene, and xylenes (BTEX), hexanes, and cyclohexanes typical of light petroleum fuels. The USACE Quality Assurance Laboratory identified the product as JP-4 with a trace of Fuel Oil No. 6. Some degree of VOC contamination was found in the groundwater from all monitoring wells. Contaminants included BTEX compounds and a variety of solvents similar to those found in the floating product from MW2. Monitoring wells MW2 and MW3 had the highest concentrations of VOCs ranging up to 740 µg/L. Three wells (MW4, MW5, and MW7) appeared to be at the downgradient edge of the dissolved contaminant plume due to their very low VOC levels.

The analytical results and sample locations for the subsurface soil and groundwater samples collected during the Remedial Investigation are included in Appendix A-6-2. The *Final IRP Remedial Investigation Report* (Walk, Haydel & Associates, 1989) recommended that a feasibility study be conducted for site remediation.

2.6.2.3 Remedial Action Excavation

To mitigate the potential risks posed by the site, a remedial action was proposed in 1991. IT Corporation was contracted to perform a remedial action excavation of the PCS at the Old AGE Refueling Station in September 1991. The Quality Control Daily Reports indicated that 3,320 cubic yards of PCS and approximately 10,000 gallons of wastewater were removed. The excavation covered an area approximately 200 ft long by 65 ft wide and roughly 6.5 ft deep which corresponds to about 80% of the parking lot area in front of Building 296. The excavation was backfilled with clean fill from the HAFB borrow pit and the area was restored (IT

Corporation, 1991). Information including a map showing the area of excavation from this remedial action is included in Appendix A-6-3.

2.6.2.4 Confirmation Sampling

Confirmation sampling was conducted at Site OT-45 in 1994 by Foster Wheeler to ensure that the remaining levels of TRPH in the soil surrounding the PCS excavation did not exceed 1,000 mg/kg. The following information was obtained from the *Technical Memorandum, Installation Restoration Sites SS-12, SD-27, and OT-45* (Foster Wheeler, 1996). The scope of work for the confirmation sampling included the following field activities:

- Subsurface soil samples were initially collected from four soil borings (45-B09 through 45-B12). A soil boring was drilled on each side of the rectangular shaped former PCS excavation area.

- The soil samples were collected from the 1.0 to 2.5 ft bgs and the 3.0 to 4.5 ft bgs intervals. The soil samples were submitted for analysis by USEPA Method SW8015 modified for purgeable and extractable organics. However, the only purgeable parameters analyzed by the laboratory were gasoline range organics (GRO) and diesel range organics (DRO).

- Due to the absence of BTEX data from the original samples, four additional hand auger samples were collected for boreholes 45-B09R through 45-B12R. These hand auger soil samples were collected within three ft of the original soil boring and submitted to the laboratory for DRO, GRO, and BTEX analysis.

With the exception of soil borings 45-B10 and 45-B12, only low levels of DRO, GRO, and BTEX were detected in the samples. Elevated DRO (310 mg/kg) and GRO (750 mg/kg) concentrations were detected in the 3.0 to 4.5-ft sample interval of soil boring 45-B10. Elevated DRO (1,200 and 530 mg/kg) and GRO (1,900 and 3,400 mg/kg) concentrations were detected in the 1.0- to 2.5-ft and 3.0- to 4.5-ft sample intervals of soil boring 45-B12.

The analytical results and sample locations for the subsurface soil samples collected during the confirmation sampling event are included in Appendix A-6-4. The *Technical Memorandum for Installation Restoration Sites SS-12, SD-27, and OT-45* (Foster Wheeler, 1996) determined that although the GRO/DRO sum exceeded the Base-specific cleanup level of 1,000 mg/kg, the TRPH contamination above 1,000 mg/kg was very limited and recommended site closeout for OT-45.

2.6.3 Geology and Hydrogeology

The geology and subsurface conditions at OT-45 were defined by direct sampling and observation of the eight soil borings completed by Walk, Haydel & Associates during the RI. The drilling logs, monitoring well construction diagrams and well development data for the previous OT-45 (formerly Site 51) investigations are included in Appendix A-6-1, A-6-2, and A-6-4. Site OT-45 is overlain with clayey sands, silty sands, poorly graded sands, and to a limited

degree, poorly graded gravel. These uppermost beds extend to a maximum depth of 8 ft bgs. Underlying these beds is a 6 ft thick bed of silts and very fine grained sands in the center of the site, with silty clays in the southwest portion of the site. Beneath these beds lay a thick bed of poorly graded (well sorted) sands (Walk, Haydel & Associates, 1989).

During the RI, groundwater was observed at approximately 5.6 ft bgs. The direction of groundwater flow is toward the south. The average hydraulic gradient for the site is 0.0065 foot per foot (ft/ft). Field slug tests (rising head tests) were conducted to estimate the in-situ permeability of the screened stratum of each monitoring well. Estimated in-situ permeability for OT-45 wells range from 6×10^{-5} to 7×10^{-4} cm/sec (Walk, Haydel & Associates, 1989).

2.7 SS-06 JP-4 Fuel Line Spill Site

2.7.1 Site Description and Background

This site is an Area of Concern and is listed on Table A of the HAFB RCRA Permit as JP-4 Fuel Line Spill Site, AOC-R. Site SS-06 is located along the eastern boundary of the Base, in the Main Base Area near Building 1254 (Figure 2-1). The site is situated approximately 200 ft south of the POL storage area. In 1979, a road grader accidentally hit and ruptured the JP-4 fuel line leading to the POL storage areas. Approximately 8,000 gallons of JP-4 spilled onto the ground before the release could be stopped. Cleanup operations were immediately performed and the majority of the jet fuel was reportedly recovered.

2.7.2 Previous Investigations

A record search for Site SS-06 was conducted by CH_2M Hill in 1982 (CH_2M Hill, 1983). The site was not considered to present a significant risk and further investigation of the site was not recommended at that time. A SI was conducted at SS-06 in March 1995 by Ebasco Services, Inc. The objective of the SI was to determine the presence or absence of contaminants in the soil and groundwater related to the 1979 JP-4 release from the pipeline. The following information was obtained from the *Draft Final Site Investigation Report Waste Sites SS-06, SD-15, AOC-RR, and AOC-BBMS* (Ebasco, 1995). The scope of work for the SS-06 SI included the following field activities:

- Thirty-six (36) soil-vapor points (SS-06-SG-1 through SS-06-SG-36) were installed in a rectangular pattern on a 50-ft grid spacing around the spill area identified in the records search. Soil-vapor samples were analyzed by an on-site mobile laboratory for BTEX constituents and total petroleum hydrocarbons (TPH) as JP-4.

- Six soil boring locations (SS-06-SB-01 through SS-06-SB-06) were drilled in a pattern that straddled the pipeline. Two samples, one from the groundwater interface and the other from the highest headspace VOC reading were selected for offsite chemical analysis. Soil samples were analyzed for TPH, VOCs, and Target Analyte List (TAL) metals. One sample for each boring was also selected for geotechnical analysis.

- Six temporary 1-inch diameter monitoring well points (GP-01 through GP-06) were installed during the SI. Groundwater samples were collected from wells GP-01, GP-02, and GP-03. Wells GP-04, GP-05, and GP-06 did not contain water and were not sampled. The three groundwater samples were analyzed for VOCs, dissolved TAL metals, and field parameters (pH, temperature, and specific conductance). After sampling, the temporary wells were removed from the ground and the holes were backfilled with bentonite pellets.

The soil-vapor survey was inconclusive; TPH was detected in only one sample (SG-36) with a concentration of 22 µg/L. Benzene and toluene concentrations ranged from not detected (<0.05 µg/L) to 0.14 µg/L and 1.20 µg/L, respectively at soil-vapor point SG-1. Total BTEX concentrations ranged from 0.24 µg/L (SG-31) to 2.05 µg/L (SG-1). However, total BTEX concentrations in the field blanks ranged from 0.45 µg/L to 1.13 µg/L.

No VOCs or TPH constituents were detected above the reporting limits in each of the 12 soil samples collected at SS-06, and all of the TAL metal concentrations were below their respective SSLs (NMED, 2006). No VOCs except acetone (17 µg/L) were detected in the three groundwater samples and duplicate samples analyzed. Zinc and lead were the only TAL metals detected above the Basewide UTLs with concentrations of 3.4 mg/L and 0.063 mg/L, respectively. The analytical results and sample locations for the subsurface soil and groundwater samples collected during the Site Investigation are included in Appendix A-7-1.

Review of SI data collected at SS-06 indicates that clean up and excavation of JP-4 contaminated soil from the 1979 spill was sufficient. No petroleum related constituents were detected in the soil or groundwater samples collected during the SI, indicating that the 1979 release did not impact the subsurface. Under separate cover and pending NMED approval, HAFB will submit a Statement of Basis requesting NFA for Site SS-06.

2.7.3 Geology and Hydrogeology

The subsurface conditions at SS-06 were defined by direct sampling and observation of the six soil borings completed by Ebasco during the RI. The drilling logs and geotechnical soil analytical data are included in Appendix A-7-1. The lithology at SS-06 consists of fine grained materials, mostly inorganic silts and clayey sands with abundant gypsum crystals. The unconsolidated material varies from a light brown sand or clayey sand near the surface to a red silt with depth. Groundwater was encountered from 9 to 13 feet during borehole and direct push techonology (DPT) sampling but some wells at this depth did not produce enough water for sampling. A hard caliche layer is located above the groundwater table. Information describing the hydraulic gradient and flow direction was not provided in the SI Report.

2.8 SS-12 Northeast Fuel Line Spill Site

2.8.1 Site Description and Background

This site is an Area of Concern and is listed on Table A of the HAFB RCRA Permit as Northeast Fuel Line Spill Site, AOC-K. Site SS-12, is located immediately east of the main housing area at

HAFB (Figure 2-1). In 1975, approximately 2,000 gallons of JP-4 were spilled at the site as a result of a rupture (due to excessive pressure) in the main pipeline that serves the HAFB POL area. The majority of fuel was reportedly collected in a pit and pumped into a truck shortly after the spill. In 1992, petroleum product was allegedly encountered while installing a utility trench west and upgradient of the pipeline.

2.8.2 Previous Investigations

A record search for Site SS-12 was conducted by CH_2M Hill in 1982 (CH_2M Hill, 1983). The site was not considered to present a significant concern for adverse effects on health or the environment. Since 1993, SS-12 has been the subject of two environmental investigations related to evaluating the soil and groundwater conditions. The initial investigation was a Site Investigation conducted by Radian in 1993. A follow-on investigation was performed by Foster Wheeler in 1994. The chronology and findings of the previous investigations conducted at Northeast Fuel Line Spill Site are presented below.

2.8.2.1 Site Investigation

The site was investigated in November 1992 and February 1993 during a Site Investigation (SI) conducted by Radian Corporation. The following information was obtained from the *Chemical Data Acquisition Plan Investigation for Four Waste Sites* (Radian, 1993a) and the *Draft Final Preliminary Assessment and Site Investigation Report for Four Waste Sites* (Radian, 1993b). The SI focused on two principal areas of possible contamination: the segment of the JP-4 pipeline that ruptured in 1975 and an area where the alleged fuel product was encountered during the sewer installation. The scope of work for the SS-12 SI included the following field activities:

- A passive soil-gas survey was conducted at the site using a grid of 32 samplers. During the installation of the samplers, visibly contaminated soil was observed along the pipeline at a depth of 1 ft bgs. Twenty-four (24) of the passive soil gas samplers were stolen and one was broken. The remaining seven samplers were analyzed for aromatic compounds and petroleum hydrocarbons (Radian, 1993a).

- A second, real-time soil-gas survey was conducted to obtain more information (Radian 1993a).

- Six soil borings (BH-12-01 through BH-12-06) were installed to collect soil samples (one per borehole) for chemical analysis in the potentially contaminated areas along the storm sewer and pipeline. The six soil samples were analyzed for total fuel hydrocarbons (TFH) (Radian 1993b).

- Three of the soil borings (BH-12-01, -02 and -03) were completed as monitoring wells (WL-12-01 through WL-12-03). The wells were installed in potential source areas to determine the local groundwater flow direction and whether there had been a release to groundwater. One round of groundwater samples were collected and analyzed for TFH (Radian 1993b).

The soil-gas surveys at Site SS-12 indicated potential contamination along both the pipeline in the vicinity of the storm sewer drainage and the storm sewer between two houses in the Base housing area (Buildings 2461 and 2464). Kerosene was detected (35 micrograms per gram [μg/g]) in the soil sample from BH-12-02 (0 to 2 ft bgs) located adjacent to the JP-4 pipeline and near a ditch that receives runoff from the storm sewer. This detection of kerosene is more likely a result of runoff from the storm sewer that accumulates in the ditch (Foster Wheeler, 1996). In addition, a very low level (3.1 μg/g) of an unidentified organic compound eluting in the diesel range was also detected in one soil sample from the 2-4 ft depth at BH-12-06. TFH was not detected in any of the other four soil samples collected at the site.

Benzene (0.49 μg/L) and toluene (0.66 μg/L) were detected in the groundwater sample from WL-12-01. Benzene (0.4 μg/L) and ethylbenzene (3.6 μg/L) were detected in the sample from monitoring well WL-12-02. Both of these wells are located along the JP-4 pipeline. All of the concentrations for benzene, toluene, and ethylbenzene were well below their respective NMWQCC standards (20.6.2.301 NMAC). No petroleum constituents were detected in the sample from monitoring well WL-12-03, located adjacent to the storm sewer.

The analytical results and sample locations for the soil-gas, subsurface soil, and groundwater samples collected during the SI are included in Appendix A-8-2. The *Draft Final Preliminary Assessment and Site Investigation Report, Investigation of Four Waste Sites* (Radian, 1993b) determined based on a qualitative risk assessment that detected concentrations did not pose a potential risk to human health and the environment and recommended site closeout.

2.8.2.2 Additional Sampling

NMED reviewed the results of the SI and requested additional sampling. To address the NMED's concerns, additional sampling was performed by Foster Wheeler in 1994. The following information was obtained from the *Technical Memorandum for Installation Restoration Sites SS-12, SD-27, and OT-45* (Foster Wheeler and Radian, 1996). Two soil borings (94-12-01 and 94-12-02) were drilled and soil samples were collected from within and below a gray soil layer identified during the SI. Six additional soil samples were collected and analyzed for VOCs, SVOCs, and TRPH.

Visible staining was noted from approximately 5.2 to 6.2 ft bgs in soil boring 94-12-01 and from 0 to 11.8 ft bgs in boring 94-12-02. Subsurface soil samples were collected within and below the gray layer in both boreholes. The only VOCs or SVOCs detected were low concentrations of acetone and methylene chloride which are common laboratory contaminants and are not indicative of petroleum contamination. The maximum concentration of TRPH (590 mg/kg) was detected in the sample from 94-12-01 from the 2 to 4 ft depth.

The analytical results and sample locations for the subsurface soil samples collected during this additional investigation are included in Appendix A-8-3. The *Technical Memorandum, Installation Restoration Sites SS-12, SD-27, and OT-45* (Foster Wheeler, 1996) also recommended site closeout.

2.8.3 Geology and Hydrogeology

The geology and hydrogeology of SS-12 was characterized in the *Draft Final Preliminary Assessment and Site Investigation Report, Investigation of Four Waste Sites* (Radian, 1993b). The PA/SI defined subsurface conditions at site SS-12 via direct sampling and observation of drilling operations. Drilling logs and monitoring well construction diagrams for the PA/SI report can be found in Appendix A-8-2. The site lithology consists primarily of silty and clayey sands. The first 3 feet are primarily clay, with sand becoming a larger constituent from 3 to 6 feet. From 6 feet down to 17 feet the site is primarily clayey sand. Groundwater occurs in clayey sands in a shallow unconfined aquifer approximately 3 ft bgs. Radian used a three point plot in March of 1993 to calculate flow direction and rate. The flow direction is east-southeast toward Dillard Draw, with a hydraulic gradient of approximately 1.8×10^{-3}.

2.9 SS-18 Chromic Acid Spill Site

2.9.1 Site Description and Background

This site is an Area of Concern and is listed on Table A of the HAFB RCRA Permit as AOC-H, Chromic Acid Spill Area. The Chromic Acid Spill Site (SS-18) is located on the south side of Building 281 (Figure 2-1). The 479th CRS maintained a chrome plating shop in Building 281 until the late 1970s. When the operation was discontinued, the full chromic acid vats were temporarily stored along the south wall inside Building 281. It is estimated that approximately 500 gallons of chromic acid were spilled on the ground in this storage area with some of the acid reaching the surface drainage ditch just west of the storage area. The spill site is approximately 30 by 30 feet. In 1982, 10 yellow stained surface soil samples were collected and composited for hexavalent chromium analysis. The extraction results for hexavalent chromium found in the composite sample was equivalent to 0.600 mg/L, well below the USEPA standard of 5 mg/L (CH_2M Hill, 1983).

2.9.2 Previous Investigations

A record search for Site SS-18 was conducted by CH_2M Hill in 1982 (CH_2M Hill, 1983). The study concluded that the site was not considered to present a significant concern for adverse effects on health or the environment. A Phase II - Stage 1 investigation was conducted at Site SS-18 in September 1984 by Dames & Moore. Based on the site description and background presented in the *IRP Records Search* (CH_2M Hill, 1983), the Phase II investigation for SS-18 was conducted at the wrong location. The Records Search and recent interviews conducted with Building 281 personnel indicate that the chromic acid vat storage area (spill source area) was located in the southeast corner of Building 281 and not in the northwest corner of the building (Appendix A-9-1). The following information was obtained from the *IRP Phase II – Confirmation/Quantification Stage 1* (Dames & Moore, 1987). The scope of work for this investigation included the following field activities:

- One soil boring (18B1) and one monitoring well (18W1) were installed. The soil boring and monitoring well were installed northwest of the chromic acid vat storage area and reported spill area (adjacent to the northwest corner of Building 281).

- Both boreholes were completed to a depth of 21.5 ft bgs. Six soil samples, three from each boring were collected from the surface to 6.5 ft bgs and analyzed for total and hexavalent chromium.

- The monitoring well 18W1 was installed at 21.5 ft bgs with a 10 foot screened interval. The groundwater sample was also analyzed for total and hexavalent chromium (extraction procedure [EP] Toxicity analysis).

All six soil sample results were below the extraction procedure detection limits of 0.05 and 0.004 mg/L, respectively for total and hexavalent chromium. These detection limits are well below the RCRA EP Toxicity standard of 5.0 mg/L. Hexavalent chromium was detected in the groundwater sample from monitoring well 18W1 with a concentration of 0.007 mg/L and total chromium was less than the detection limit of 0.1 mg/L. Misidentification of the source area would explain the lack of significant chromium data. The analytical results and sample locations for the subsurface soil and groundwater samples collected during the Phase II investigation are included in Appendix A-9-2.

2.9.3 Geology and Hydrogeology

The geology of SS-18 was briefly described in the Phase II - Stage 1 report (Dames & Moore, 1987). The subsurface profile consists of 6 feet of brown or tan silty clay with some sand overlying a pink to tan gypsum clayey sand layer. Monitoring well soil samples from 2 to 9 feet had a slightly septic odor. The groundwater table was 5 feet bgs and the general flow direction is believed to be to the southwest. The drilling logs and monitoring well construction diagram are included in Appendix A-9-2.

2.10 RW-42 Radioactive Waste Burial Site

2.10.1 Site Description and Background

This site is a Solid Waste Management Unit and is listed on Table A-1 of the HAFB RCRA Permit as the Radioactive Waste Disposal Area, SWMU 111. Site RW-42 is located approximately 6.5 miles of the northern outskirts of the Main base Area (Figure 2-1). The site is located east of Range Road 9 and south of Hay Draw in the undeveloped northeastern area of HAFB. The Radioactive Waste Burial Site is in a secluded area on flat terrain that gently slopes to the southwest. The site consists of a buried concrete cylinder surrounded by a three-stand barbed wire fence (40 ft x 50 ft x 4 ft) with a three stand gate on a moveable fence post. Warning signs indicating radioactive waste disposal are posted 10 ft outside each side of the fence.

RW-42 was created in the 1950s by the U.S. Air Force to bury radioactive waste in accordance with Technical Order TO-00-110A-1. The buried concrete cylinder contains unknown quantities

of wastes. Suspected wastes include animal carcasses containing low-level radioactivity and contaminated pharmaceutical supplies (lab gowns, syringes etc.). Former Air Force personnel present during the internment operation described the vault to be a concrete cylinder approximately 10 ft in length, and 5.5 ft in diameter with an opening 8 ft long and 1.5 ft in diameter. The cylinder is buried at a depth of 2 to 4 ft bgs with a concrete cover (3 ft by 3 ft, 4 inches thick) to indicate the exact location.

2.10.2 Previous Investigations

Site RW-42 (SWMU 111) was initially investigated during the RCRA Facility Assessment Preliminary Review/Visual Site Inspection performed by A.T. Kearney, Inc. in August 1988. The report for this study recommended further investigation and that subsurface soil sampling should be conducted to determine whether hazardous constituents had been released (A.T. Kearney, 1988). During the investigation of 29 waste sites, a PA was conducted by Radian for the Radioactive Waste Burial Site (Site RW-42). The RW-42 Preliminary Assessment was subsequently included with the 29 Waste Sites Remedial Investigation. The scope of the PA included a review of the available file information, a site reconnaissance, and comprehensive receptor identification. The following information from the Site 42 PA was included in the *Draft Final Remedial Investigation (RI) Report, Investigation, Study and Recommendation for 29 Waste Sites* (Radian, 1992).

Periodic monitoring (including soil samples and surface readings) conducted by HAFB's Bioenvironmental Engineering department has shown normal background levels of radioactivity for the site. Surface soil samples were collected by Bioenvironmental Engineering in February 1990. The results indicated no significant differences between background radioactivity levels of the soil taken approximately 100 ft southwest of the site and levels found in the soil taken 8 ft southeast of the concrete pad locating the burial site. During Radian's site reconnaissance in February 1991, measurements were taken using portable alpha and beta/gamma detectors. The results again indicated background radioactivity levels supporting the previous sampling results. The PA determined that radioactivity levels at the site are within background levels and that there has been no release to the groundwater, surface water or air and recommended no further action. The sampling results from 1990 and information from the Preliminary Review/Visual Site Inspection (1988) and Preliminary Assessment (1992) are included in Appendix A-10-1.

2.10.3 Geology and Hydrogeology

There is no site specific geologic or hydrogeological data available for the Radioactive Burial Waste Site (RW-42). Based on regional water level data, the groundwater flow direction is to the south-southwest at a depth of approximately 50 ft bgs.

2.11 OT-37 Early Missile Test Site

2.11.1 Site Description and Background

This site is a SWMU and is listed on Table A of the HAFB RCRA Permit as the Early Missile Test Site, SWMU AOC-L. The Early Missile Test Site is located east of the sled maintenance area in the North Base (Figure 2-1). The Early Missile Test Site was used to develop rocket and missile systems from 1947 to 1955. The test site covers an area of approximately 160 acres and includes three block houses (used as communication and observation points), the inclined test track, three vertical launch pads, a very large pit northwest of Blockhouse 1142, and four transformer concrete pads (transformers have been removed). Fuels used at these sites included JP-4, kerosene, and solid rocket propellants, and PCBs were contained in the transformer dielectric fluid. At some sites solid rocket propellants such as nitrocellulose, nitroglycerine, potassium perchlorate, and polysulfide were exclusively used. Areas of concern at OT-37 include the fuel staging area at the base of the incline track, the outfall for the drainpipe at the inclined track, the three launch facilities, the large pit northwest of Blockhouse 1142, and the four step-down transformer pads.

2.11.2 Previous Investigations

A record search for Site OT-37 was conducted by CH_2M Hill in 1982 (CH_2M Hill, 1983). The site was investigated in August 1991 during a Remedial Investigation conducted by Radian Corporation. The following information was obtained from the *Draft Final Remedial Investigation (RI) Report Investigation, Study and Recommendation for 29 Waste Sites* (Radian, 1992). The scope of work for the OT-37 RI included the following field activities:

- Four hand auger surface soil samples (0 to 2 ft bgs) were collected at each of the four former step-down transformer stations. Each of these 16 soil samples was field screened using the PCB RISc® Test System. One sample from each pad was then selected for offsite laboratory analysis. The four selected surface soil samples (HA-37-04, -06, -11 and -14) were analyzed for PCBs and petroleum hydrocarbons.

- A total of six soil borings (SB-37-01 through SB-37-06) were drilled at Site OT-37 at the following locations; one at the fueling area at the inclined track, one at the outfall drainage pipe from the inclined track, and four at the vertical launch pads. Two samples collected from each soil boring were analyzed for VOCs, metals, and petroleum hydrocarbons.

- The drill rig could not access the proposed soil boring location for SB-37-07; therefore a hand auger was used to collect the two soil samples located in the arroyo.

- A total of six groundwater monitoring wells (MW-37-01 through MW-37-06) were installed at OT-37. The wells were placed downgradient of the possible source areas at the launch facilities where the soil borings were drilled.

- One round of groundwater samples was analyzed for VOCs, TDS, metals, and common anions.

- Two subsurface soil samples were also collected from the monitoring well borings and were analyzed for geotechnical properties.

The RI conducted at OT-37 focused on two different possible contaminant releases; an investigation of the four step-down transformer concrete pads for PCBs and petroleum hydrocarbons, and an investigation of the launch facilities (four vertical launch facilities and the inclined track) for fuel components. The results and conclusions of these investigations are discussed below.

2.11.2.1 Transformer Stations

Petroleum hydrocarbons were detected in the surface soil samples collected from each of the four step-down transformer locations at concentrations ranging from 21.6 mg/kg to 30,600 mg/kg. The TRPH detected in the sample from HA-37-04 (30,600 mg/kg) exceeds the SSL (NMED, 2006) for dielectric fluid (1,560 mg/kg); all other detections were below this SSL. PCBs were detected at three of the former transformer locations. Aroclor 1254 was detected in the soil sample collected from HA-37-06 with a concentration of 9.2 µg/kg. In addition, aroclor 1260 was detected in soil samples collected from HA-37-11 and HA-37-14 with concentrations of 80 and 3,200 µg/kg respectively. The concentration of aroclor 1260 detected in HA-37-14 (3.2 mg/kg) is above the SSL (NMED, 2006) for aroclor 1260 (1.12 mg/kg).

2.11.2.2 Vertical Launch Pad Facilities and Inclined Test Track

The metals detected in the soil samples collected from the seven soil borings at OT-37 were all below their respective SSLs (NMED, 2006). With the exception of lead detected at a concentration of 14 mg/kg (SB-37-03 and SB-37-07) and cadmium detected at 4.7 mg/kg (SB-37-05) all metals were also detected at concentrations below their respective UTLs for background. Petroleum hydrocarbons were detected in 5 of the 14 samples. With the exception of one sample collected at SB-37-03, all TRPH results were less than 48 mg/kg. TRPH exceeding the current SSL (800 mg/kg for unknown oil) was detected in the 0 to 2 ft bgs interval at SB-37-03 with a concentration of 3,860 mg/kg, however TRPH was not detected in the sample from 7.5 to 9.5 ft bgs collected from the same borehole. Several VOCs were detected in the soil samples across the site at levels below their respective SSLs (NMED, 2006).

The VOCs and metals detected in the groundwater samples collected from the six monitoring wells installed at OT-37 during this investigation were all below the NMWQCC Groundwater Standards (NMAC 20.6.2). The NMWQCC Regulations are published groundwater quality standards for aquifers with TDS concentrations less than or equal to 10,000 mg/L (20.6.2.301 NMAC). TDS concentrations ranged from 10,000 to 17,000 mg/L and exceed the NMWQCC standard for each well. Each of these wells exceeds the allowable limits for TDS for the groundwater to be considered a viable drinking water source. In addition the concentrations for chloride, sulfate, fluoride, and nitrate (anions) also exceeded their respective NMWQCC

standards in all of the OT-37 monitoring wells. However, these anions (TDS constituents) were detected at concentrations below their established background ranges for Holloman AFB (Tetra Tech Foster Wheeler, 2004). Chloride, sulfate, fluoride, and nitrate ranged in concentration from 3,000 to 6,800 mg/L, 3,100 to 4,700 mg/L, 1.3 to 2.0 mg/L. and 48 to 75 mg/L, respectively

The analytical results and sample locations for the surface soil, subsurface soil, and groundwater samples collected during the OT-37 RI are included in Appendix A-11-1. The RI Report (Radian, 1992) recommended implementation of a RCRA corrective action remedy and that a pre-design investigation may be warranted to determine the extent of remediation required at OT-37.

2.11.3 Geology and Hydrogeology

The geologic conditions at OT-37 were defined by direct sampling and observation during the drilling operations for the six soil borings and six monitoring wells conducted by Radian during the RI (Radian, 1992). The drilling and monitoring well construction logs for this investigation are included in Appendix A-11-1. Four geologic units were broadly defined at OT-37. The uppermost unit consists of 7 to 10 feet of low plasticity silt and silty sand. Five to 15 ft of interbedded highly plastic silt and silty clays underlie the uppermost unit. Beneath this unit is 7 to 15 ft of well sorted, fine grained sand with intermittent gypsum and clay layers. A basal silty clay was encountered in the monitoring well borings MW-37-01 and MW-37-03.

Groundwater occurs in a shallow unconfined aquifer beneath the site approximately 30 to 35 ft bgs in the sand and basal clay units. Water level elevations from November 1991 and the base-wide potentiometric surface map indicate that groundwater flows toward Lost River to the west at a rate between 4 and 56 ft/year. The hydraulic conductivity reported by Radian ranges from 4.88×10^{-3} to 5.33×10^{-3}.

3 ADDITIONAL INVESTIGATION ACTIVITIES

Previous sections of this Work Plan have reviewed the existing background information and environmental data obtained from historical environmental investigations performed at the 11 ERP sites located at HAFB, NM for this ACM Work Plan. Based on these previous evaluations, additional investigations are necessary to characterize the extent of the previously identified contaminant source areas for eight of these sites (OT-20, OT-32, OT-38, OT-45, SS-12, SS-18, RW-42, and OT-37). As previously discussed, two sites (SS-06 and OT-35) will be petitioned for NFA and due to its small size, the source area at OT-03 will be excavated without further characterization.

The ACM Work Plan will be implemented in two separate phases. The first phase involves additional investigations at eight sites to collect sufficient subsurface soil data to delineate the presumed source areas for these sites. Groundwater conditions in the vicinity of the presumed source areas will also be evaluated. Soil and groundwater data collected during the additional investigations will be utilized to support the completion of site-specific risk based evaluations for exposure pathways relative to current and future industrial/commercial workers and residents at each site. The site-specific field investigations are presented in Section 3.1 of this Work Plan. Section 3.2 summarizes the pre-investigation requirements. A detailed discussion regarding soil and groundwater sampling parameters and sampling methodology is presented in Section 3.3. The sample identification and investigation derived waste management procedures are discussed in Sections 3.4 and 3.5 respectively.

The second phase of the ACM Work Plan is to remove, through excavation and properly dispose of the source areas for the sites (refer to Section 4 of this Work Plan for the site specific procedures for source area excavation). Additionally a risk based evaluation will be conducted at Sites where contaminants are detected above groundwater standards (see Section 6.4 of this Work Plan)

3.1 Site Specific Field Investigations

This section describes the additional field sampling activities and rationale for performing the source area characterization for each of the eight sites requiring further investigation. The additional investigations and proposed sampling activities for each site are summarized in Table 3-1. Parameter selection for sample analyses is based on the types of waste or contaminants suspected to be found at each site and is designed to fill the data gaps that were identified in the previous investigations. Table 3-2 presents the analytical methods and the number of soil and groundwater samples to be collected at each site. The objectives of these additional investigations are to complete or improve characterization of the presumed source areas and to assess the current groundwater conditions for each site.

In general, these field activities consist of:

- DPT borehole drilling and subsurface soil sampling

- Surface soil sampling (0 to 2 ft bgs)
- Transect trenching and soil sampling (only at OT-20)
- Monitoring well installation and development
- Groundwater sampling (new and existing monitoring wells)
- Collect groundwater level measurements (new and existing monitoring wells)

During this investigation, the source areas will be mapped to scale with particular notation of the perimeter of the source area, ancillary structures, sampling locations, and existing monitoring wells and surveyed via Global Positioning System (GPS) methods. These site specific maps will show all buildings, roads, sidewalks, paved, and unpaved areas. Additionally all site maps will include a coordinate system (i.e., latitude/longitude) and the site boundaries.

3.1.1 OT-20 Sewage Lagoons Disposal Trenches

The objectives of the additional investigation at site OT-20 are to define the eastern extent of the three sewage grit disposal trenches, characterize the sewage grit for source removal, and evaluate the current groundwater conditions at the site. These objectives will be accomplished by trenching, surface and subsurface soil sampling, permanent monitoring well installation, and groundwater sampling.

3.1.1.1 Trenching

In order to determine the eastern extent of the three previously identified grit disposal trenches, a north-south trench will be dug parallel to the existing fence line located to the east of the site as shown in Figure 3-1. This investigative trench (2 ft wide by 4 ft deep) will extend approximately 150 ft along the eastern side of the fence. One soil sample will be collected at 1-ft bgs in line with the three grit burial trenches. A total of 3 soil samples will be collected from the trench; each sample will be analyzed by an offsite laboratory for VOCs, SVOCs, TPH (DRO/GRO/Oil Range Organics [ORO]), PCBs, organochlorine pesticides, chlorinated herbicides, and 8 RCRA metals.

At completion, the exploration trench will be backfilled with the excavated trench spoils. In the event that visible grit is encountered, the grit material will be segregated for offsite disposal when the three grit disposal pits are excavated. A lithologic/contaminant description of the trench will be recorded in the field logbook. It should be noted that if visible grit is encountered in the trench an additional trench will be dug further to the east to delineate the extent of the grit disposal trenches.

3.1.1.2 DPT Soil Borings

Nine DPT boreholes (OT20-DP-01 to OT20-DP-09) will be installed to define the boundaries of the grit disposal trenches (Figure 3-1). The estimated depth of the source area boreholes is 7 to

10 ft bgs. In order to determine the exact location of the grit disposal trenches it may be necessary to adjust some of proposed DPT soil boring locations during the field investigation. Two soil samples per boring will be collected and sent offsite for laboratory analysis as per the following criteria:

- One soil sample will be collected from 0 to 2 ft bgs
- A second soil sample will be collected from a location above the capillary fringe (4 to 7 ft bgs)

A total of 18 soil samples will be collected from the nine DPT boreholes; each sample will be analyzed by the laboratory for VOCs, SVOCs, TPH (DRO/GRO/ORO), PCBs, organochlorine pesticides, chlorinated herbicides, and 8 RCRA metals. In addition, two undisturbed geotechnical samples will be collected from one of the nine DPT boreholes for the site-specific risk based evaluation. These samples will be analyzed for moisture content, dry bulk density, specific gravity, and fractional organic carbon content.

3.1.1.3 Groundwater Monitoring Wells

One upgradient and two downgradient permanent monitoring wells will be installed at OT-20 using DPT drilling techniques to determine and quantify the presence or absence of groundwater contamination. The groundwater data collected during this investigation will also be utilized to support the completion of a risk based evaluation after the source area (grit disposal trenches) has been excavated. The monitoring well locations (OT20-MW-01 to OT20-MW-03) are shown on Figure 3-1. Based on the Holloman AFB base-wide potentiometric surface the groundwater flow direction is to the south-southeast. The depth to groundwater is approximately 5 to 8 ft; therefore the monitoring wells will be installed to a depth of approximately 10 to 15 ft bgs.

One round of groundwater samples will be collected from the new OT-20 monitoring wells. A total of three groundwater samples will be collected. Each sample will be analyzed by the laboratory for VOCs, SVOCs, PCBs, organochlorine pesticides, chlorinated herbicides, 8 RCRA metals, and TDS. In addition, a round of water levels will be collected to develop a map of the potentiometric surface.

3.1.2 OT-32 Collapsed Primate Research Area Sewer Lines

The objectives of the additional investigation at site OT-32 are to determine if historical sewer line collapses in the vicinity of the former Primate Research Area have impacted the subsurface soil and to evaluate the current groundwater conditions along the sewer line. These objectives will be accomplished by subsurface soil sampling, temporary monitoring well installation, and groundwater sampling.

3.1.2.1 DPT Soil Borings

Twelve DPT boreholes (OT32-DP-01 to OT32-DP-12) will be drilled along the sewer line that connects with the former Primate Research Institute (Buildings 1200 through 1208). Subsurface

soil samples will be collected from these boreholes to determine if there was a release to the subsurface due collapsed/corroded segments of sewer line. Breaches in the sewer line leading from the former Primate Research Area were identified in the *IRP Records Search* (CH_2M Hill, 1983) and from discussions with current HAFB employees. As discussed in Section 2.3.2, Dames & Moore investigated a section of sewer line located approximately 1.5 miles southwest of this location during the Phase II - Stage 1 study (1984) and found no significant contamination (probably because the site location had been mislocated).

The 12 DPT boreholes will be installed in approximately 250 ft intervals along 3,000 ft of sewer line that is directly connected to the former Primate Research Institute. These segments of sewer line include the east-west and north-south trending lines as shown in Figure 3-2. The anticipated depth of the borings is 25 to 35 ft bgs. In order to define source areas (location(s) of the corroded and collapsed sewer line) it may be necessary to install additional DPT soil borings if subsurface contamination is observed during the investigation. Two soil samples per boring will be collected and sent for offsite laboratory analysis based upon the results of headspace screening and/or other observations such as staining or odor. If the screening techniques do not indicate a clear selection for analysis, then the samples will be collected from immediately above the groundwater table (approximately 30 ft bgs) and from the mid depth of the borehole (approximately 15 ft bgs).

A total of 24 subsurface soil samples will be collected from the 12 DPT boreholes. Each soil sample will be analyzed by the laboratory for VOCs, SVOCs, TPH (DRO/GRO/ORO), TAL metals, and tritium. Due to the short half-life of Iodine-125 (60 days) and that carbon-14 is naturally occurring and is not a carcinogen, iodine-125 and carbon-14 are not considered chemicals of potential concern for the OT-32 additional investigation. Additionally, two undisturbed geotechnical samples will be collected from 1 of the 12 DPT boreholes for the site-specific risk based evaluation. These samples will be analyzed for moisture content, dry bulk density, specific gravity, and fractional organic carbon content.

3.1.2.2 Groundwater Monitoring Wells

Each of the 12 DPT soil boreholes (OT32-DP-01 to OT32-DP-12) will be converted into temporary groundwater monitoring wells (OT32-MW-01 to OT32-MW-12) to determine if the corroded/collapsed sewer lines have impacted the groundwater quality (Figure 3-2). The groundwater data collected during this investigation will also be utilized to support the completion of a risk based evaluation. The depth to groundwater is approximately 25 to 30 ft bgs; therefore the temporary monitoring wells will be installed to a depth of 25 to 35 ft bgs. One round of groundwater samples will be collected from the OT-32 temporary monitoring wells. A total of 12 groundwater samples will be collected. Each sample will be analyzed by the laboratory for VOCs, SVOCs, TAL metals, tritium, and TDS. Additionally, a round of water levels will be measured to develop a potentiometric surface map.

3.1.3 OT-38 Building 1166 Test Sled Maintenance Area

The objectives of the additional investigation at site OT-38 are to characterize the subsurface soil around the former cesspool/existing drain field leach pipe and to determine the current

groundwater conditions at the site. These objectives will be accomplished by subsurface soil sampling and sampling the existing groundwater monitoring well network.

3.1.3.1 DPT Soil Borings

Six DPT boreholes (OT38-DP-01 to OT38-DP-06) will be drilled during this investigation as shown in Figure 3-3. Three of the boreholes will be installed around the perimeter of the existing septic tank to determine if there was a release to the subsurface from the former cesspool (source area). Three soil samples will be collected from each of the cesspool characterization boreholes based upon the results of headspace screening and/or other observations such as staining or odor. If the screening techniques do not indicate a clear selection for analysis the three samples will be collected at 5-ft, 10-ft, and above the capillary fringe (approximately 18 ft bgs).

The three remaining boreholes will be installed along the length of the drain field leach pipe (approximately 150 ft long) to characterize potential contamination from the leach pipe that was installed in the late 1980s. The three leach pipe characterization boreholes will be installed every 50 feet along the pipe and 2 soil samples will be collected from each borehole at approximately 3 to 5 ft and 8 to 10 ft bgs, or from intervals with visible staining.

A total of 15 subsurface soil samples will be collected from the 6 DPT boreholes. Each soil sample will be analyzed by an offsite laboratory for VOCs, SVOCs, TPH (DRO/GRO/ORO), PCBs, and 8 RCRA metals. Two undisturbed geotechnical samples will be collected from one of the six DPT boreholes for the site-specific risk based evaluation. These samples will be analyzed for moisture content, dry bulk density, specific gravity, and fractional organic carbon content.

3.1.3.2 Groundwater Monitoring Wells

One round of groundwater samples will be collected from the previously installed monitoring wells (MW-38-01 through MW-38-03) to characterize the current groundwater quality at the site. The locations of the three existing monitoring wells are shown on Figure 3-3. The groundwater data collected during this investigation will also be utilized to support the completion of a risk based evaluation after the source area (former cesspool area) has been excavated. A total of three groundwater samples will be collected. Each sample will be analyzed by the laboratory for VOCs, SVOCs, PCBs, perchlorates, 8 RCRA metals, and TDS. In addition, a round of water levels will be collected to develop a current potentiometric surface map.

3.1.4 OT-45 Old AGE Refueling Station

The objectives of the additional investigation at site OT-45 are to delineate the remaining PCS for source area removal and to evaluate the current groundwater conditions. These objectives will be accomplished by subsurface soil sampling and sampling the existing groundwater monitoring well network.

3.1.4.1 DPT Soil Borings

Fifteen DPT boreholes (OT45-DP-01 to OT45-DP-15) will be drilled during this investigation. The boreholes will be installed in a grid pattern around the northeastern perimeter of the 1991 OT-45 PCS excavation including the area where the former USTs, pump island, and fuel station were located as shown in Figure 3-4. In order to determine the precise location of the remaining PCS it may be necessary to adjust some of proposed DPT soil boring locations during the field investigation. The boreholes will be drilled to approximately 5 ft bgs. One soil sample will be collected in each borehole and sent offsite for laboratory analysis based upon the results of headspace screening and/or other observations such as staining or odor. If the screening techniques do not indicate a clear selection for analysis, then the sample will be collected from immediately above the groundwater table (approximately 4.5 ft bgs). Each soil sample (15 total) will be analyzed by the laboratory for VOCs, SVOCs, and TPH (DRO/GRO/ORO). Two undisturbed geotechnical samples will be collected from one of the 15 DPT boreholes for the site-specific risk based evaluation. These samples will be analyzed for moisture content, dry bulk density, specific gravity, and fractional organic carbon content.

3.1.4.2 Groundwater Monitoring Wells

One round of groundwater samples will be collected from the previously installed monitoring wells (MW1, MW3, MW4, MW5, and MW7) to characterize the current groundwater quality at the site. The locations of the five existing monitoring wells are shown on Figure 3-4. The groundwater data collected during this investigation will also be utilized to support the completion of a risk based evaluation after the source area (remaining PCS) has been excavated. A total of five groundwater samples will be collected; each sample will be analyzed by the laboratory for VOCs, SVOCs, and TDS. In addition, a round of water levels will be measured to develop a potentiometric surface map.

3.1.5 SS-12 Northeast Fuel Line Spill Site

The objectives of the additional investigation at site SS-12 are to delineate a potential PCS source area and to evaluate the current groundwater conditions. These objectives will be accomplished by subsurface soil sampling and sampling the existing groundwater monitoring well network.

3.1.5.1 DPT Soil Borings

Fifteen DPT boreholes (SS12-DP-01 to SS12-DP-15) will be drilled during this investigation. In order to delineate the PCS source area associated with the ruptured JP-4 fuel line, boreholes will be drilled along the storm sewer drainage ditch and the JP-4 fuel pipeline as shown in Figure 3-5. The boreholes will be drilled to approximately 5 to 7 ft bgs. One soil sample will be collected from each borehole and sent offsite for laboratory analysis based upon the results of headspace screening and/or other observations such as staining or odor. If the screening techniques do not indicate a clear selection for analysis, then the sample will be collected from immediately above the groundwater table (approximately 5 ft bgs). Each soil sample (15 total) will be analyzed by the laboratory for VOCs, SVOCs, TPH (DRO/GRO/ORO), and 8 RCRA

metals. Two undisturbed geotechnical samples will be collected from one of the 15 DPT boreholes for the site-specific risk based evaluation. These samples will be analyzed for moisture content, dry bulk density, specific gravity, and fractional organic carbon content.

It may be necessary to adjust some of proposed DPT soil boring locations during the field investigation to accurately define the extent of PCS.

3.1.5.2 Groundwater Monitoring Wells

One round of groundwater samples will be collected from the previously installed monitoring wells (WL-12-01 through WL-12-03) to characterize the current groundwater quality at the site. The locations of the three existing monitoring wells are shown on Figure 3-5. The groundwater data collected during this investigation will also be utilized to support the completion of a risk based evaluation after the source area (PCS) has been excavated. A total of three groundwater samples will be collected; each sample will be analyzed by the laboratory for VOCs, SVOCs, 8 RCRA metals, and TDS. Additionally, a round of water levels will be collected to develop a map of the potentiometric surface.

3.1.6 SS-18 Chromic Acid Spill Area

The objectives of the additional SS-18 investigation are to delineate a potential chromium contaminated soil source area and to evaluate the current groundwater conditions. These objectives will be accomplished by subsurface soil sampling and sampling the new and existing groundwater monitoring wells.

3.1.6.1 DPT Soil Borings

Three DPT boreholes (SS18-DP-01 to SS18-DP-03) will be advanced along the south side of Building 281 to verify the location of the chromic acid spill that was identified in the *IRP Records Search* (CH_2M Hill, 1993). The *IRP Records Search* and interviews with long time employees indicated that the 500 gallon spill occurred along the south side of the building where the chrome plating shop was located. As discussed in Section 2.9.2 of this Work Plan, Dames & Moore investigated the northwest corner of Building 281 during the Phase II - Stage 1 study in 1984 and found no significant chromium contamination.

The three borings in the suspected source area will be advanced to approximately 10 ft bgs. In addition, three boreholes (SS18-DP-04 to SS18-DP-06) will be drilled and converted into permanent groundwater monitoring wells (one upgradient and two downgradient). The depth of the monitoring well boreholes is anticipated to be 15 ft bgs. The locations for the three source area and three monitoring well boreholes are shown on Figure 3-6. One soil sample will be collected from each borehole and sent offsite for laboratory analysis. If there is no evidence of visible yellow staining (due to chromium), the soil samples will be collected from the capillary fringe just above the groundwater table (approximately 5 ft bgs). The six subsurface soil samples will be analyzed by the offsite laboratory for VOCs, SVOCs, TPH (DRO/GRO/ORO), TAL metals, and hexavalent chromium (CrVI). Two undisturbed geotechnical samples will be

collected from one upgradient monitoring well borehole for the site-specific risk based evaluation. These samples will be analyzed for moisture content, dry bulk density, specific gravity, and fractional organic carbon content.

It may be necessary to adjust some of the proposed DPT soil boring locations during the field investigation to accurately define the extent of chromium contamination.

3.1.6.2 Groundwater Monitoring Wells

One round of groundwater samples will be collected from the previously installed monitoring well (18W1) and the three new permanent wells (SS18-MW-02 to SS18-MW-04) to determine if there was a release and to characterize the current groundwater quality at the site. The locations of the existing and three new monitoring wells are shown on Figure 3-6. The groundwater data collected during this investigation will also be utilized to support the completion of a risk based evaluation after the source area (chromium contaminated soil) has been excavated. A total of four groundwater samples will be collected; each sample will be analyzed by the laboratory for VOCs, SVOCs, TAL metals, and TDS. In addition, a round of water levels will be collected to develop a map of the potentiometric surface.

3.1.7 RW-42 Radioactive Waste Burial Site

The objectives of the additional investigation at RW-42 are to determine if a hazardous/low level radioactive waste source area exists and evaluate the current groundwater conditions. These objectives will be accomplished by subsurface soil sampling, permanent monitoring well installation, and groundwater sampling.

3.1.7.1 DPT Soil Borings

Four DPT boreholes (RW42-DP-01 to RW42-DP-04) will be advanced around the 3-ft by 3-ft concrete cover that indicates the location of the vertically buried concrete cylinder that reportedly contains animal carcasses (primates) that were injected with low-level radioactive tracers (e.g. tritium, iodine-125, and carbon-14) from aerospace experimentation. Based on the Site RW-42 Preliminary Assessment (Radian, 1992) the cylinder is 10 ft in length, and 5.5 ft in diameter with an opening 8 ft long and 1.5 ft in diameter. The cylinder is buried approximately 2 to 4 ft bgs. The source area boreholes will be drilled to 24 ft bgs and the proposed locations are shown on Figure 3-7. Three soil samples will be collected per borehole and sent offsite for laboratory analysis. The sample collection intervals will be based on the results of field radiation screening and/or headspace screening (organic vapor analyzer [OVA]). If the screening techniques do not indicate a clear selection for analysis, the samples will be collected from the 8 to 10 ft, 14 to 16 ft, and 22 to 24 ft bgs intervals. The 12 subsurface soil samples will be analyzed by the offsite laboratory for VOCs, SVOCs, TPH (DRO/GRO/ORO), TAL metals, and tritium. Due to the short half-life of Iodine-125 (60 days) and that carbon-14 is naturally occurring and is not a carcinogen, iodine-125 and carbon-14 are not considered chemicals of potential concern for the RW-42 additional investigation.

3.1.7.2 Groundwater Monitoring Wells

One upgradient and two downgradient permanent monitoring wells will be installed at RW-42 using DPT drilling techniques to determine and quantify the presence or absence of groundwater contamination. The groundwater data collected during this investigation will also be utilized to support the completion of a risk based evaluation. The proposed monitoring well locations (RW42-MW-01 to RW42-MW-03) are shown on Figure 3-7. Additionally, two undisturbed geotechnical samples will be collected from the upgradient monitoring well borehole for the site-specific risk based evaluation. These samples will be analyzed for moisture content, dry bulk density, specific gravity, and fractional organic carbon content. Based on the regional potentiometric surface maps the groundwater flow direction is to the south-southwest. The depth to groundwater is approximately 45 ft, therefore the monitoring wells will be installed to a depth of approximately 50 ft bgs.

One round of groundwater samples will be collected from the new RW-42 monitoring wells. A total of three groundwater samples will be collected; each sample will be analyzed by the laboratory for VOCs, SVOCs, TAL metals, tritium, and TDS. In addition, a round of water levels will be collected to develop a current potentiometric surface map.

3.1.8 OT-37 Early Missile Testing Site

The first objective of the additional site OT-37 investigation is to define the extent of the PCB petroleum contaminated soil associated with each of the four former transformers, for source removal. The second objective is to evaluate the current subsurface conditions (soil and groundwater) at each of the three vertical launch pads and the inclined test track. These objectives will be accomplished by, subsurface soil sampling, monitoring well installation, and groundwater sampling. An OT-37 site map showing the locations of the four transformers, three vertical launch pads, and the inclined vertical test track is presented on Figure 3-8.

3.1.8.3 Transformer Stations

A total of eight shallow DPT boreholes (OT37-DP-01 through OT37-DP-08) will be installed around the perimeter of the four concrete transformer pads (two per pad). Approximate locations for the eight shallow transformer borings are presented on Figures 3-9 through 3-12. The estimated depth of the transformer pad boreholes is 8 to 10 ft bgs. One surface soil (0 to 2 ft bgs) and one subsurface soil sample will be collected from each borehole and sent for laboratory analysis. The sampling interval for the subsurface soil sample will be determined by the results of the headspace screening and/or other observations such as staining or odor. Continuous OVA headspace readings will be collected during each soil boring. If screening techniques do not indicate a clear selection for analysis, the subsurface soil sample will be collected from the 8 to 10 ft bgs interval.

A maximum of 16 soil samples will be collected from the eight transformer pad DPT boreholes; each sample will be analyzed by the laboratory for TPH (DRO/GRO/ORO) and PCBs.

3.1.8.4 Vertical Launch Pad Facilities and Inclined Test Track

A total of eight deep DPT boreholes (OT37-DP-9 through OT37-DP-16 will be installed at each of the three vertical launch pads and inclined test track (adjacent to the fuel staging area) or two boreholes per facility. Approximate locations for the eight deep launch pad facility borings are presented on Figures 3-9 through 3-12. The estimated depth of these boreholes is 30 to 40 ft bgs. Continuous OVA headspace readings will be collected during each soil boring. Two soil samples per borehole will be collected from each borehole and sent offsite for laboratory analysis. If there are no elevated headspace headings or visual evidence of contamination the two samples will be collected using the following criteria:

- One soil sample will be collected mid depth (12 to 17 ft bgs)
- A second sample from a location above the capillary fringe (27 to 32 ft bgs)

A total of 16 subsurface soil samples will be collected from the eight DPT boreholes; each sample will be analyzed for VOCs, SVOCs, TPH (DRO/GRO/ORO), PCBs, 8 RCRA metals, and perchlorates.

Four of the DPT boreholes (one per facility) will be converted into monitoring wells (OT37-MW-07 through OT37-MW-10). The selection of which boreholes that will be converted into monitoring wells will be determined in the field based on elevated headspace readings and/or visual contamination. In the event that there is no evidence of contamination the most downgradient well at each launch pad facility will be selected for monitoring well conversion. Additionally, two undisturbed geotechnical samples will be collected from one of the two monitoring well boreholes installed at the Central Vertical Launch Pad for the site-specific risk based evaluation. These samples will be analyzed for moisture content, dry bulk density, specific gravity, and fractional organic carbon content.

One round of groundwater samples will be collected from the six previously installed monitoring wells (MW-37-01 through MW-37-06) and the four new wells (OT37-MW-07 through OT37-MW-10) to determine if the launch pad facilities and former transformers have impacted the groundwater quality. Proposed and previous installed wells are shown on Figures 3-9 through 3-12. The groundwater data collected during this investigation will also be used to the completion of a site specific risk based evaluation. A total of 10 groundwater samples will be collected; each sample will be analyzed by the laboratory for VOCs, SVOCs, PCBs, 8 RCRA metals, perchlorates, and TDS. Additionally, a round of water levels will be collected to develop a potentiometric surface map.

3.2 Pre-investigation Requirements

Before site-specific activities can begin, there are several pre-investigation documents and approval requirements to be met, including Air Force Form (AF Fm) 332 approval, Base dig permit(s) with utility clearances, site security measures, and facility manager notification of the intended operations. Bhate will coordinate project requests for Base installation support services through the 49th Civil Engineering Squadron/Environmental Flight (CES/CEV). Pertinent to the

start of activities, a pre-construction meeting and site walk-through will be conducted with the USACE Resident Engineer, HAFB personnel, and Bhate Site Manager, to inspect site-specific conditions for equipment access, equipment staging, and decontamination area(s), potential site hazards, and emergency evacuation routes. Also reviewed at this time will be project procedures in accordance with the schedule and planned activities.

3.2.1 AF Form 332

Prior to initiating the additional characterization activities, a completed and approved AF Fm 332 will be obtained. This form authorizes construction work at HAFB and is required for the initiation of any subsurface investigative work. This work order describes what activities will take place at the location.

3.2.2 Dig Permit/Utility Clearances

Prior to the submittal of the dig permit(s) (AF Fm 103), the drilling locations (and trenching location at OT-20) will be clearly delineated with marker flags, stakes, or paint, as appropriate to the surface material. Utility clearance approvals will be completed by the appropriate HAFB utility office (e.g., telephone, sewer, water, natural gas etc.). Upon receipt of the approved dig permit (AF Fm 103) with the utility clearances, the Bhate Site Manager or other authorized project personnel will complete a site walk-through confirming the dig permit authorizations and make any required changes.

3.2.3 Site Security

Site security is concerned with safety at the site(s) during all drilling and investigative trenching activities and will be addressed as outlined in the *Basewide Health and Safety Plan* (HASP) (Bhate, 2003b). At a minimum the exclusion zone will be secured with caution tape, and traffic cones surrounding the perimeter of the site. The size of the exclusion zone will be determined by the size of the drilling and support equipment, and the prevailing site conditions. Open boreholes will not be left unattended without first securing the immediate area surrounding the borehole, and covering the opening so that it does not become a hazard.

3.3 Investigation Requirements

Field activities will be performed in accordance with the Site-Specific Addendum to the Basewide Health and Safety Plan, the Quality Assurance Project Plan (QAPP) Addendum (Appendices B and C of this Work Plan, respectively), as well as other USACE mandated procedures for laboratories and activities such as groundwater sampling. The field work for these additional investigations will be conducted in accordance with HAFB Standard Operating Procedures (SOPs) provided in the *Basewide Quality Assurance Project Plan* (Bhate, 2003a) and the *Bhate Standard Operating Procedures* (Bhate, 2002). These SOPs outline methodologies for soil boring advancement, soil sampling, soil sample description, field screening, sample management, equipment decontamination, and chain-of-custody procedures. Bound copies of the *Basewide Quality Assurance Project Plan* (Bhate, 2003a) and the *Bhate Standard Operating*

Procedures (Bhate, 2002) are kept at the Bhate Field Office, Holloman AFB, NM. Sample nomenclature will follow the Environmental Restoration Program Information Management System (ERPIMS) format for the ERPIMS submittal. The specific HAFB SOPs for this sampling event are listed below:

HAFB SOP-1 Documentation, Sample Handling, Chain-of Custody, and Shipping

HAFB SOP-2 Sampling Equipment Documentation

HAFB SOP-3 Staking, Utility Clearance, and Permitting

HAFB SOP-4 Direct Push Sampling for Soil and Groundwater

HAFB SOP-5 Soil Sampling for Chemical Analysis

HAFB SOP-6 Procedure for Field Screening of Volatile Organics

HAFB SOP-7 Lithologic Description and Geotechnical Sampling

HAFB SOP-8 Groundwater Sampling for Chemical Analysis

HAFB SOP-9 Field Management of Investigation-Derived Waste

HAFB SOP-10 Borehole Abandonment and Site Restoration

The following sections describe the procedures for laboratory analytical methods, DPT subsurface soil sampling, and monitoring well installation to be performed at the eight sites (OT-20, OT-32, OT-38, OT-45, SS-12, SS-18, RW-42, and OT-37) requiring additional characterization.

3.3.1 Laboratory Analytical Methods

The chemical analysis of soil and groundwater samples collected for these additional site investigations will follow the USEPA SW-846 protocol. The site-specific analytical requirements for soil and groundwater samples are summarized in Table 3-2. Additionally, the analytical preparation methods are summarized on Table 3-2 in the QAPP Addendum (see Appendix C of this Work Plan). The soil and groundwater samples will be analyzed as follows:

- VOCs by USEPA Method 8260B (soil and groundwater at all sites)
- SVOCs by USEPA Method 8270C (soil and groundwater at all sites)
- TPH (GRO, DRO, ORO) by modified USEPA Method 8015M (Soil at all sites)
- Organochlorine Pesticides by USEPA Method 8081A (soil and groundwater at site OT-20)

- Chlorinated Herbicides by USEPA Method 8151A (soil and groundwater at site OT-20)
- PCBs by USEPA Method 8082 (soil and groundwater at sites OT-20, OT-37, and OT-38)
- Perchlorate by USEPA Method 6860 (soil and groundwater at site OT-37 and groundwater at site OT-38)
- Tritium by modified USEPA Method 906.0M (soil and groundwater at sites OT-32 and RW-42)
- 8 RCRA Metals (arsenic, barium, chromium, cadmium, lead, mercury, selenium, and silver) by USEPA Method 6010B/7470A/7471A (soil and groundwater at sites OT-20, OT-37, OT-38, and SS-12)
- TAL Metals by USEPA Method 6010B/7470A/7471A (soil and groundwater at sites OT-32, SS-18, and RW-42)
- Hexavalent Chromium by USEPA Method 7196A (soil at site SS-18)
- TDS by USEPA Method 160.1 (groundwater at all sites)

Samples selected for laboratory analysis will be labeled, handled, and prepared for shipment in accordance with HAFB SOP-1. The detection reporting limits for all analytical parameters and the quality assurance sampling requirements (trip blanks, duplicates, and matrix spike/matrix spike duplicates [MS/MSD]) are summarized in the QAPP Addendum (see Appendix C of this Work Plan). Each cooler containing samples for VOC analysis will require a trip blank. The samples will be placed on ice and shipped under strict chain-of-custody to Severn Trent Laboratories in Denver, Colorado. Residual soil from the soil sampling will be discarded in accordance with the waste management procedures established in Section 3.5 of this Work Plan, Investigation-Derived Waste (IDW) Management.

3.3.2 DPT Soil Sampling

Soil samples will be collected continuously from soil borings using DPT methodology in accordance with HAFB SOP No. 4. The DPT soil sampler is a stainless steel tube that contains an inner acetate sleeve. Each boring will be visually classified and lithology described in the field according to HAFB SOP No. 7 and the Unified Soil Classification System (USCS) (American Society for Testing and Materials [ASTM] D 2487-92 and ASTM D 2488-90). The specific locations of the borings may be modified based on site-specific (access, any observed or underground utilities, etc.) field conditions.

Subsurface soil samples will be collected continuously at four foot intervals. Soils will be field screened in accordance with HAFB SOP No. 6 (*Procedure for Field Screening of Volatile Organics)* using an OVA equipped with a flame ionization detector (FID) or a photoionization detector (PID) to access the qualitative concentrations of VOCs present in soil samples at 2-foot

intervals. Refer to the manufacture's operating instructions for proper use and specific calibration procedures. Field radiation screening will be conducted at each of the boreholes drilled at RW-42. Notation will also be made of any visual (discoloration) and/or aromatic observations that are indicative of potential contamination. The soil samples selected for chemical analysis will be collected as discrete (grab) samples. The site-specific analytical requirements for subsurface soil samples are summarized in Table 3-2.

A qualified surveyor will locate the DPT boreholes using a GPS. All horizontal coordinates will be referenced to the State Plane Coordinate System, New Mexico Central and surveyed to an accuracy of +/- 1.0 ft.

3.3.2.1 Geotechnical Soil Sampling

Two undisturbed geotechnical samples will be collected from each of the eight sites requiring additional investigation. The geotechnical data will be utilized for the site specific risk based evaluations that will be included in the site closure reports. The soil samples will be collected from borings that have not been impacted by contaminated source areas, therefore these boring/geotechnical sampling locations will be determined during the additional investigation. The undisturbed soil samples (two per borehole) will be collected from 0 to 1 ft bgs and at a depth above the water table where the lithology is representative of the site. To ensure that these samples have not been impacted, OVA readings for soil collected from this zone should not be above background. The geotechnical soil samples collected during this investigation will be analyzed as follows:

- Moisture Content by USEPA Method 160.3M
- Dry Bulk Density by ASTM Method D2937
- Specific Gravity by ASTM Method D1429
- Fractional Organic Carbon Content by ASTM Method D2974

The soil samples for geotechnical analysis will be collected in a thin-walled tube sampler, the tube ends will be capped and the top and bottom ends of the tube labeled. The soil core samples will be shipped to Severn Trent Laboratories in Denver, Colorado for analysis. The soil samples which will be submitted for geotechnical analysis are also summarized in Table 3-2.

3.3.3 Monitoring Well Installation and Development

A total of 21 additional groundwater monitoring wells will be installed as part of the additional characterization activities at sites OT-20 (3 permanent wells), OT-32 (12 temporary wells), SS-18 (3 permanent wells), and RW-42 (3 permanent wells). The site-specific locations and approximate well depths for these new wells were presented in Section 3.1 of this Work Plan.

The 21 new monitoring wells will be constructed using DPT drilling techniques. A geologist or geological engineer will log each borehole. Based upon the site-specific depth to groundwater,

each monitoring well will extend to a minimum depth of 5 feet below the water table and be completed with 10 feet of 1-inch diameter 0.010 or 0.020 inch slotted PVC screen. The remaining borehole casing will be comprised of flush threaded 1-inch PVC casing. The annular space surrounding the screen will be backfilled with 10/20 Colorado silica sand capped with at least 2 feet of bentonite pellets. The remaining annular space will be backfilled with neat cement. The permanent monitoring wells at sites OT-20, SS-18, and RW-42 will be installed as aboveground well completions. The surface completion will consist of a lockable and tamper proof 6-inch diameter steel cover, concrete pad (3 feet square), and four bumper posts.

The completed wells will be developed to remove fine particulates and improve hydraulic communication with the surrounding saturated material. After completion, the wells will be allowed to stabilize for 24 hours before development is initiated. All permanent and temporary monitoring wells will be developed in accordance with Bhate SOP No. 10 (*Subsurface Water Investigation*), Section 3, Well Development. Monitoring well development will take place by over-pumping each well until at least five well volumes have been removed, and the turbidity, pH, specific conductivity, and temperature have stabilized by +/- 10 percent for at least three consecutive readings.

3.3.4 Monitoring Well Groundwater Sampling

Thirty-three new and existing monitoring wells will be sampled as part of the additional characterization activities at sites OT-20 (3 new permanent wells), OT-32 (12 new temporary wells), OT-38 (3 existing wells), OT-45 (5 existing wells), SS-12 (3 existing wells), SS-18 (1 existing and 3 new permanent wells), and RW-42 (3 new permanent wells). Groundwater samples will be collected in accordance with Bhate SOP No. 10 (*Subsurface Water Investigation*) Section 4, Monitoring Well Sampling. A minimum of 48 hours will elapse between well development and sampling. Groundwater samples will be labeled, handled, and prepared for shipment in accordance with HAFB SOP-1. The site-specific analytical requirements for the groundwater samples collected during this sampling event are summarized Table 3-2. Following sampling, the 12 temporary monitoring wells installed at OT-32 will be completely removed from the ground and the borehole will be sealed in accordance with HAFB SOP-10.

3.3.4.1 Surveying

A registered New Mexico Surveyor will survey the 33 new and existing monitoring well locations at sites OT-20, OT-32, OT-38, OT-45, SS-12, SS-18, and RW-42 in accordance with methods described in the Basewide QAPP (Bhate, 2003a). Horizontal locations will be relative to the State Plane Coordinate System, New Mexico Central and surveyed to an accuracy of +/- 1.0 ft. Vertical elevations will be referenced to the North American Datum (NAD) 1983. The top of casing (vertical control) will be used to determine the depth and elevation of the groundwater and surveyed to an accuracy of +/-0.01 ft. During the investigation, each site and source area will be mapped to scale showing ancillary structures, sampling locations, buildings, roads, sidewalks, and paved and unpaved areas. Additionally, all maps will include a coordinate system (e.g., latitude and longitude) and the site boundaries.

3.3.4.2 Groundwater Elevations

During the sampling of monitoring wells under this Work Plan, groundwater elevations will be measured. Elevations will be measured for the 33 new and existing wells at sites OT-20, OT-32, OT-38, OT-45, SS-12, SS-18, and RW-42. The static water level for each well will be measured using a decontaminated electronic water level probe as per Bhate SOP No. 10, *Subsurface Water Investigation*, Section 2, Fluid Level Measurement and Recording. A current site-specific potentiometric surface map will be developed from the groundwater elevation data collected during these investigations.

3.4 Sample Identification System

Each environmental sample collected will be identified on the sample label and chain-of-custody (COC) records, regardless of type. Sample documentation, handling, and shipping will be in accordance with HAFB SOP-1. Table 3-3 provides the sample collection information inclusive of the container type and quantity for the soil and groundwater samples collected during the additional investigations at sites OT-20, OT-32, OT-38, OT-45, SS-12, SS-18, and RW-42. The field duplicate samples will appear in sequence with the regular samples. An example of the sample identification nomenclature for soil samples collected from DPT boreholes will be as follows:

SS18-DP01-5-a

Site alpha-numeric identifier: SS18 = Chromic Acid Spill Site 18

Sample type identifier: DP = direct push boring

Sequential direct push boring number: 01, 02, etc.

Ending depth of sample interval: 5

Reserved for quality assurance (QA) sample identifiers: a = field duplicate, TB = trip blank, MS = matrix spike, MSD = matrix spike duplicate

An example of the sample identification nomenclature for groundwater samples collected from monitoring wells will be as follows:

SS18-MW01-a

Site alpha-numeric identifier: SS18 = Chromic Acid Spill Site 18

Sample type identifier: MW = monitoring well

Monitoring well number: 01, 02, etc.

Reserved for QA sample identifiers: a = field duplicate, TB = trip blank, MS = matrix spike, MSD = matrix spike duplicate

3.5 Investigation-Derived Waste Management

IDW will be managed and characterized according to HAFB SOP-9. Whenever possible, waste minimization techniques will be used to reduce the amount of IDW. IDW generated by installing the new monitoring wells and subsequent groundwater sampling activities will be managed and characterized according to the guidelines outlined below. The DPT drilling

technique does not generate cuttings. Left over soil from the sample tubes will be screened with an OVA for the presence of organic vapors. If the soil is free of organic vapors, it will be spread on the ground surrounding the well. If OVA screening of the soil indicates the presence of organic vapors, the soil will be placed in the FT-31 land farm at HAFB. Purged groundwater from development and sampling activities will be collected in a 1,000 gallon portable tank and managed by Bhate. At the conclusion of sampling activities the water within the tank will be sampled for VOCs, SVOCs, TAL metals, PCBs, pesticides, herbicides, tritium, and perchlorate. The analytical results will be compared to the HAFB Wastewater Treatment Plant (WWTP) pretreatment standards. If all of the results are less than the pretreatment standards, the purge water will be discharged to the HAFB sanitary sewer system. If any of the results are above the WWTP pretreatment standards, the purge water will shipped offsite for compliant disposal. Other liquid wastes, such as decontamination rinses, are anticipated to be non-hazardous and as such, can be disposed of through the HAFB WWTP. Personal protective equipment (PPE) and other site non-hazardous debris/waste shall be disposed of in standard trash receptacles.

3.5.1 General Decontamination Procedures

Small equipment, such as sampling tools, will be decontaminated in accordance with HAFB SOP-2. Heavy equipment such as the Trackhoe (for the OT-20 investigation) and DPT rig will be decontaminated by steam cleaning at a temporary decontamination pad set up at each site. The containers and decontamination pad will be managed in a secure area and the decontamination water will be either allowed to evaporate or combined with the purged groundwater and discharged to the HAFB WWTP. Sediment remaining in the decontamination pad area after the water has either evaporated or been discharged to the WWTP, will be combined with the soil to be remediated in the onsite land farm or spread on the ground.

3.5.2 Personal Protective Equipment

Prior to disposal, used PPE, disposable items, and the decontamination pad liner will be rinsed clean with tap water and diluted detergent solution. Cleaned PPE and presumed clean, based upon non-contact with contaminated soils, water, or equipment, and other disposable clean items will be contained in trash bags and disposed of at the applicable onsite sanitary waste receptacle.

3.6 Site Restoration

Upon completion of the site inspection activities, the site will be restored to the original condition. Sampling locations will have been backfilled or grouted to the surface. The site will be canvassed for trash, debris, etc.

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4 EXCAVATION PROCEDURES

This section presents the procedures for excavating source areas at sites OT-03, OT-20, OT-37, and OT-45. Similar steps will be taken at sites OT-32, OT-38, SS-12, SS-18, and RW-42 if the results of the planned additional investigations indicate that excavation and removal of contaminated soil is required. In the event that source area removal is required at these five sites, an addendum to this ACM Work Plan will be submitted to NMED for approval prior to excavation. With the exception of OT-32, these sites were investigated in the past but require additional investigation to confirm that a source of contamination exists and to delineate its size. Based on the review of the available data, it was determined that:

- The PCS source area at OT-03 has been sufficiently characterized to support excavation and treatment of the contaminated soil.
- The previous confirmation sampling at OT-45 indicated an area of remaining PCS where the former USTs, pump island, and fuel station were located. Additional subsurface soil sampling is planned to delineate its size for excavation.
- Sites OT-37, OT-38, and SS-12 are the other PCS sites.
- The previous investigations at SS-06 and OT-35 did not find a source of contamination. Therefore, HAFB will submit a Statement of Basis requesting NFA for these sites.
- The previous investigations at sites OT-32, OT-38, SS-12, SS-18, and RW-42 were not conclusive regarding a source of contamination and additional assessment tasks are planned to confirm the presence of a source and its size.
- The chemicals of potential concern at OT-20, OT-32, SS-18, and RW-42 include pesticides, metals (chromium), PCBs, and tritium. If remediation is required at these sites, the excavations would follow the guidelines described herein with the only significant difference being that the overburden will be assumed to be contaminated and disposal would be at an off-site facility.

Subsurface soils either contaminated by TPH at levels exceeding 800 mg/kg (TPH screening guideline for an unknown oil, NMED, 2006) or soils posing a risk due to exposures to VOCs, SVOCs, PCBs, and/or metals as established by the NMED soil screening guidance (NMED, 2006) will be removed. Contaminated soils will be removed to approximately one foot below the site's encountered groundwater table. This depth will ensure complete removal of PCS and account for any potential smear zone. Horizontally, the excavation will be completed based upon TPH levels of greater than 800 mg/kg (and/or other contaminants based on NMED SSLs) as determined by soil samples collected subsequent to the excavation and analyzed at a fixed-base laboratory. Planned excavations, inclusive of the temporary clean soil stock piles and the total areas of disturbance are expected to be less than one acre; therefore a project Storm Water Pollution Prevention Plan (SWPPP) will not be required.

Except where noted below, the excavation activities will be conducted in accordance with the procedures outlined in Unified Facilities Guide Specifications (UFGS) Section 02111 *Excavation and Handling of Contaminated Material* (included as Appendix D of this Work Plan) and the *USACE Safety and Health Requirements Manual, EM 385-1-1* (USACE, 2003). The UFGS are a joint effort of the USACE, the Naval Facilities Engineering Command (NAVFAC), and the Air Force Civil Engineer Support Agency (AFCESA). The UFGS are for use in providing construction specifications and guidelines for the military services.

4.1 Pre-Excavation Activities

Before excavation and other site activities can begin, there are several pre-construction documents and approval requirements to be met, including: Form 332 approval, dig permit with utility clearances, site security measures, and facility manager notification of the intended operations. Bhate will coordinate project requests for Base installation support services through the 49th CES/CEV. Pertinent to the start of activities, a pre-construction meeting and site walk-through will be conducted with HAFB personnel, and the Bhate Site Manager to inspect site conditions for site/equipment access, equipment staging area(s), soil stockpile areas, potential site hazards, and emergency evacuation routes. Also reviewed at this time will be project procedures in accordance with the schedule and planned activities.

Prior to initiating excavation activities, a subsurface soil sample will be collected within each identified source area adjacent to the most contaminated subsurface soil sample. The soil sample will be analyzed by the Toxicity Characteristic Leaching Procedure (TCLP) for VOCs, SVOCs, and metals to characterize the contaminated soil prior to treatment at the FT-31 land farm. Contaminated soil for offsite disposal may also need to be analyzed for PCBs, pesticides, and herbicides to meet the waste acceptance criteria of the disposal facility (Sites OT-20 and OT-37).

4.1.1 AF Form 332

Prior to initiating excavation activities, a completed and approved AF Fm 332 will be obtained. This form authorizes excavation work at HAFB and is required for the initiation of any excavation work. This work order describes what activities will take place at the location.

4.1.2 Dig Permit/Utility Clearances

Prior to the submittal of the dig permit (AF Fm 103), the area of excavation will be clearly delineated with marker flags, stakes, or paint, as appropriate to the surface material. Utility clearance approvals will be completed by the appropriate HAFB utility office (e.g., telephone, sewer, water, natural gas etc.). Upon receipt of the approved dig permit (AF Form 103) with the utility clearances, the Bhate Site Manager or other authorized project personnel will complete a site walk-through confirming the dig permit authorizations and make any required changes.

4.1.3 Excavation Area Site Safety

As an Occupational Safety and Health Administration (OSHA) Class II excavation, site safety is concerned with the excavation and the areas around the excavation. Concerns include: the

proper designation and demarcation of excavation boundaries (i.e. exclusion zone [EZ], contamination reduction zone [CRZ], and support zone [SZ]), compliance with excavation requirements, posting of potential hazards, and control of un-authorized site personnel. This is discussed in the 2003 *Basewide Health and Safety Plan* (Bhate, 2003b). Although the excavations will occur in low pedestrian traffic areas (except OT-45) site control will still be paramount for the safety at the site. At OT-45, notification of the excavation activities, duration, and alternate routes for pedestrian traffic will be provided to the appropriate personnel in Building 296 prior to the initiation of any field activities.

At a minimum, the sites will be secured with caution tape surrounding the perimeter of the site delineating the outer boundary of the SZ. This is essential in the utility clearance process and it serves as the demarcation of the site for both project and non-project persons. A CRZ and/or EZ will be established as guided by the HASP and prevailing site conditions. At the immediate edge of the excavation, a temporary construction fence will be erected completely around the excavation site. Postings will indicate the excavation hazard as well. Additionally, when workers will be in or around the excavations, a certified competent person (as per 29 Code of Federal Regulations [CFR], 1926, Subpart P) shall inspect the excavation, the adjacent areas, and protective systems daily, as needed throughout the work shifts, and after every rainstorm or other hazard increasing occurrence (USACE, 2003).

4.2 Decontamination Procedures

Small equipment, such as sampling tools, will be decontaminated in accordance with the *Basewide Quality Assurance Project Plan* (Bhate, 2003a). Heavy equipment, such as the backhoe, trackhoe, etc., will be decontaminated at a temporary decontamination pad set up at each site.

4.3 Excavation Activities

The objective of this section is to provide more detail about the scope of the excavations at sites OT-03, OT-20, OT-45, and OT-37 particularly with regard to excavation boundary, shoring, depth; soil screening and segregation; confirmation sampling; backfilling; disposal; and site restoration. Should source area removal be required at sites OT-32, OT-38, SS-12, SS-18, and/or RW-42 an addendum to this ACM Work Plan will be submitted to NMED prior to initiating excavation activities at these sites.

4.3.1 Excavation Boundaries

The proposed currently known source area excavations for sites OT-03, OT-20, OT-45, and OT-37 are discussed below. Clean overburden material (if applicable) will be temporarily stockpiled at each site in an area to be determined. Excavated material will be placed at least 2 ft from the edge of the excavation (USACE, 2003).

4.3.1.1 OT-03

The former disposal pit is located east of the POL Yard between two parallel chain link security fences that are 23 feet apart. This is not expected to interfere with the excavation and transportation equipment that will be needed to complete this remediation. However, early notification to the operations personnel at the POL Yard will be required as the POL Yard is a secure area. It may be necessary to excavate adjacent to or perhaps even under the security fence to remove the PCS, therefore pre-planning with the POL Yard operations personnel will include the possibility of having to remove a portion of the security fence. Prior to excavation, a soil sample will be collected from the OT-03 source area (disposal pit) and analyzed by TCLP for VOCs, SVOCs, and metals. The approximate limit of the area to be excavated at OT-03 is shown on Figure 4-1 (hatched area). Based upon the estimated depth (5 ft bgs) and size of the disposal pit (6 ft x10 ft), up to 40 cubic yards of contaminated soil will be removed and transported to the FT-31 land farm. The excavation will be backfilled with clean soil from the FT-31 land farm.

4.3.1.2 OT-20

The three grit disposal trenches are each approximately 2 ft wide, 5 ft deep, and 40 ft long. Chemicals of potential concern determined during the 1992 RI include heptachlor (pesticide) and aroclor 1254 (PCB). Prior to excavation, a soil sample will be collected from the OT-20 source area (disposal pit) and analyzed by TCLP for VOCs, SVOCs, and metals as well as pesticides, herbicides, and PCBs. The proposed area to be excavated is approximately 75 ft by 130 ft by 5 ft deep and is shown in Figure 4-2. The excavated contaminated soil (approximately 1,805 cubic yards) will be sent to a RCRA offsite landfill for disposal. The excavation will be backfilled with clean soil from the FT-31 land farm.

4.3.1.3 OT-45

This site has been investigated several times and in 1991, 3,320 cubic yards of PCS were removed from the area shown on Figure 4-3. Subsequent verification sampling measured levels of Diesel Range Organics at 1,200 mg/kg and Gasoline Range Organics at 3,400 mg/kg next to the former locations of the pump island and fuel station, indicating a zone of PCS that was not removed by the excavation in 1991. Pending the results of the additional assessment tasks that will help define the extent of PCS, the excavation tasks will focus in the area where the USTs/Pump Island/Fuel Station were located but removed in the 1980s. Prior to excavation, a soil sample will be collected from the OT-45 source area (disposal pit) and analyzed by TCLP for VOCs, SVOCs, and metals. The approximate area of PCS is also depicted in Figure 4-3. The excavation will be backfilled with clean soil from the FT-31 land farm.

4.3.1.4 OT-37

The four transformer concrete pads (transformers have been removed) are each approximately 10 ft wide and 20 ft long. TRPH and PCBs were detected in the shallow soil (0 to 2 ft bgs) above the SSLs at the Southern (HA-37-04) and Northern Vertical Launch Pad (HA-37-14) transformer pad locations (Radian, 1992). Additionally, TRPH was detected above the SSL in the sample

collected from 0 to 2 ft bgs at SB-37-03 (Northern Vertical Launch Pad). The three proposed areas to be excavated are expected to be about 5 ft wide, 10 ft long, and 3 ft deep and are shown in Figures 4-4 and 4-5. The excavated PCB/TRPH soil (approximately 20 cubic yards) will be profiled by TCLP (VOCs, SVOCs, and metals) and PCBs and sent to an offsite RCRA landfill for disposal. Soil with PCB concentrations exceeding 50 mg/kg will be sent to an offsite Toxic Substances Control Act (TSCA) landfill for disposal. The three excavations will be backfilled with clean soil from the FT-31 land farm.

4.3.1.5 OT-32, OT-38, SS-12, SS-18, and RW-42

The excavation boundary at these sites cannot be defined with the data available. For this reason, these sites are being re-investigated. The re-investigation results may justify remediation or they may support a petition for NFA with the NMED on the basis that a source of contamination above SSLs does not exist. On a speculative basis, the additional data collected at OT-38 could justify remediation if TPH concentrations are confirmed at levels above the SSLs for an unknown oil (800 mg/kg). If excavation to remove contaminated soil from this site is necessary, the boundary of the excavation would be expected to be near the former cesspool (adjacent to the existing septic tank).

4.3.2 Excavation Shoring

During excavation activities at each site, personnel will not enter the excavation at any time. Shoring or benching may need to be erected ensuring that the excavation sidewalls do not collapse. Shoring shall be used for unstable soil or depths > 5 ft (> 1.5 meters) unless benching, lay-back, or other acceptable plan is implemented by the Contractor (USACE, 2003). The determination will be made as the excavation progresses. If any slumping or sidewall failure is evident, then shoring and/or benching will be implemented.

Excavation activities associated with other soil remediation projects at HAFB (e.g., SS-02/05, FT-31, and SS-17) indicate that the native soils demonstrate significant stability achieving near vertical walls during these excavations. The soils, in the vicinity of the known source areas that will be excavated (i.e., OT-03, OT-20, OT-45, and OT-37) are native as determined from the previous investigations. At this time, shoring of the excavation is not intended however sidewall benching may be required.

4.3.3 Soil Excavation

Excavation activities will utilize the appropriate excavation equipment and a wheel loader to assist with soil management. Workers exposed to vehicular or equipment traffic including signalpersons, spotters, or inspectors shall wear high visibility apparel meeting American National Standards Institute/International Safety Equipment Association (ANSI/ISEA) 107 class 3 requirements. All overburden soils determined to be clean will be removed prior to the removal of the contaminated soils. The clean overburden soils will be temporarily stockpiled for subsequent backfilling. Soil stockpiles will be managed as to not allow for any material to be

removed or transported off-site via wind or precipitation (see Section 7 of this Work Plan, *Waste Management*).

The contaminated subsurface smear zone is estimated to begin at 3 to 15 feet above the groundwater table. Applicable HAFB SOPs for completing these excavations are located in Appendix A of the *Basewide Quality Assurance Project Plan* (Bhate, 2003a). All contaminated soils will be live loaded and directly transported to the FT-31 Base land farm or previously approved offsite disposal facility.

4.3.3.1 Soil Screening at Sites with Petroleum Contamination

The soil screening at sites with known petroleum contamination is comprised of three phases: 1) initial field screening, 2) field confirmatory, and 3) laboratory validation. These steps are detailed in Section 5, *Excavation Soil Sampling and Analysis,* of this Work Plan.

Throughout the excavation at sites contaminated with known petroleum products (i.e., OT-03 and OT-45) observation of discoloration and unusual odors will be documented. Potential PCSs will be field screened for petroleum hydrocarbon contamination using the SiteLAB® Analytical Test Kit Ultraviolet Flourometer in accordance with the UVF-3100 Operating Manual (included as Appendix E of this Work Plan). Excavated soil will be segregated in the field based on visual observation, headspace readings, and onsite analysis of TPH with laboratory confirmation. Soils that demonstrate a field screened TPH concentration above 800 mg/kg exceed the regulatory limit for PCS and will be managed in accordance with Section 7, *Waste Management,* of this Work Plan. Soils demonstrating a concentration below 800 mg/kg will be stockpiled for backfill once the excavation is complete. All soil stockpiled for backfill will undergo laboratory analysis to verify that no TPH hazardous constituents (e.g., VOCs and SVOCs) in excess of NMED residential soil screening levels (NMED, 2006) are present. Soil screening will not be conducted at sites where there are other non-PCS chemicals of potential concern (e.g. PCBs, pesticides and herbicides). Therefore, all soil excavated from the OT-20 and OT-37 source areas will be considered contaminated and disposed offsite. The site specific excavation sampling frequency and analyses are summarized in Table 4-1.

The field screening incorporates the initial screening for the segregation of the excavated soils between contaminated and un-contaminated and the corresponding Quality Assurance/Quality Control (QA/QC) confirmation and validation analyses. Screening of soil at non-PCS and mixed waste PCS sites (e.g., OT-20 and OT-37) will not need to undergo the screening steps outlined above.

4.3.3.2 Soil Segregation

Soil segregation will only be conducted at the PCS source area sites (OT-03 and OT-45). The 800 mg/kg action level for PCS is listed in Table 2b of the NMED Residential Direct Exposure Limit for unknown oil in the TPH Screening Guidelines, October, 2006 (included as Appendix F of this Work Plan). This cleanup level is part of a previous agreement between HAFB and NMED. The concentrations for the TPH carbon fractions will be summed for the total TPH value and compared to the NMED SSL for TPH containing unknown oil (800 mg/kg).

The **un-impacted soils** are the overburden soils which have historically demonstrated no contamination and the source of the contamination is not from a surface release. These soils will be determined during the first phase of excavation covered under this ACM Work Plan.

Suspected contaminated soils are those primarily within the smear zone. These are typically contained in a 1 to 2 foot zone above the contaminated soils. The **contaminated soils** are those that are definitively contaminated as validated by laboratory analytical data. Suspected contaminated soils will be handled as though they are contaminated, directly loaded, and transported to the FT-31 Land farm for treatment or stockpiling. Soils contaminated with any other contaminants other than petroleum products cannot be taken to this land farm.

4.3.3.3 Confirmation Soil Sampling

After the excavation is complete, and all suspected petroleum and non-petroleum contaminated soils have been removed, sidewall confirmation samples will be collected. Excavation confirmation samples will be analyzed for site specific contaminants that have been detected above their SSLs. Samples will be collected at a minimum frequency of 2 per 18 linear feet (ln ft) per side wall at mid-depth of the contamination zone. At a minimum, 1 sample per side wall will be collected for side walls less than 18 ln ft (i.e. OT-03). Based on the historical site specific data, the excavation confirmation sampling frequency and analysis for Sites OT-03, OT-20, OT-45, and OT-37 is presented in Table 4-1. The list of sampling parameters for each site could increase based on the findings of the additional ACM investigations.

4.3.4 Excavation Backfilling and Compaction

Clean soils will be obtained for backfill as needed from a clean, reliable source. Backfill adjacent to any and all types of structures shall be placed and compacted to at least 90 percent laboratory maximum density for cohesive materials or 95 percent laboratory maximum density for cohesionless materials to prevent wedging action or eccentric loading upon or against the structure. The material shall be placed in successive horizontal layers of loose material not more than 8 inches in depth. Compaction shall be accomplished by sheepsfoot rollers, pneumatic-tired rollers, steel-wheeled rollers, vibratory compactors, or other approved equipment. The compaction of the final two base lifts will be confirmed by determination of the soil density via an in-place nuclear or similar method per ASTM Method D 2922 (included as Appendix G of this Work Plan). If applicable, the final 12-inches of backfill will adhere to the specifications of Subgrade Preparation found in UFGS Section 02770A *Concrete Sidewalks and Curbs and Gutters* (included as Appendix H of this Work Plan).

4.3.5 Soil Disposal

Petroleum contaminated soils exceeding 800 mg/kg of TPH will be transported to the permitted FT-31 Land farm for treatment/processing, or stockpiling. Prior to the mobilization of the excavation efforts, if the permitted base land farm is at operational capacity, disposal of the soils will be to a previously approved off-site facility. Soils will be handled, transported, and managed in accordance with the NMED guidelines and respective facility's requirements.

Contaminated soils that do not contain petroleum products or exhibit TPH levels less than 800 mg/kg AND exhibit levels of contaminants (PCBs, pesticides, and herbicides) greater than the NMED SSLs shall be disposed of at a permitted solid waste off-site disposal facility such as the landfills at Otero County or Camino Real in Sunland Park, New Mexico. Offsite disposal will require collecting the necessary data to satisfy the facility's waste profiling criteria and acceptance policies.

4.3.6 Site Restoration

Upon completion of site excavation and backfill activities, each site will be restored to its original appearance. Construction equipment and debris will be removed. Each site will be canvassed for trash, debris, etc. The final grade for areas which will not have a surface improvement upon them will allow for positive drainage in accordance with the surrounding area.

If any section(s) of walk way, paved areas, or decorative landscaping are removed or damaged during the excavation they will be replaced in similar construction and match in appearance to that which was removed. The design and construction, inclusive of materials, will be completed in accordance with the UFGS specifications for concrete sidewalks and gutters, Section 02770A *Concrete Sidewalks and Curbs and Gutters*, March 2004 (located in Appendix H of this Work Plan). Matching of the new sidewalk to the existing sidewalk has primacy over the UFGS guideline. The guideline should be adhered to utilizing best management practices and holding to the intent of the guideline. The guideline shall be implemented in its entirety except for the following Parts and/or subparts:

Sections 1.1 through 1.3	Sections 2.2.2 and 2.2.3
Section 1.6.2	Sections 3.7.1.1 and 3.7.1.3

Sections 2.1.3-Reinforcement Steel; 3.5.3-Reinforcement Steel Placement; and 3.7.4-Protective Coating are only applicable if the existing sidewalk is constructed in a similar manner.

5 EXCAVATION SOIL SAMPLING AND ANALYSIS

5.1 Excavation Sampling

The PCS excavation soil sampling requirements, detailed in Table 4-1, include field screening of overburden soils with headspace analysis via an OVA and SiteLAB® ultra violet flourometer (UVF), laboratory analysis of stockpiled soils for backfill characterization purposes, and excavation confirmation samples to denote the extent of excavation. Excavated PCS that is suspect or visibly contaminated will be directly loaded into trucks and transported to the FT-31 Land farm for treatment. Excavation soil samples for chemical analysis will be collected as discrete (grab) samples from the trackhoe bucket as per Bhate SOP No. 1, *Soil Sampling and Subsurface Investigations,* Section 7, Test Pit and Trenching Procedures. Table 5-1 provides the analytical methods and container requirements for the samples that will be collected for offsite laboratory analysis.

5.1.1 Overburden Field Screening

At the beginning of PCS excavation activities, initial field screening (headspace analysis with an OVA) will be performed on overburden soil at a frequency of one sample every 25 cubic yards of excavated soil. At small sites like OT-03 where the total excavation is less than 25 cubic yards, the frequency will be one sample every 10 cubic yards. If the headspace analysis reveals the presence of significant contamination (> 300 parts per million on the OVA), the soil will be transported to the FT-31 Land farm for treatment. Otherwise the overburden soil will be stockpiled on site for backfill purposes. Every 50 cubic yards of stockpiled soil will undergo confirmatory field TPH analysis with the field fluorometer (SiteLAB® Analytical Test Kit) in accordance with the UVF-3100 Operating Manual (included in Appendix E of this Work Plan). At small sites where the total excavation is less than 50 cubic yards, the frequency will be one sample every 25 cubic yards. Overburden field screening will only be conducted at sites with PCS source areas (e.g. OT-03 and OT-45).

5.1.2 Overburden Stockpile Sampling

For backfill characterization purposes, laboratory validation sampling will be performed at a frequency of one sample per every 200 cubic yards of stockpiled overburden soil or every 100 cubic yards if the total excavation is less than 100 cubic yards. The samples will be analyzed by a fixed-based laboratory for TPH (DRO, GRO, ORO) using USEPA method 8015M, VOCs (USEPA Method 8260B), and SVOCs (USEPA Method 8270C). Laboratory analyses will be completed at an expedited turn-around time of 24 hours. Overburden stockpile sampling will only be conducted at sites with PCS source areas. Source areas with other chemicals of potential concern (PCBs, pesticides, and herbicides) will be excavated in their entirety for offsite disposal.

5.1.3 Excavation Confirmation Sampling

Excavation confirmation sampling will be conducted at each site requiring source area removal. Excavation confirmation samples will be analyzed for site specific contaminants that have been detected above their SSLs. Excavation confirmation samples will be collected at a frequency of two per 18 ln ft per side wall at mid-depth of the contamination zone. At a minimum, one sample per side wall will be collected for side walls less than 18 ln ft. Analytical confirmation sampling from the bottom of the excavation is not required because the excavation will be terminated at one to two feet below the water table. Based on the historical site specific chemicals of potential concern, samples will be analyzed by a fixed-base laboratory for TPH, -DRO, –GRO, and -ORO using USEPA Method 8015M, VOCs (USEPA Method 8260B), SVOCs (USEPA Method 8270C), PCBs (USEPA Method 8082), organochlorine pesticides (USEPA Method 8081A), and chlorinated herbicides (USEPA Method 8151A). The site specific excavation confirmation sampling parameters based on historical data are presented in Table 4-1. The list of excavation confirmation sampling parameters for each site could increase based on the findings of the additional ACM investigations. If any single sample demonstrates an exceedance of NMED residential SSLs, excavation will continue along that face or to greater depth until field screening deems termination with re-evaluation via laboratory confirmation analysis.

Soil data collected will adhere to project data quality objective (DQO) requirements, method reporting limits, duplicate field samples, and QA samples as established within the Basewide QAPP (Bhate, 2003a). Sample quantities, containers, methods of preservation, and holding times will be consistent with the requirements of associated method protocols. Laboratory analyses will be completed at a standard turn-around time of 7 days.

5.2 Analytical Methods

Each laboratory excavation confirmation soil sample (including the field duplicates) will be analyzed for their respective site specific analytes in accordance with Table 5-2. Depending on the site specific chemicals of potential concern, samples will be analyzed for VOCs, by Method 8260B; SVOCs, by Method 8270C; TPHs by Method 8015M; PCBs by Method 8082; organochlorine pesticides by Method 8081A; and chlorinated herbicides by Method 8151A.

Laboratory analyzed samples will be completed by Severn Trent Laboratories in Denver, Colorado. A copy of their USACE validation is included in Appendix I of this Work Plan.

6 RISK BASED CLEAN-UP APPROACH

The objective of the excavation activities presented in Section 4 of this Work Plan is to remove the PCS and/or hazardous constituent source area(s) to support closure of the site(s). Data collected as a result of field screening will be evaluated based upon the DQO's for the project. The results from the offsite laboratory confirmation samples from the sidewalls of the excavation will be evaluated to determine whether excavation activities at the site have removed the contaminated soil to the point where there is an acceptable risk due to exposure at the site. If the completed evaluation indicates an acceptable risk, then no further excavation will be required and the site(s) can be considered for closure with no further action.

6.1 Evaluation of TPH

Based on the direction provided by NMED, pertaining to the remediation of petroleum-impacted sites at HAFB, a TPH screening level of 800 mg/kg will be used to evaluate the data provided by the offsite analytical laboratory. The 800 mg/kg action level for PCS is the Residential Direct Exposure Limit for an unknown oil, is listed in Table 2b, of the *New Mexico Environment Department TPH Screening Guidelines*, October 2006 (included in Appendix F of this Work Plan).

6.2 Evaluation of VOCs and SVOCs

For any VOCs or SVOCs that are detected in excavated soil, the concentration will be evaluated against the screening levels provided in the revised NMED guidance document *Technical Background Document for Development of Soil Screening Levels, Revision 4.0*, June 2006 (NMED, 2006). Tables containing the SSLs from this guidance document are provided in Appendix J of this Work Plan. Laboratory data for each collected soil sample will be compared to these SSLs.

6.3 Evaluation of Other Chemicals of Potential Concern

For any other chemicals of potential concern (pesticides, herbicides, metals, PCBs) that are detected in excavated soil, the concentration will also be evaluated against the screening levels provided in the revised NMED guidance document *Technical Background Document for Development of Soil Screening Levels, Revision 4.0*, June 2006 (NMED, 2006). Tables containing the SSLs from this guidance document are provided in Appendix J of this Work Plan. Laboratory data for each collected soil sample will be compared to these SSLs. Analytical results for tritium will be compared to the Nuclear Regulatory Commission's surface soil screening level (110 pCi/g) (Federal Register, Vol. 64, No. 234, 1999).

6.4 Risk Based Evaluation

Subsequent to the investigative and the excavation activities detailed in this work plan, a site specific risk based evaluation will be performed for each site to ensure that the risks to current

and future receptors are acceptable. The risk based evaluation will be included in the Closeout Report for each site that has contaminants above SSLs or groundwater standards. The following sections present the various steps that will be included in the site specific risk assessments.

6.4.1 Review of Available Analytical Data

As a first step in the risk evaluation process, soil and groundwater data produced by the source area investigations will be combined with the historical data for each site. The data will then be reviewed to determine (i) the most probable source(s) of contamination, (ii) that soil and groundwater impacts have been adequately delineated, and (iii) if any additional chemicals were detected that were not previously of concern at the sites. Additionally, the data will be evaluated to ensure it meets standards for data quality established in the NMED *Technical Background Document for Development of Soil Screening Levels, Revision 4.0* (NMED, June 2006).

6.4.2 Re-Evaluation of the Conceptual Site Model

Following a review of available data, a conceptual site model (CSM) for each site requiring a risk based evaluation will be re-evaluated. This includes (i) re-assessing the distribution of chemicals of potential concern (COPCs) in soil and groundwater, (ii) verifying current and future land use, and (iii) verifying site stratigraphy and hydrogeology. To date, the COPCs identified in soil and groundwater at the four sites (OT-03, OT-20, OT-45, and OT-37) currently requiring soil remediation and a risk based evaluation include TPH, benzene, ethylbenzene, and xylenes at OT-03; heptachlor, dicamba and aroclor 1254 at OT-20; TPH, benzene, toluene, ethylbenzene, and xylenes at OT-45; and TPH and aroclor 1260 at OT-37. However, additional COPCs may be identified during the review of data collected during the source investigation.

6.4.3 Re-Evaluation of the Exposure Model

Once the conceptual site model has been completed an exposure model will be re-evaluated. The exposure model is based on the CSM, and identifies the following:

- Media of concern,
- Current and future receptors, and
- Complete and incomplete exposure pathways

Media of concern includes surficial soil, subsurface soil, soil to depth of potential future construction, and groundwater. Based on current information available, receptors include (i) a current and future commercial/industrial worker and (ii) a future construction worker for each site. Complete routes of exposure for each media of concern/COPC/receptor combination will be identified based on the above information.

6.4.4 Preliminary Screening Evaluation

As a first step, maximum concentrations for each COPC in each media of concern will be compared with the NMED Screening Levels for residential soils presented in Table A-1 of the *Technical Background Document for Development of Soil Screening Levels, Revision 4.0* (NMED, June 2006) for each site. If the maximum concentration of each COPC in soil and

groundwater is below its respective SSL, no additional analysis will be performed, and the findings will be reported to NMED. Depending on the results of the screening evaluation, site-specific screening levels may be developed for all media based on current and future receptors. Development of site-specific screening levels is described below.

6.4.5 Calculation of Site-Specific SSLs

Parameters required for the calculation of site-specific SSLs include:

- Carcinogenic toxicity values (Slope Factors),
- Non-carcinogenic toxicity values (Reference Doses),
- Exposure Factors, and
- Fate and Transport Parameters.

Default toxicity values and exposure factors will be obtained from Tables C-1 and B-1 (respectively) of the *Technical Background Document for Development of Soil Screening Levels, Revision 4.0* (NMED, June 2006). Site-specific fate and transport parameters will be obtained from available reports for each site. Using the above information and geotechnical data (dry bulk density, specific gravity, fractional organic carbon, and moisture content) site-specific screening levels will be calculated using equations presented in the *Technical Background Document for Development of Soil Screening Levels, Revision 4.0* (NMED, June 2006).

6.4.6 Site-Specific Screening Level Evaluation

The site-specific screening levels will be compared with the representative concentration of each COPC in each media of concern for each site. If any COPC exceeds its respective site-specific screening level, additional risk management strategies (i.e., institutional controls or other alternatives) will be evaluated.

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7 WASTE MANAGEMENT

Contaminated soil/debris and IDW generated by the activities of the excavations include excavated soil, decontamination residuals, and PPE (Table 7-1). Each waste stream will be managed and characterized according to the following guidelines. Waste containers and the decontamination pad will be managed in a secure area.

7.1 Excavated Soil

7.1.1 Clean Soils – Stockpiles

The clean soil stockpiles will be constructed in accordance with best management practices to mitigate soil loss due to erosion, wind, and run-off. They will employ the use of a plastic liner, straw bales for berming or silt fencing and a cover. Excavated non-PCS (e.g. OT-20) will be placed on thick plastic sheeting within a constructed berm for protection from off-site transportation by wind and rain until characterization is complete. If offsite laboratory analysis indicates concentrations are below the SSL for TPH (800 mg/kg) and the SSL for each individual VOC and SVOC constituent, the stockpiled soil will be used as backfill once the excavation activities are complete.

7.1.2 Petroleum Contaminated Soils – Base Land farm

Excavated petroleum contaminated soils (e.g., OT-03 and OT-45) will be handled in accordance with Sections 4 and 5 of this Work Plan. Contaminated soils will be loaded and transported to the selected location for treatment/disposal; either the FT-31 Land farm or an offsite disposal location.

7.1.3 Non-Petroleum Contaminated Soils – Offsite Disposal

Potential source area excavations at the remaining sites (OT-20, OT-32, SS-18, and RW-42) may exhibit concentrations of other contaminants (e.g., herbicides, pesticides, PCBs, or metals) in soil greater than the corresponding SSLs and cannot be treated at the FT-31 Land farm. Based on the available historical data, these soils are not anticipated to meet the definition of RCRA hazardous waste in 40 CFR Part 261 however, this assumption will be confirmed by analyzing the excavated soil using the protocol described in Section 5 of this Work Plan. Excavated soil that does not meet the FT-31 Land farm treatment criteria will be transported offsite to a permitted solid waste disposal facility such as the Otero County Landfill and/or the Camino Real Landfill in Sunland Park, New Mexico.

7.2 Decontamination Water

Decontamination water is anticipated to be non-hazardous and as such, can be disposed of through the HAFB WWTP. When feasible, decontamination water will be allowed to evaporate from the decontamination pad area. Sediment remaining in the decontamination pad area after

the water has either evaporated or has been discharged to the WWTP will be combined with the excavated contaminated soil for treatment at the FT-31 Land farm.

7.3 Personal Protective and Disposable Sampling Equipment

PPE and other site non-hazardous debris/waste shall be placed in plastic trash bags and disposed in a standard trash dumpster or receptacle as directed by HAFB personnel.

7.4 Construction Rubble

Unless visibly stained, all construction debris (sidewalk and/or asphalt if encountered) is assumed to be non-hazardous, non-contaminated, and will be disposed of accordingly at the Base re-use facility.

8 PROJECT QUALITY ASSURANCE

The laboratory performing the chemical sample analysis will follow the Basewide QAPP (Bhate, 2003a) and the Quality Assurance Project Plan Addendum (Appendix C of this Work Plan).

8.1 Standard Operating Procedures

Applicable SOPs for completing this excavation are located in Appendix A of the Basewide QAPP (Bhate, 2003a).

8.2 Sample Identification

Each environmental sample will be identified on the sample label and COC records for each sample collected, regardless of type. Field duplicates will be paired with another field sample and will be classified as blind samples. The duplicate samples will appear in sequence with the regular samples. The identifier nomenclature will adhere to the procedures and guidelines established in the Basewide QAPP. Sample labeling will adhere to the format provided in Section 3.4 of this Work Plan.

8.3 Project Documentation

The field operations documentation will provide consistent procedures and formats for documentation and management of field records and collected samples.

8.3.1 Sample Documentation

Sample documentation, identification, and tracking will adhere to the prescribed methods found in the Basewide QAPP. All sampling activities will include documentation of significant activities, potential environmental influences during sampling, field variances, and sample identification information. At a minimum, field logbooks will be utilized to record dates and times, sampling protocols, project numbers, and sampler's name. Daily Quality Assurance Reports will be completed and submitted weekly to the HAFB Project Manager. Other pertinent information will include COC numbers and air-bill tracking number. Chain-of-custody forms will be completed and included with each sample shipment; one COC per cooler.

At a minimum, the following sample collection information will be logged in the field book:

- Date and time
- Sample identification number
- Project number
- Sampler name
- Preservative (if any)
- Analysis
- Map or schematic of sampling location

If no map of sampling locations is available prior to sampling, a drawing of the site will be sketched on the left page of the field logbook to provide an illustration of all sampling points. Measured distances from sampling points to a fixed reference point will be recorded.

8.3.2 Field Logbook

Personnel will use only bound field logbooks for the maintenance of field records. The Project Manager will ensure that all field notes can be efficiently traced, filed, and retrieved. All entries will be recorded in indelible, waterproof ink. If errors are made, corrections will be made by crossing a single line through the error, correcting the information, and initialing and dating the correction. Entries will be made in the following format:

Documentation and reporting of events and activities will be made in chronological order on the right page of an open logbook. All entries will be dated and time of entry recorded. At the beginning of each day, the first two entries will be "personnel/contractors on site" and "weather". At the end of each day's entry, the personnel will draw a diagonal line originating from the bottom left corner of the page to the conclusion of the entry and sign along the line indicating the conclusion of the entry or the day's activity. Once completed, the field logbooks become accountable documents and will be maintained as part of the project files.

The following general requirements apply to field logbooks:

- The left page of the logbook will be used for auxiliary reporting such as sketches, tables, etc.
- The date will be recorded at the top of every page in the left-hand corner of the right page.
- The time of entry recordings will be in columnar form down the left-hand side of the right page.

8.3.3 Field Analytical Data

The field analytical data collected at the site will include the field screening readings for selection of PPE, as well as field screening for headspace analysis. The breathing zone of the site will be screened for VOCs in the field at the time of sample collection utilizing an OVA. If a high humidity condition exists at the time of sample collecting, a flame-ionization detector (FID) is recommended since a PID is not a completely reliable screening instrument under these conditions. The field screening data will be recorded in the field logbook.

8.3.4 Data Reporting

Data obtained during the excavation, confirmation, or field screening samples will be reported according to the Basewide QAPP (Bhate, 2003a). In accordance with USACE EM200-1-6, the investigative data is classified as definitive data. The data will be generated using rigorous, analyte-specific analytical methods where analyte identifiers and quantitations are confirmed and

QA/QC requirements have been satisfied. For this project, regular, field duplicate, and MS/MSD samples are to be collected concurrently. The data will meet the objectives of the project for level of accuracy and precision required, intended use of the data, analytical methods, time constraints, and allowable decision errors. Risk evaluation and sampling results will be tabulated and summarized in the Closure reports for each site. An ERPIMS submittal is not required for the excavation phase of this project.

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9 HEALTH AND SAFETY REQUIREMENTS

Project Health and Safety practices will adhere to the Basewide Health and Safety Plan (Bhate, 2003b) and the Site Specific Addendum to the Basewide HASP, as included in Appendix B of this Work Plan, for the excavation activities. All field work will be conducted in accordance with the *USACE Safety and Health Requirements Manual, EM 385-1-1*, 3 November 2003. It is anticipated that no greater than modified level D PPE will be required to complete the site inspection and sampling activities. This includes: OSHA approved safety shoes, ANSI approved safety glasses (Z87.1) and hard hat (Z89.1-1997: Type I), sleeved shirt and long pants, and as required, hearing protection, leather work gloves, and/or nitrile gloves during sampling.

Site security is part of safety at the site for the excavation. Items of concern include the proper designation and demarcation of the investigation boundaries (i.e., SZ, CRZ, and EZ), as appropriate. Likewise, compliance with any intrusive work requirements, posting of potential hazards, and control of un-authorized site personnel will be completed. This is discussed in the Basewide HASP.

At a minimum, the site will be secured with caution tape surrounding the perimeter of the site delineating the outer boundary of the SZ. This is essential in the utility clearance process and it serves as the demarcation of the site for both project and non-project persons. A CRZ and/or EZ will be established as guided by the HASP and site prevailing conditions.

Excavation depths are expected to exceed 4 ft, and be less than 20 ft; therefore sidewall benching may be required. For more information regarding sidewall benching please refer to Section 25.C, Sloping and Benching, *USACE Safety and Health Requirements Manual, EM 385-1-1.*

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10 ORGANIZATION AND SCHEDULE

Mr. Jim Moore, Professional Geologist (P.G.), will serve as the Bhate Field Manager during the additional investigation phase of this ACM project. During the corrective measures (excavation) phase of the project, Mr. John Hymer will serve as the Bhate Site Manager and as the Site Safety and Health Officer overseeing and directing all excavation and soil screening and confirmation sampling activities. Mr. Hymer will also provide on-site management of any sub-contractors for the project. Mr. Moore is also the Bhate Project Manager and will ensure required project documents, permits, contractual agreements, and other program tasks are completed. Key project personnel are listed in Table 10-1. The additional investigation and excavation activities are anticipated to begin in the Winter of 2007 and will last approximately 2 to 3 months.

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ATTACHMENTS

ATTACHMENT A

SCOPE OF SERVICES FOR REMEDIAL ACTION CONSTRUCTION RA-C – PROJECT # KWRD20067080

OMAHA DISTRICT

U.S. ARMY CORPS OF ENGINEERS

SCOPE OF SERVICES
FOR

Remedial Action Operation RA-O --Project # KWRD20067018
Remedial Action Construction RA-C –Project # KWRD20067080

AT
HOLLOMAN AIR FORCE BASE, NEW MEXICO

November 09, 2005

Environmental Restoration

Contract No. DACA45-03-D -0023

Delivery Order TBD

SCOPE OF SERVICES
FOR

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AT
HOLLOMAN AIR FORCE BASE, NEW MEXICO

1 Objective

The objective of this work effort is to perform Remedial Action Operation (RAO) and Remedial Action Construction (RAC) for several sites at Holloman AFB. The Contractor must perform all necessary travel, professional analysis, and work required to accomplish the work in this Scope of Services and prepare the reports required under this contract. The work must be conducted in an environmentally acceptable manner conforming to federal, state, and local regulations. This work is detailed in the following Scope of Services.

1.1. This scope is written in terms of the general performance requirements and objectives, and is not intended to describe how the work is to be accomplished. The contractor's methods of accomplishment shall be proposed in the respective work plans, which are to be reviewed for approval by USACE, regulatory, and USAF personnel. Applicable laws, policies, and guidance shall be incorporated into the work methodologies, and followed by the contractor in work execution.

1.1.1 Performance Incentives

1.1.1.1 Target Costs will be negotiated as part of this D.O.. The negotiated budgets for each task will set the basis for the contractor's operating budget. Should the contractors costs for these tasks come in below the negotiated cost for each task, identified below, the contractor will be awarded additional fee in the amount of 0.5 percent of the total costs for the site costs.

1.1.1.2 Schedule. The contractor shall negotiate an agreed upon schedule with the Corps and the Air Force for performing the work identified within. For each month that the work for the overall delivery order is performed ahead of the negotiated schedule the contractor will be awarded 0.25 percent fee above the negotiated fee amount. Total Fee for this delivery order shall not exceed 9%.

2 Work effort

1.1 The work effort involves the following.

The general scope of work to be performed in this delivery order includes Remedial Action Operation at multiple sites. Further detail will be provided later in the scope.

1.2 Work Allocation Document (WAD) Breakdown.

This delivery order will be separated into (5) work allocation documents (WADs). Each work area under this delivery order has two WADs associated with it. The first is for the actual performance of work and the second is for the fee associated with that service.

1. RA-O Multi-Site
2. Fee associated with WAD 1
3. RA-C Multi Site
4. Fee associated with WAD 3
5. Incentive Fee

3 Geology, chemistry, and health & safety requirements

All field and laboratory activities associated with the installation and testing of soils and ground water must be sampled, tested, and reported in accordance with the site-specific Geology, Chemistry, and Health & Safety Requirements previously provided.

4 Plan and Submittal Requirements/Approvals.

The Contractor, upon receiving the Notice to Proceed, must prepare the following plans. All reports and plans must satisfy the corrective action requirements of the HSWA portion of the RCRA permit and contain a declaration stating so. All plans may be reviewed by the appropriate technical staff and approval must be obtained from the U.S. Army Corps of Engineers, Omaha District, Project Manager (CENWO-PM) prior to commencement of that work effort.

1.1 PA/SI Work Plans, Draft and Final.

The Contractor must develop a site-specific work plan for fieldwork and data analysis or assessment work for each site.

1.2 Site Safety and Health Plan Addendum, Draft and Final.

The Contractor must write a site-specific addendum to the Basewide Site Safety and Health Plan.

5 Reports. The Contractor must develop the following reports:

1.1 Daily Quality Control Reports (A-E DQCR).

During the field investigation activities, the Contractor will provide DQCRs to the CENWO-PM. These reports must be faxed to the CENWO-PM on a daily basis. Should problems arise, the Contractor must notify the CENWO-PM immediately. The DQCR must be prepared in accordance with the instructions given in General Chemistry Scope, paragraph 5.2.1.

1.2 Quality Control Summary Report (QCSR).

The QCSR is a report submitted by the Contractor at the conclusion of the site investigation phase and must be submitted as part of any work plan. The QCSR must be prepared in accordance with the instructions given in General Chemistry Scope previously provided.

1.3 Draft Closure Reports.

The Draft Closure Reports must describe the fieldwork performed and analytical results.

1.4 Final PA/SI Report.

The Final Closure Report is Draft Closure Report with "accepted" review comments and responses incorporated.

1.5 Environmental Resources Program Information Management System.

All site characterization data must be submitted in electronic format to meet the ERPIMS requirements as specified in the general Chemistry Scope of services.

6 Project Engineer/Project Manager

The Contractor must assign an employee in his organization who must be known as the Project Engineer or Technical Manager. This person must oversee the coordination of the entire project, administer all instructions from the CENWO-PM, and obtain answers to all questions from the CENWO-PM during and after the work.

7 General

1.1 Travel and meetings

The Contractor must perform the following necessary travel as part of this delivery order.

1.2 Progress review and technical adequacy

At appropriate times, representatives of the Contracting Officer may review the progress and technical adequacy of the investigations. Such review must not relieve the Contractor from performing all contract requirements, except what may be waived by written instruction.

1.3 Project schedule

The Contractor must submit a project schedule outline for USACE approval ten days after the issuance of the Notice to Proceed.

1.4 Progress reports

The Contractor must submit progress reports with each request for payment. The progress reports must indicate work performed, costs, and problems incurred during the payment period. The Contractor, under this contract, must interpose no objection or restriction to the Contracting Officer's designation of another Contractor for reviewing the adequacy and correctness of the

work performed under this contract. The Progress Report must show the estimated and actual performance of this project on a project-tracking chart that illustrates the funds expended and the work completed for each site. Prior to the technical/partnering meetings, the Contractor will also provide an update on the status for each site in the format requested by the Range such as presenting visual aids, Gantt charts, and updated site summary sheets for each site.

1.5 Conference Notes and Confirmation Notices

1.1.1 Conference Notes

The Contractor must be responsible for taking notes and preparing the reports for all conferences. Conference reports must be prepared from typed notes and furnished to the USACE-PM within 5 days of the conference for concurrence prior to distribution. The report must be distributed to all attendee and include the following at a minimum:

- The date and place the conference was held;
- List of attendees, including names, organizations, and telephone numbers;
- Written comments presented by attendees attached to each report with the conference action noted.

Conference action must be "A" for an Approved comment, "D" for a Disapproved comment, "W" for a comment that has been Withdrawn, and "E" for a comment that has an Exception noted. Narrative responses must be provided with the Conference Notes for all but Approved comments.

1.1.2 Confirmation Notices

The Contractor must be required to provide a record of <u>all</u> discussions, verbal directions, telephone conversations, etc., between USACE and the Contractor and/or his representatives on matters related to this SOS. These records must be numbered sequentially entitled "Confirmation Notices." Confirmation notices must fully identify personnel who participated, the subject discussed, and any conclusions reached or decisions made. The Contractor must forward a reproducible copy of the confirmation notices to the Contracting Officer, or his representative, within five working days. USACE will distribute confirmation notices as necessary.

1.6 Submittals and reviews

1.1.1 Reports

Reports presenting data, analyses, and recommendations must be prepared in a standard format using effective technical writing. Reports submitted for public comment must be prepared in a visually appealing format using reader-oriented writing style and natural expression (see www.plainlanguage.gov). All site drawings must be of engineering quality with sufficient detail to show interrelationships among major features on the site map (i.e., north arrows, keys, scales, etc.). When drawings are required, data may be combined to reduce the number of drawings. The report must consist of 8 - 1/2" by 11", or 11" by 17" with pages folded to 8 - 1/2" by 11". A decimal paragraphing system must be used. The report covers must be durable binders that hold pages firmly while allowing easy removal, addition, or replacement. The report cover, spine,

and title page must identify the report title, the contract number, the Project Number, the name of the installation, the site name, and the date. All final submittals must be sealed by a registered Professional Engineer and a Registered Geologist may also sign and seal reports.

1.1.2 Submittals

Contract submittals must be furnished to the appropriate parties; in the numbers identified by the USACE-PM. Submittals being furnished for review must be mailed via overnight carrier.

1.1.3 Reviews

All reports are subject to technical review by USACE, federal, state, and local regulatory agencies, and AF managers. The Contractor must incorporate review comments and responses and resubmit documents for approval.

1.1.4 Revisions

The initial document submittals must be numbered Revision 0. Subsequent revisions must be numbered sequentially.

1.7 Special considerations

1.1.1 USACE property

All materials gathered and developed in the performance of this work must be the property of US Government and must not be used or distributed by the Contractor without specific permission from the Contracting Officer.

1.1.2 Public affairs

The Contractor must not make available to the news media or publicly disclose any data generated or reviewed under this contract unless instructed to do so by the USACE-PM or the Range Environmental Coordinator. When approached by the news media, or any unknown personnel, the Contractor must refer them to the USACE-PM or the Range Environmental Coordinator for response.

1.1.3 Site access

The Contractor must notify the Base ERP Manager, Range Environmental Coordinator, or their designated representative and request approval one week prior to beginning field activities. The Contractor must contact the ERP Manager or other AF representatives, either in-person or by phone conversation, upon arrival at the Base to begin field activities, and at the first morning of each work-week thereafter, if the field activities overlap into the following week.

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1.1.4 Site clean up

The Contractor must, at all times, keep the project sites, including storage areas, free from accumulation of waste materials or rubbish. Prior to completion of the work, the Contractor must remove from the site all tools, equipment, and materials, which are not the property of the

Government. Upon completion of the fieldwork, the Contractor must leave the work premises in a clean, neat, workmanlike condition. The Contractor must properly dispose of excess material (samples, sampling equipment, PPE, etc.). Non-dedicated sampling equipment must be decontaminated and properly removed form the site.

1.8 Government-furnished documents

The following documents are available to the Contractor upon request.

- Engineer Manual (EM) 385-1-1, Safety and Health Requirements Manual, EM 385-1-1, dated 3 September 1996
- Engineer Regulation (ER) 1110-1-263, Engineering and Design, Chemical Quality Management for Hazardous Waste Remedial Activities
- AE Instruction Manual
- HSWA Portion of the RCRA Permit, Avon Park Air Force Range, EPA I.D. No. FL8 572 128 587.

1.9 Reference documents

- 42 U.S.C. 6991 (c), Resource Conservation and Recovery Act (RCRA)
- 42 U.S.C. 9601 (14), Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA)
- AE Guidance for Developing AE Quality Management Procedures for Site Investigation Activities, U.S. Army Corps of Engineers, Omaha District, Environmental Branch
- Final Archive Search Report Finding, Avon Park Air Force Range, January 1999
- AFI 32-7020, The Environmental Restoration Program

8.0 Health and Safety Site Specific Requirements

1. The contractor shall prepare a site-specific addendum to the Basewide Site Safety and Health Plan (SSHP) that together satisfy the requirements for an Accident Prevention Plan and a Safety and Health Program (SHP) required by FAR Clause 52.236-13, 29 CFR 1910.120, and Appendix C of ER 385-1-92. The SSHP shall describe the safety and health procedures and equipment to be implemented to protect personnel from the potential hazards associated with site-specific tasks to be performed.

2. The contractor is responsible for reporting accidents to USACE in accordance with the table below. Blank copies of ENG Form 3394 and NWO Form 1880 will be provided if requested, and must be included in the SSHP in case a reportable accident occurs. Accident investigations are recorded for accident prevention purposes only. Findings and conclusions will not be used as a basis for determining legal liability or charges for negligence.

Accident Class	Notification of Accident (First Report)	ENG Form 3394	Notify OSHA
A	Immediately (Note 2)	Board Report (25 Days) (Note 3)	Yes
B	Immediately (Note 2)	Board Report (25 Days) (Note 3)	Yes
C	Immediately (Note 1)	7 Days	No
D	Immediately (Note 1)	7 Days	No
Medical Treatment (no lost workdays)	Not Required	No	No

NOTE 1: Use Notification of Accident (First Report) NWO Form 1880
NOTE 2: Immediately means as soon as possible after learning of the incident but no later than 8 hours. Units will have established notification procedures to cover 24 hours a day including weekends and holidays.
NOTE 3: Class A and B accidents require investigation by a board and the ENG Form 3394 will be made a part of that report.

A = $1M or more and/or fatality or permanent total disability
B = $200K or more, but less than $1M and or permanent partial disability and/or three or more people are hospitalized.
C = $10K or more, but less than $200K and/or nonfatal injury resulting in loss of workday - Nonfatal illness/disability causes loss of workdays.
D = Property Damage $2K or more, but less than $10K.

3. Incorporate by reference only those sections of the BW SSHP applicable to the current investigation. Add information to the SSHP addendum as necessary to satisfy the requirements in EM 385-1-1 and other applicable directive. The SSHP addendum must at minimum include a signature page, site description, activity hazard analysis, and medical emergency instructions.

a. Signature page: On-site personnel including visitors shall be restricted from entering a controlled area of the site until either reviewing the SSHP addendum and applicable sections of the BW SSHP or receiving a safety briefing. Access to controlled areas at the site shall be restricted at least until the worker or visitor has signed the SSHP addendum. His or her signature represents understanding of the hazards at the site and agreement with the safety controls implemented at the site.

b. Site specific description: Identify the site and describe its physical features. Consult historical information including reports from previous investigations to document hazards that

may be present during site activities. Document or reference toxicity summaries for chemical and radiological contaminants known or suspected to exist at the site, including promulgated occupational exposure limits. Include contractor personnel responsibilities and lines of authority for the current investigation.

c. Activity hazard analysis: Analyze the principle steps for each activity planned. Identify possible safety, chemical, physical radiological, and biological hazards for each step. Propose controls to minimize and control personnel health hazards during site activities, including site control areas, personal protective equipment, workplace monitoring, work procedures, specific personnel training, and other controls that can effectively minimize hazards. Document the activity hazard analysis in the SSHP addendum.

d. Medical emergency instructions: Identify procedures for obtaining medical treatment for injured personnel. Include a map in the SSHP addendum that clearly identifies the route to the nearest medical facility. Include the facility telephone number and other contact information as well as driving directions from the site. Document or reference accident reporting requirements.

4. A Certified Industrial Hygienist (CIH) with experience in hazardous waste site operations is responsible for the development, implementation, and oversight of the contractor's SHP and this project's SSHP. The CIH shall sign and date the draft SSHP addendum before submittal to USACE. The contractor must address USACE review comments, if any, and prepare a final SSHP addendum before beginning onsite activities.

Site Specific Scope of Services for the FY-06 Remedial Action Operations

PURPOSE: Remedial Action-Operation (RA-O) is required to manage and/or maintain:

- The continued removal of petroleum contaminated soil at Site SS-17 that was not remediated by the soil vapor extraction (SVE) system.
- Asphalt covers at sites SD-08 (41,000 square feet at the Refuse Collection Truck Washrack) and OT-14 (12,000 SF at the Former Entomology Shop).
- Investigation and Removal of soil at the leach field at SD-08 and groundwater monitoring.
- Progress monitoring of soil below the engineered caps at SD-08 and OT-14 to assess current status of pesticides in the underlying soil.
- The soil cover, perimeter roads, and fencing at WP-49 (approximately 100 acres at the Sewage Lagoons).
- Natural Attenuation (NA) monitoring as directed by NMED at site SS-61 (AOC-1001).

SD-08 & OT-14, Routine inspection and repairs to cracks in the asphalt caps are necessary at SD-08 (Refuse Collection Truck Washrack) and OT-14 (Former Entomology Shop). At SD-08, approximately 1,500 lineal feet of cracks will be repaired while approximately 2,500 lineal feet of cracks will be repaired at OT-14. Also, additional characterization and removal of contaminated soil associated with the leach field will be required at SD-08. In FY06, co-located soil samples will be collected from beneath the cap at OT-14 from locations where pesticides were identified during the Remedial Investigation . The soil samples will be analyzed to determine if degradation of pesticides has occurred during the 12 years since the original sampling. These results will then be compared to NMED Soil Screening Levels (SSLs). If the results are favorable, the sites will be petitioned for site closeout NFA with NMED.

Work also includes, as necessary, replacing old, incorrect, or missing warning signs at the sites. Repairs and replacements will be conducted as required.

SS-17, Continued excavation to remove PCS and the final decommissioning of branches to the SVE system will be performed at SS-17 (BX Service Station). Approximately 6,000 cubic yards of PCS will be excavated and treated in the onsite landfarm. Approximately 80 soil samples (plus 8 duplicates for quality assurance/quality control) will be analyzed to document site closure and soil treatment.

WP-49, The soil cover must be maintained for a period of 30 years. Maintenance of the cover includes erosion repair, erosion controls, access road grading, and re-vegetation of repair areas. Fence maintenance and repairs are included. During FY06 required activities will include similar activities such as periodic inspections, erosion control, fence maintenance, and removal of salt cedar from fence areas and re-vegetation with climate appropriate cover. Fence repair will include replacement of any damaged sections and replacement of worn or missing signs. The annual repairs to eroded areas will require re-working of approximately 100 yards of soil and grading of the access roads (approximately 1,250 lineal feet).

Site SS-61 (Spill Site AOC-1001) is located east of building 1001. In February 2005, NMED directed the base to initiate at least 8 quarters of natural attenuation groundwater monitoring at this site. The directive identified the specific wells and analytical parameters for groundwater monitoring. Further, the directive included the development and submittal of a plan for NA monitoring. In FY06, the base will develop and submit a NA groundwater monitoring plan for the site and initiate quarterly assessment of groundwater (including the reduction of hydrocarbon constituents).

Site Specific Scope of Services for the RAC Multi-Site

. DESCRIPTION OF PROPOSED CONSTRUCTION: This remedial action-construction (RA-C) at Multi-Sites consists of labor, materiel, equipment and support for: Removal of petroleum contaminated soil (PCS)and hazardous constituents including sludge grit and radionuclide. Removal of these constituents and documentation of site conditions is required to meet the requirements for Site Closeout. The contractor will provide on a monthly basis through the service center to the base and the MAJCOM program manager, the estimated and actual performance of this project on a projected tracking chart.

PROJECT: This RA-C project provides for: the remediation and characterization of subsurface conditions at uncontrolled spills, sludge burial pits, refueling stations, solvent disposal pits, collapsed sewer lines, and burial cylinders. The New Mexico Environment Department (NMED) has ordered these sites cannot be closed out until hazardous waste and/or petroleum hydrocarbon constituents have been removed from these sites. Further, any soil or debris determined to contain hazardous constituents must be remediated in accordance with applicable regulations before Site Closeout can occur. Site Closeout will result in providing an unregulated area available for mission needs of the Air Force.
REQUIREMENT: Health and Safety concerns for Holloman Air Force Base (HAFB) employees and the general public who frequent the area. The regulatory basis of this requirement is provisions of 29 CFR 1910.120, New Mexico Department of Environment and Natural Resources state codes on hazardous wastes, the Federal Comprehensive Environmental Response and Liability Act (CERCLA), and the National Contingency Plan (NCP). Action is required to eliminate a threat to human health and the environment.
Further, in February 2004, the NMED rejected the request to close out these sites (remove them from the HAFB RCRA Permit) and directed HAFB to remove surface debris, PCS and sludge and perform additional characterization of waste materials contained in the identified units

CURRENT SITUATION: A petition to close out sites SS-12, OT-03, OT-20, OT-45, OT-35, OT-37, OT-38, SS-18, OT-32, and RW-42 have been rejected by the NMED. If these actions are not taken or performed, these sites will not receive

Closeout status. If no action is taken, Holloman AFB could receive a Notice of Violation (NOV) resulting in fines from the NMED. A concise description of the current situation and the proposed scope of work by site, are summarized below.

OT-3 The POL Tank Sludge Burial Site is located along the fence east of the POL Area. From 1955 to 1975 wastes such as sludge from the bottoms of tanks containing leaded fuels (Aviation gasoline and regular gasoline) plus jet fuel (JP-4) were discarded in the unlined pit at the fence boundary. The sludge is comprised of grit, metal fragments, and rags. Soil surrounding the pit is dark stained. Analysis of the debris indicates high quantities of lead (maximum 3,750 mg/kg). The site was located by trenching the entire length of the eastern POL Yard fence line. After the location of pit OT-03 was determined, soil and groundwater samples were collected from the pit and surrounding areas to delineate the site. The maximum concentration of TPH detected was 2,200 mg/kg. Also, soil samples containing other petroleum related VOCs and SVOCs were detected along with elevated levels of lead and beryllium. Groundwater samples (one monitoring well only) contained petroleum constituents (benzene, ethylbenzene, toluene, and xylenes) and lead. Groundwater collected from the one monitoring well contained total dissolved solids (TDS) at 14,000 mg/L. The risk assessment conducted as part of the RI determined the site posed an unacceptable risk. During FY06, the sludge and contaminated soil (estimated at 50 cy) will be excavated and removed from the Base for offsite disposal. The soil is assumed to be characteristically hazardous due to the elevated concentration of lead. Soil samples (10) will be analyzed for TPH, VOCs, SVOCs, and RCRA metals. One soil sample will be analyzed for hazardous characteristics using the TCLP (Method 1311). Three groundwater monitoring wells will be installed along the perimeter of the site in order to delineate groundwater conditions including groundwater flow direction. Groundwater samples from new and existing wells (5 total) will be sampled for VOCs, SVOCs, and RCRA metals. A comprehensive report documenting all site activities including all

sampling and analytical results with documentation of excavation activities will be presented to NMED along with a request for site close out NFA.

SS-06 POL Fuel Line Spill Site is located along the eastern boundary of the Base in the main Base area near Building 1254 and 200 feet south of the POL yard. In 1979, a grader ruptured the pipeline and approximately 8,000 gallons of JP-4 were spilled. The bulk (exact volume unknown) was recovered. The site was petitioned for site closeout in 1999 and rejected by NMED in February 2000 due to insufficient characterization. Soil samples collected in 1995 identified the presence of PCS above the NMED Soil Screening Levels (SSLs). Further, NMED believes that more groundwater data from monitoring wells is required to characterize site conditions.

The proposed scope of work for FY06 is to perform additional characterization at the site and excavate PCS and treat the soil at the Base landfarm (estimated at 750 cubic yards [cy]). The additional investigation will consist of installing and sampling four soil borings and permanent monitoring wells as required by the NMED to characterize the extent of contamination. Soil samples will be collected from the excavation to document subsurface conditions. Soil samples (20) will be analyzed for TPH, VOCs, and SVOCs. Groundwater samples (5) will be analyzed for VOCs, SVOCs, and RCRA metals. One soil sample will be analyzed for hazardous characteristics using the TCLP (Method 1311). A comprehensive report documenting all site activities including all sampling and analytical results with documentation of excavation activities will be presented to NMED along with a request for site close out NFA.

SS-12 West POL Fuel Line Spill Site is located east of the main housing area. In 1975, the main pipeline that supplies the POL yard ruptured and approximately 2,000 gallons of JP-4 were spilled to the ground. Much of the fuel (undetermined amount) was collected in a sump using a pumping truck. In 1993 and 1994, investigations of soil and groundwater at the site were conducted to determine the nature and extent of contamination. The site was petitioned for site closeout in 1999 and rejected by NMED in February 2000 due to insufficient characterization. Specifically, the NMED was concerned about the visible staining, vapors from the release, and inadequate characterization given the release was in a residential neighborhood. The proposed scope of work for FY06 is to remove PCS from the site,

perform additional characterization to document removal of PCS, and treat the soil at the Base landfarm (estimated at 2,000 cy). Soil samples will be collected from the excavation to document subsurface conditions. Soil samples (30) will be analyzed for TPH, VOCs, and SVOCs. One soil sample will be analyzed for hazardous characteristics using the TCLP (Method 1311). A comprehensive report documenting all site activities including all sampling and analytical results with documentation of excavation activities will be presented to NMED along with a request for site close out NFA.

SS-18 Chromic Acid Spill Site is located on the south side of Building 281. It is estimated that 500 gallons of chromic acid spilled on the ground at Site 18 and some of the acid may have flowed to the surface drainage ditch just west of the storage area. No hexavalent chromium was identified in the soil and groundwater samples selected from the borehole and monitoring well. During FY06, the site will be characterized to determine if hazardous constituents exist at the site. Three DPT soil borings will be installed in the suspect area. Field screening techniques will be used to identify two soil samples from each boring (6 plus 1 duplicate) for laboratory analysis. Three additional groundwater monitoring wells will be installed and groundwater samples will be collected (from the new wells and existing well MW-18-1) and analyzed (4 plus 1 duplicate) to assess groundwater quality and to identify the presence of hazardous constituents. Soil samples will be analyzed for TPH, VOCs, SVOCs, and RCRA metals. Groundwater samples (5 total) will be sampled for VOCs, SVOCs, and RCRA metals. A comprehensive report documenting all site activities including all sampling and analytical results will be presented to NMED along with a request for site close out NFA (if appropriate).

OT-20 Sewage Lagoons Disposal Trenches are located northeast of Sewage Lagoon Pond B. The site is comprised of three distinct trenches. The trenches contain sludge and grit removed from processing equipment in

the treatment plant. The site was delineated with transverse trenching performed during the 1991 RI. Sludge identified in the trenches was gritty, wet, black, and grey and included fecal material. Soil surrounding the grit was also stained dark and moist. The trenches are approximately 2 feet wide, 5 feet deep, and 40 feet long. Soil samples collected from the trenches contained RCRA metals with lead (maximum 48 mg/kg) and mercury (maximum 2.5 mg/kg) being the most abundant. Soil samples contained the pesticides endoslfan II (maximum 430 µg/kg) and heptachlor epoxide (maximum 5,000 µg/kg) and the herbicide dicamba (maximum 220 µg/kg). One soil sample contained PCBs at 4,800 µg/kg. No VOCs or SVOCs were positively identified in the samples. The site was petitioned for site closeout in 1999 and rejected by NMED in February 2000 due to the presence of pesticides and PCBs. The proposed scope of work for FY06 is to remove the grit and any impacted soil exceeding the NMED SSLs. Soil samples will be collected from the excavations to document subsurface conditions. Soil samples (27) will be analyzed for TPH, VOCs, SVOCs, RCRA metals, pesticides (plus PCBs), and herbicides. One (1) sample of the excavated soil and grit will be analyzed for hazardous characteristics using the TCLP (Method 1311) to facilitate disposal. The estimated cost for this operation assumes the soil and grit is non hazardous and can be disposed of as solid waste (special waste) at a Subtitle D landfill (such as the Otero County Landfill or the Camino Real Landfill in Sundland Park, New Mexico). A comprehensive report documenting all site activities including all sampling and analytical results with documentation of excavation activities will be presented to NMED along with a request for site close out NFA.

OT-32 Collapsed Primate Research Area Sewer Lines serviced the Primate Research Area (PRA). The collapsed lines are approximately 3,000 to 4,000 feet in length and are buried approximately 6 to 8 feet below grade south of the PRA. The lines drained sewage from the PRA and the collapse resulted in the release of sewage which may have contained small quantities of Carbon^{14}, Iodine^{125}, and tritium plus volatile and semi-volatile organic compounds from the PRA

PRA. Leakage from the sewer lines is believed to have occurred from the early 1960s to 1981 when the lines were replaced. Soil samples collected from borings installed along the collapsed lines contained no oil and grease. Analytical results from the soil samples did contain TOX (maximum 24.7 mg/kg), and Carbon^{14} (maximum 240 ±194 pCi/g). Analysis of NMEDSSL constituents (such as VOCs, SVOCs, and RCRA metals) was not performed.

NMED rejected the request for site closeout NFA because of insufficient characterization. Site closeout can not be obtained from NMED without additional characterization of soil and groundwater conditions and the removal or treatment of soil with constituents above the NMED SSLs. During FY06, the site will be characterized to determine if hazardous constituents exist at the site. Twelve DPT soil borings will be installed along the length of the collapsed area as close as possible to the PRA. Field screening techniques will be used to identify two soil samples from each boring (24 plus 3 duplicates) for laboratory analysis. The boreholes will be completed with temporary groundwater monitoring wells. Groundwater samples will be collected and analyzed (12 plus 2 duplicates) to assess groundwater quality and to identify the presence of hazardous constituents. Based upon the soil and groundwater analytical results, approximately 300 lineal feet of collapsed line will be excavated and examined further to document conditions in the lines. If necessary, the lines will be removed for disposal prior to backfilling of the trench. This estimate assumes the lines can be disposed of as solid waste construction debris. Soil samples will be analyzed for TPH, VOCs, SVOCs, RCRA metals, and radionuclide (gross alpha, gross beta, and total gamma). Groundwater samples (5 total) will be sampled for VOCs, SVOCs, RCRA metals, and radionuclide. A comprehensive report documenting all site activities including all sampling and analytical results will be presented to NMED along with a request for site close out NFA (if appropriate).

OT-35 Spent Solvent Disposal Area is an area of bare ground near the Central Inertia Guidance Test Facility. Interviews with past employees indicated that spent solvents possibly containing radioactive tracers were placed on the ground surface and ignited. The practice was reported to be intermittent during the 1950s with volumes per ignition ranging from 20 to 70 gallons. The radioactive tracers in the solvents may have been iodine^{125}, carbon^{14}, and tritium. It should be noted that not all past employees could verify the solvent disposal practice. A PA was performed at the site in 1991. No soil or groundwater samples were collected and analyzed to characterize the site. The PA and risk evaluation determined using only visual evidence and employee interviews that the site posed no

threat to human health or the environment and should be closed. NMED rejected the request for site closeout NFA because of insufficient characterization. Site closeout can not be obtained from NMED without the characterization of soil and groundwater at the site and the removal of soil containing constituents exceeding the NMED SSLs. Further, the additional investigation will require characterization of groundwater conditions at the site. During FY06, the site will be characterized to determine if hazardous constituents exist at the site. A passive soil vapor survey (16 points) will be installed across the site to identify "hot spots" for soil boring and soil sample collection. Based upon the soil vapor survey, three direct push technology (DPT) soil borings will be installed in the suspect area. Field screening techniques will be used to identify two soil samples from each boring (6 plus 1 duplicate) for laboratory analysis. Four groundwater monitoring wells (one up-gradient well and three down-gradient wells) will be installed and groundwater samples will be collected and analyzed (4 plus 1 duplicate) to assess groundwater quality and to identify the presence of hazardous constituents. Soil samples will be analyzed for TPH, VOCs, SVOCs, RCRA metals, and radionuclide (gross alpha, gross beta, total gamma, and tritium). Groundwater samples (5 total) will be sampled for VOCs, SVOCs, RCRA metals, and radionuclide. A comprehensive report documenting all site activities including all sampling and analytical results will be presented to NMED along with a request for site close out NFA (if appropriate

OT-37 Early Missile Testing Site is located east of the sled test maintenance area and was used to develop rocket and missile systems from 1947 to 1955. The site is comprised of three block houses, an inclined track, three vertical launch pads, and a large pit located northwest of building 1142. Step down transformers are located in close proximity of each block house and the inclined track. Soil borings and monitoring wells were installed at the site during the 1991 RI. Soil analytical results identified two metals, cadmium and lead, above the background upper threshold limits (UTLs) but are less than NMED SSLs. Soil samples collected near the transformers, however, identified TPH (maximum concentration 30,600 mg/kg) in excess of NMED SSLs. The maximum concentration of PCBs detected in soil was 3.2 mg/kg. Groundwater analytical results from samples collected from the monitoring wells at the site contained total dissolved solids (TDS) greater than 10,000 mg/L. No VOCs or metals were detected in excess of New Mexico Water Quality Control Commission (NMWQCC) standards except for nitrate which ranged from 48 mg/L to 66 mg/L. The concentration of TPH near the transformers (HA-37-04 at 30,600 mg/kg) exceeds the NMED SSLs for TPH regardless of the PCB content. The maximum PCB concentration identified during the RI (PCB 1260 of 3.2 mg/kg) exceeds the NMED SSL of 1.1 mg/kg. The site was rejected by NMED for site closeout NFA due to insufficient characterization and the high concentration of TPH in soil. The proposed scope of work for FY06 is to remove the impacted soil exceeding the NMED SSLs from around the transformers (estimated at 300 cy). Soil samples will be collected from the excavations to document subsurface conditions. The estimated volume of soil requiring removal is 300 cubic yards. Soil samples (50) will be analyzed for TPH, VOCs, SVOCs, RCRA metals, explosives, and PCBs. One sample of the excavated soil will be analyzed for hazardous characteristics using the TCLP (Method 1311) to facilitate disposal. One round of groundwater samples will be collected from the existing monitoring wells to document the most recent groundwater conditions. Groundwater samples (6 plus 1 duplicate) will be analyzed for VOCs, SVOCs, explosives, PCBs, RCRA metals, and perchlorates. The estimated cost for this operation assumes the soil is non hazardous and can be disposed of as solid waste (special waste) at a Subtitle D landfill (such as the Otero County Landfill or the Camino Real Landfill in Sundland Park, New Mexico). A comprehensive report documenting all site activities including all sampling and analytical results with documentation of excavation activities will be presented to NMED along with a request for site close out NFA.

OT-38 Test Sled Maintenance Area is located at the rear of Building 1166 near the Test Sled Drain Field. From 1951 to 1979 waste oils, solvents, paint strippers, and hydrocarbon fuels were discharged to the cesspool behind the building. The cesspool was an unlined pit approximately 6 feet deep and 10 feet in diameter. In the early 1980s, the cesspool was replaced with a septic tank and drain field system. Soil borings and groundwater monitoring wells were installed and sampled during the 1991 RI. Soil samples from borings installed in the pit contained TPH (maximum 1,540 mg/kg) above the NMED SSLs. No metals exceeded UTLs and no VOCs were detected in the soil samples. Analytical results from groundwater samples collected at the site identified trichloroethene (TCE) with a maximum

concentration of 3.1 µg/L. No other VOCs were positively identified in the groundwater. TDS in wells at the site ranged from 5,500 mg/L to 15,000 mg/L. Other constituents such as chloride (maximum 3,800 mg/L), sulfate (maximum 4,900 mg/L), and nitrate (maximum 130 mg/L) exceed NMWQCC standards. NMED rejected the request for site closeout NFA because of insufficient characterization. Site closeout can not be obtained from NMED without additional characterization of soil conditions and the removal of PCS above the NMED SSLs. Further, since it has been 14 years since groundwater was last assessed, a round of groundwater samples must be collected and analyzed from the existing wells. The proposed scope of work for FY06 is to perform additional characterization at the site, excavate PCS, and treat the soil at the Base landfarm (estimated at 350 cy). The additional investigation will consist of sampling the three existing monitoring wells as required by the NMED to characterize the extent of contamination. Soil samples will be collected from the excavation to document subsurface conditions. Soil samples (10) will be analyzed for TPH, VOCs, and SVOCs. Groundwater samples (4) will be analyzed for VOCs, SVOCs, perchlorates, and RCRA metals. One soil sample will be analyzed for hazardous characteristics using the TCLP (Method 1311). A comprehensive report documenting all site activities including all sampling and analytical results with documentation of excavation activities will be presented to NMED along with a request for site close out NFA.

RW-42 Radioactive Waste Burial Site is located approximately 6.5 miles north of the Main Base Area east of Range Road 9 and south of Hay Draw in an undeveloped northeastern area of Holloman AFB. The repository consists of a buried concrete cylinder surrounded by a three strand barb wire fence. The cylinder is 10 feet long and 5.5 feet in diameter with an extended opening tube 8 feet long and 1.5 feet in diameter. NMED rejected the request for site closeout NFA because of insufficient characterization. Additional characterization and removal of any radioactive material or hazardous material is required before site closeout will be granted.

During FY06, in-situ investigation of the cylinder will be conducted to determine its contents and the appropriate disposal. Worker protection and environmental monitoring will be conducted as the cylinder lid is penetrated with a small hole. If radiation levels are acceptable, then additional monitoring for volatile organic vapors will be performed. A camera will be lowered into the opening to assess the volume and types of materials in the cylinder. Excavation will be performed adjacent to the cylinder (20 feet deep) in order to assess its condition, whether the cylinder has a bottom, and to access the contents of the cylinder. If appropriate, samples of the material will be collected for analysis. The crews performing the activity will have sufficient PPE to either complete the task or safely backfill the excavation in the event conditions warrant. Once the content of the cylinder is known, appropriate disposal of the contents and the cylinder can be performed. Samples of the cylinder contents will be analyzed for TPH, VOCs, SVOCs, RCRA metals, and radionuclide (Carbon^{14}, Iodine^{125}, tritium, gross alpha, gross beta, total gamma). Groundwater samples (5 total) will be sampled for VOCs, SVOCs, RCRA metals, and radionuclide. A comprehensive report documenting all site activities including all sampling and analytical results will be presented to NMED along with a request for site close out NFA (if appropriate).

OT-45 Old Aero Space Ground Equipment (AGE) Refueling Station was comprised of several underground storage tanks (USTs), a pump island, and fuel station. The facilities were removed in the 1980s and were replaced with a parking lot and landscaped areas. Workers encountered liquid hydrocarbons during a trenching operation in the late 1980s. The site has undergone limited excavation to eliminate PCS, and two phases of RI. Additional investigation was conducted in 1994 to determine if PCS above the action level was still present. Samples from at least 2 borings contained PCS in excess of the NMED SSLs. The site was petitioned for site closeout in 1999 and rejected by NMED in February 2000 because PCS exceeded the NMED SSLs. The proposed scope of work for FY06 is to excavate the remaining PCS and treat the soil at the Base landfarm (estimated at 1,500 cy). Soil samples will be collected from the excavation to document subsurface conditions. Soil samples (30) will be analyzed for TPH, VOCs, and SVOCs. One soil sample will be analyzed for hazardous characteristics using the TCLP (Method 1311). A comprehensive report documenting all site activities including all sampling and analytical results with documentation of excavation activities will be presented to NMED along with a request for site close out NFA.

ATTACHMENT B

RESPONSE TO COMMENTS

Nick Geibel

RESPONSE TO COMMENTS
Voluntary Corrective Measures Work Plan
Multiple Sites, September 2006
Holloman AFB, New Mexico

COMMENT NO.	SECTION	PAGE	COMMENT	RESPONSE
AUTHOR:	**Nick Geibel (USACE Omaha)**		**Date of Comments: October 5, 2006.**	**Date of Response: October 6, 2006**
DOCUMENT:	**Multiple Sites VCM Work Plan**			
1	Sec. 3, 1st para., last sent.	3-1	With respect to the petition for NFA for sites SS-06 and OT-35 is there any rational, in addition to small source area sizes, that could be listed to further NFA?	The referenced sentence states, "As previously discussed, two sites (SS-06 and OT-35) will be petitioned for NFA and due to its small size, the source area at OT-03 will be excavated without further characterization." A complete description of the previous investigations and rational for NFA at sites SS-06 and OT-35 is presented in Sections 2.7.2 and 2.4.2 respectively. Due it's small size, the OT-03 source area (approx 10-ft x 6-ft) will be excavated without further characterization as agreed upon by NMED during the May 5, 2006 meeting (see Sec 1., 3rd para., 5th sent.)
2	Sec. 3, 3rd para.	3-1	Should clarify for phase 2 activities that soil source areas will be excavated (and/or any significant smear zone at the water table), as needed, because we seem to do a lot of soil excavation below the water table. Also, should clarify what will be done, if anything, if a groundwater plume is identified (may also need to distinguish between a soil source area and a groundwater hotspot). Some of these items are discussed in a little more detail later in this work plan but should be identified here also.	Section 3 of the Multiple Sites ACM Work Plan provides the site specific details for the additional investigation activities at each site (if required). The purpose of the 3rd paragraph in Section 3 is to refer the reader to Section 4 (Excavation Procedures) for the site specific procedures for excavating source areas. For clarification, this sentence will be reworded as follows, "The second phase of the ACM Work Plan is to remove, through excavation and properly dispose of the source areas for the sites (refer to Section 4 of this Work Plan for site specific procedures for source area excavation)." Additionally a risk based evaluation will be conducted at Sites where contaminants are detected above groundwater standards (see Section 6.4 of this Work Plan).
3	Sec. 3.1, 1st bullet	3-1	I assume surface soil samples are not required (at OT-03, OT-20, OT-37, OT-45) because it is anticipated that each of these source areas will be excavated. Could it turn out, after review of subsurface soil sampling, that the source areas for the other sites will not need to be removed for whatever reason? If so, would surface-soil samples then be needed to support NFAs?	Correct, based on historic data there are detections in the soil that are above current NMED soil screening levels (SSLs) (Rev. 4, June 2006) at OT-03, OT-20, OT-37, and OT-45, therefore each of these source areas will be excavated as part of this Work Plan. It is also true that the data from the previous investigations at sites OT-32, OT-38, SS-12, SS-18, and RW-42 were not conclusive. The excavation of source areas at these sites may not be necessary if the additional sampling results are not above the SSLs. Additionally, surface soil samples (0 to 2 ft bgs) will be collected for analysis at OT-37 (transformer pads) and at OT-20 therefore a "surface soil sampling" bullet has been added Section 3.1 after the 1st bullet.

RESPONSE TO COMMENTS
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COMMENT NO.	SECTION	PAGE	COMMENT	RESPONSE
4	Sec. 3.1.1.1	3-2	A) At completion of exploration trenching, state what is going to be done with the trench spoils (are they just going to be backfilled into the trench or segregated and disposed of?). B) I assume DPT soil borings are going to be logged, what about the trench – is some type of lithologic/contaminant log going to be developed along with photographic documentation?	A) Concur, added the following sentences at the beginning of the 2nd paragraph; " At completion, the exploration trench will be backfilled with the excavated trench spoils. In the event that visible grit is encountered, the grit material will be segregated for offsite disposal when the three grit disposal pits are excavated." B) Concur, added sentence, " A lithologic/contaminant description of the trench will be recorded in the field logbook".
5	Sec. 3.1.1.2 , 1st para., last 2 sent.	3-3	Are the samples obtained from DPT truly classified as undisturbed with respect to geotechnical criteria? Also, are undisturbed samples required for dry bulk density and specific gravity? Just curious.	Accutest and Severn Trent Laboratories have confirmed that the DPT soil samples collected in a thin-walled plastic tubed sampler (with tube ends capped) classify as undisturbed samples that can be analyzed for; Moisture Content (EPA160.3), Bulk Density (ASTM D2937), Specific Gravity (ASTM 1429) and Fractional Organic Carbon (ASTM D2974).
6	Sec. 3.1.1.3, general	3-3	With wells being placed up and down gradient of the site, is this appropriate for completion of risk-based evaluation (i.e., what if there is higher concentrations of target compounds between the up- and down-gradient well locations)? Or, is the site so small that this is not a concern?	NMED requires site specific up and downgradient groundwater quality data for the Site Closure documentation.
7	Sec. 3.1.7.1, last sent.	3-8	A) for this site, RW-42 radioactive waste burial site, where carcasses of primates injected with low level radioactive tracers where disposed by encasement in and burial of a concrete cylinder why would VOCs, SVOCs, TPH be required to be tested (also in groundwater samples)? Is this a NMED requirement to sample for these constituents. B) Is tritium the only tracer that was used or was there others that need to be analyzed for (need to clarify per 1st sentence in this section where the example given is tritium)?	A) Yes sampling for VOCs, SVOCs, metals and TPH is an NMED requirement. B) Tritium, iodine-125, and carbon-14 were all used as tracers, therefore iodine-125 and carbon-14 have been added to the first sentence.
8	General		Please note that some of the above comments may pertain to sites other than the site referenced.	Comment noted.

END OF COMMENTS

Judy Strawhecker

RESPONSE TO COMMENTS
Voluntary Corrective Measures Work Plan
Multiple Sites
Holloman AFB, New Mexico

COMMENT NO.	SECTION	PAGE	COMMENT	RESPONSE
AUTHOR:	Judy Strawhecker (USACE Omaha)		Date of Comments: October 31, 2006.	Date of Response: November 3, 2006
DOCUMENT:	VCM Work Plan Site Multiple Sites			
1	3	3-1, 2nd ¶ and through-out doc.	At some sites, there is surface soil sample collection. The document usually refers to subsurface soil data – please revise.	Concur. A bullet for "Surface soil sampling" has been added to the list of field activities. Surface soil sampling (0 - 2 feet below ground surface [ft bgs]) will be conducted at OT-20 and OT-37.
2	3.1.1	3-2, 1st ¶	Surface soil sampling is also involved.	Concur. "Surface soil sampling" has been added to this paragraph.
3	3.1.1.2	3-2, 1st bullet	Please elaborate on the reasoning behind the 1-ft bgs sample taken at each DPT soil boring location. The risk-based evaluation will evaluate exposure pathways relative to current and future industrial workers, and the NMED Soil Screening Levels guidance cites the commercial/industrial worker exposure to surface and shallow subsurface soils at depths of zero to two ft bgs.	Identifiable grit waste was observed from 0.2 to 8 ft bgs within the three OT-20 sewage disposal pits during the 1992 29 Waste Sites Remedial Investigation (see Section 2.2.2). Therefore, the first bullet in Section 3.1.1.2 has been revised to read "One soil sample will be collected from 0 to 2 ft bgs".
4	3.1.2.1	3-4, 2nd ¶ and through-out doc.	There is a discrepancy between text in Section 3 and Section 6. The text in Section 3 calls chemical constituents "chemicals of concern", and the text in Section 6 refers to them as "chemicals of potential concern". Please revise for consistency.	Concur. For consistency, "chemicals of concern" and "contaminants of concern" have been changed throughout this Work Plan to read "chemicals of potential concern".
5	3.1.2.1	3-4, 2nd ¶	Please elaborate in Section 6 as to how geotechnical samples will be used in the site-specific risk evaluation.	Site-specific risk evaluations will be performed in accordance with the NMED risk evaluation guidance. The geotechnical data (dry bulk density, specific gravity, fractional organic carbon and moisture content) are used to develop site specific soil screening levels (SSLs). The calculation of SSLs is presented in Section 4.7, Development of Site Specific SSLs for Protection of Groundwater, *NMED Technical Background Document for Development of Soil Screening Levels*, Rev 4.0, June 2006 (for the entire SSL guidance document please refer to http://www.nmenv.state.nm.us/hwb/guidance.html). The reference for calculating SSLs using NMED guidance is presented in the last sentence of Section 6.4.5. For clarification, this sentence has been revised to read "Using the above information and geotechnical data (dry bulk density, specific gravity, fractional organic carbon, and moisture content) site-specific screening levels will be calculated using equations presented in the *Technical Background Document for Development of Soil Screening Levels, Revision 4.0* (NMED, June 2006)."

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COMMENT NO.	SECTION	PAGE	COMMENT	RESPONSE
6	3.1.6	3-7, 1st ¶	If this investigation is necessary because the source area was misidentified in the first investigation, please provide justification as to why surface soil sampling is not necessary based on the conceptual site model.	During the initial SS-18 investigation (1982) 10 yellow stained surface soil samples were collected from the chromic acid spill area and analyzed for hexavalent chromium analysis. These samples were collected in the correct spill/source area. The TCLP results for the composite hexavalent Cr sample was 0.600 mg/L which is well below the USEPA standard of 5 mg/L. The IRP Phase II investigation (Dames & Moore, 1987) was conducted in the wrong downgradient locations. Therefore, surface soil sampling of the source area is not required for this investigation. Please refer to Section 2.9 for additional information regarding the SS-18 site description and previous investigations.
7	3.1.8.3	3-9, 1st ¶	Please elaborate on the reasoning behind the 1-ft bgs sample taken at each DPT soil boring location. Section 6 indicates that new data will be pooled with historical data for risk evaluations. Most of the historical data has surface soil data being 0-2 ft bgs. Please check for data usability for risk evaluations and State of New Mexico concurrence of what constitutes a "surface soil" sample.	The rationale (presented in Table 3-1) is to better define/delineate the extent of PCB/TPH soil contamination around each of the four OT-37 transformer pads. In order to be consistent with the historical data the sampling interval has been revised to "0 to 2 ft bgs". As per the *Technical Background Document for Development of Soil Screening Levels,* Rev. 4, NMED, June 2006, Section 5, 4th sentence last paragraph, "...surface soil, may be defined as extending to a depth of approximately two feet below ground surface..."
8	3.1.8.3	3-9, 1st ¶	Please elaborate on the reasoning behind the statement, "If headspace readings are less than 50 ppm, no subsurface soil samples will be collected for offsite analysis." The constituents of potential concern are PCBs and DROs which do not volatilize well, and PCBs also have risk-based screening levels below 50 ppm in soil.	Concur. Removed referenced sentence and replaced with, "If screening techniques do not indicate a clear selection for analysis, the subsurface soil sample will be collected from the 8 to 10 ft bgs interval."
9	4	4-1, 5th bullet	Please be consistent with either contaminant of concern or contaminant of potential concern.	Concur. For consistency, "chemicals of concern" and "contaminants of concern" have been changed throughout this Work Plan to read "chemicals of potential concern". (See Comment # 4)
10	4.1.3	4-3, 2nd ¶	Please revise, 29 CFR **1926**, Subpart P.	Concur. Revised to read, "...as per 29 CFR 1926, Subpart P.
11	4.3.1.4	4-5, 1st ¶	Please provide more clarification as to why the soil at OT-37 will be sent to an offsite TSCA landfill for disposal. The PCB-contaminated soil only goes to a TSCA landfill if concentrations exceed 50 mg/kg or if the concentration below 50 ppm was the result of dilution.	Concur. Although there are documented exceedances above the NMED SSLs for PCBs at OT-37, none of the historical data indicates that PCB-contaminated soil has exceeded 50 mg/kg. Therefore the 5th sentence in the referenced paragraph has been revised to read, "...and sent to an offsite RCRA landfill for disposal. Contaminated soil with PCB concentrations exceeding 50 mg/kg will be sent to an offsite TSCA landfill for disposal."
12	4.3.2	4-5, 1st ¶	Please revise. As per USACE EM 385-1-1 (3 Nov 03), Shoring shall be used for unstable soil or depths **>5 ft (>1.5 m)** unless benching, lay-back, or other acceptable plan is implemented by the Contractor.	Concur. Added sentence and USACE EM 385-1-1 reference to Section 4.3.2 after the 1st sentence.

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COMMENT NO.	SECTION	PAGE	COMMENT	RESPONSE
13	6.4.1	6-2, 1st ¶, 1st sent.	Please revise to say, "the first step in the risk evaluation process…." A risk assessment implies a different evaluation process, and that process is not outlined here.	Concur, The sentence has been revised to read, " As a first step in the risk evaluation process…"
14	6.4.2	6-2, 1st ¶	Please be consistent with either contaminant of concern or contaminant of potential concern	Concur. For consistency, "chemicals of concern" and "contaminants of concern" have been changed throughout this Work Plan to read "chemicals of potential concern". (See Comment # 4)
15	6.4.4	6-3, 1st ¶	Please indicate what NMED screening numbers will be used for soil, Residential, Industrial/Occupational, or Construction Worker. My suggestion is to use the more conservative of the Industrial/Occupational or Construction Worker.	As per the Holloman AFB RCRA permit (NM6572124422) the NMED SSLs for residential soil will be used for soil cleanup levels at HAFB. The reference to residential soil has been added to the first sentence in the first paragraph of Section 6.4.4.
16	6.4.5	6-3, 1st ¶	I don't see the practicality in calculating site-specific screening levels when NMED guidance already has Industrial/Occupational and Construction Worker soil screening numbers. Do you mean to say that you would calculate preliminary remediation goals? Please provide additional justification for why this is necessary and also if there is NMED buy in.	As per the Holloman AFB RCRA permit (NM6572124422) Appendix 4-F *Action Levels and Cleanup Levels,* "The Permittee may use site-specific data to develop cleanup levels provided for in NMED's *Technical Background Document for Development of Soil Screening Levels".* Appendix 4-F of the Holloman AFB RCRA permit can be found on NMED's website, http://www.nmenv.state.nm.us/.
17	6.4.6	6-3, 1st ¶	There is a disconnect in the risk evaluation process. Section 6.4 states that the risk evaluation process is happening after investigation and excavation activities, while the rest of the section implies that you are using the data after the investigation to determine the amount of excavation activity, especially Section 6.4.6 which implies that target clean up levels/preliminary remediation goals will be determined and compared to the COPC representative concentration (maximum?). This section needs to be revised/checked to reflect how the data will be used to assess risk and site closure.	Concur. Site specific risk based evaluations will be conducted after the investigative and excavation activities have been performed. Section 6.4 states, "The risk based evaluation will be included in the Closeout Report for each site that has contaminants above SSLs or groundwater standards." In addition, the last sentence in Section 6.4.6 has been revised to read, "If any COPC exceeds its respective site-specific screening level, additional risk management strategies (i.e., institutional controls or other alternatives) will be evaluated."

END OF COMMENTS

Adam Little

RESPONSE TO COMMENTS
Voluntary Corrective Measures Work Plan
Multiple Sites
Holloman AFB, New Mexico

COMMENT NO.	SECTION	PAGE	COMMENT	RESPONSE
AUTHOR:	**Adam Little (USACE Omaha)**		**Date of Comments: November 3, 2006.**	**Date of Response: November 8, 2006**
DOCUMENT:	**VCM Work Plan Site Multiple Sites**			
1	General Comment		Recommend staying away from calling the document a "Soil Remediation" due to the fact that it is a broader investigation versus just a soil remediation.	Concur. Based on recent new guidance from the New Mexico Environment Department (NMED) the work plan has been renamed "Accelerated Corrective Measures Work Plan, Multiple Sites, Holloman AFB, NM". "Soil Remediation" has been removed from the Work Plan title. This global change has been made throughout the Work Plan.
2	2		When referring back to all the historical detections either being high or low with regards to the clean-up level, please clarify or reference where the specific levels are found in order to give a better sense of how high or low they actually are. The detections will then have more value with deciding how necessary the new samples will be.	Historical data is compared and referenced to the NMED Soil Screening Levels (SSLs) presented in the *Technical Background Document for Development of Soil Screening Levels,* Rev. 4.0, June, 2006 throughout Section 2 during the discussions of site-specific previous investigations. The current SSLs (NMED, 2006) will be used as the soil clean up criteria for site-specific contaminants of concern (presented in Section 6) and are presented in Appendix J.
3	2		Please verify with the State of New Mexico regulations as to what a "surface" soil sample is considered with regards to feet below ground surface. Then clarify in the report which are surface and which are subsurface samples for consistency.	Concur. As per the Technical Background Document for Development of Soil Screening Levels, Rev. 4, NMED, June 2006, Section 5, 4th sentence last paragraph, "...surface soil, may be defined as extending to a depth of approximately two feet below ground surface..." For clarification the following bullet "Surface soil sampling (0-2 ft bgs)" has been added to the list of field activities presented in Section 3.1 *Site Specific Field Investigations* .
4	2.4.1		Change "Solid" to Solvent in the second sentence.	Concur. Changed "Solid" to "Solvent" in the second sentence, first paragraph.
5	3		Please clarify in the report initially how you will be collecting your DPT samples (i.e. acetate sleeve, split spoon, etc.). Will you have enough soil to fill all the necessary containers for each parameter? If this is in an SOP, please reference this in the report and make sure it specifically states how it will be sampled at this site and not just a generic SOP with multiple methods.	Concur. The following sentence has been added after the first sentence (1st para., Sec. 3.3.2), "The DPT soil sampler is a stainless steel tube that contains an inner acetate sleeve." The acetate sleeve is approximately 1.25-in by 4-ft. Based on previous DPT sampling events at HAFB, this sampler will hold enough soil for the required sampling analyses at these sites. The first sentence (1st para., Sec. 3.3.2) references HAFB SOP No. 4 *Direct Push Sampling for Soil and Groundwater.*
6	3		Insert minimal language for clarification stating if the soil samples are going be composite samples or not.	Concur. The following sentence has been added after the 4th sentence (2nd para., Sec. 3.3.2), "The soil samples selected for chemical analysis will be collected as discrete (grab) samples".

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COMMENT NO.	SECTION	PAGE	COMMENT	RESPONSE
7	3.1.1		Please elaborate on your justification for sampling VOCs, SVOCs, TPH (DRO,GRO,ORO) PCBs, organochloride pesticides, chlorinated herbicides, and 8 RCRA metals. In the historical section for this site, not only did they recommend NFA, but they state that only solvents, metals and PCBs were historically associated with site. Please also elaborate on the parameters being sampled on the other sites as well as parameters for groundwater. Often times it seems as though the parameter list is a little excessive and can be minimized and still meet the objectives. Please clarify reasoning behind collecting TDS at groundwater sites. How is this helping you meet your objectives of delineating and excavating contaminated soil and seeing if groundwater is impacted?	Regardless of historically documented site specific contaminants of potential concern, the New Mexico Environment Department (NMED) requires the analysis of a full suite of parameters in order to prove that a site is "clean". Additionally sampling for a full suite of parameters (with no detections above soil screening levels [SSLs] or groundwater standards) will facilitate NMED's site specific approval of "No Further Action". The analysis of TDS for all groundwater samples is also an NMED requirement.
8	3.1.1.2		Please clarify what you mean by the "two undisturbed geotechnical samples" that are being collected. Some of what these samples are being analyzed for sounds similar to geotechnical soil characterization. How are they going to be utilized for risk-based evaluation?	Geotechnical soil sampling procedures and analytical methods are described in Section 3.3.2.1. Site-specific risk evaluations will be performed in accordance with the NMED risk evaluation guidance. The geotechnical data (dry bulk density, specific gravity, fractional organic carbon and moisture content) are used to develop site specific SSLs. The calculation of SSLs is presented in Section 4.7, Development of Site Specific SSLs for Protection of Groundwater, *NMED Technical Background Document for Development of Soil Screening Levels*, Rev 4.0, June 2006 (for the entire SSL guidance document please refer to http://www.nmenv.state.nm.us/hwb/guidance.html). The reference for calculating SSLs using NMED guidance is presented in the last sentence of Section 6.4.5 *Calculation of Site-Specific SSLs*. For clarification, this sentence has been revised to read "Using the above information and geotechnical data (dry bulk density, specific gravity, fractional organic carbon, and moisture content) site-specific screening levels will be calculated using equations presented in the *Technical Background Document for Development of Soil Screening Levels*, Revision 4.0 (NMED, June 2006)."
9	3.1.1.3		Insert language stating if these wells are going to be permanent wells or if they are temporary. Some sites it is clear and some sites it is not. Also, elaborate briefly as to how specifically at these sites the groundwater is going to be sampled (i.e. low flow, stabilizing parameters, etc.). If it is included in a SOP, please reference the SOP and include it in this document and make sure that it is not a generic groundwater sampling SOP with multiple sampling techniques; it needs to be specific for the specific site.	Concur. The first sentence in Section 3.1.1.3 has been revised to read; "One upgradient and two downgradient permanent monitoring wells will be installed at OT-20…". The groundwater sampling methodology is presented in Section 3.3.4. The following text has replaced the second sentence in Section 3.3.4; "Groundwater samples will be collected in accordance with Bhate SOP No. 10 (*Subsurface Water Investigation*), Section 4, Monitoring Well Sampling. A minimum of 48 hours will elapse between well development and sampling.". These SOPs are not being included in this Work Plan for several reasons; the NMED is familiar with the sample collection procedures for soil and groundwater and have audited sampling activities in the past. Copies of the Bhate and HAFB SOPs are located in the Bhate field office, Holloman AFB, NM.

RESPONSE TO COMMENTS
Voluntary Corrective Measures Work Plan
Multiple Sites
Holloman AFB, New Mexico

COMMENT NO.	SECTION	PAGE	COMMENT	RESPONSE
10	3.1.2.1		Please elaborate on the field screening method that you will be utilizing. Some sites it is clear and others it is not, stay consistent through the document.	The methodology for using an Organic Vapor Analyzer for field screening is presented in Section 3.3.2. Section 3.3.2 states that subsurface soils will be field screened in accordance with HAFB SOP. No. 6 *Procedure for Field Screening of Volatile Organics.* Additionally, Section 3.1.2.1 states that "If the screening techniques do not indicate a clear selection for analysis, then the samples will be collected from immediately above the groundwater table (approximately 30 ft bgs) and from the mid depth of the borehole (approximately 15 ft bgs)."
11	3.1.2.2		Clarify when and how you are planning on sampling the newly installed monitoring wells. Reference the SOP and include if necessary as to if you are going to develop the wells, come back and sample, is this going to be under another report, etc. Please also address other newly installed wells also.	Concur. The methodology for monitoring well development and groundwater sampling is presented in Sections 3.3.3 and 3.3.4 respectively. The following text has been added after the first sentence in the third paragraph of Section 3.3.3. "After completion, the wells will be allowed to stabilize for 24 hours before development is initiated. All permanent and temporary monitoring wells will be developed in accordance with Bhate SOP No. 10 (*Subsurface Water Investigation)* Section 3, Well Development. In addition, the second sentence in Section 3.3.4 has been replaced with the following text; "Groundwater samples will be collected in accordance with Bhate SOP No. 10 (*Subsurface Water Investigation*), Section 4, Monitoring Well Sampling. A minimum of 48 hours will elapse between well development and sampling." A detailed discussion on how the Section 3 subsections are organized has been added the second paragraph of Section 3 (p. 3-1).
12	3.1.5.1		It is stated in the report at this site that the boreholes will be drilled to approximately 12 feet bgs and the water level is at 5 feet bgs. Please clarify your justification for sampling for soils below the water.	Concur. Subsurface soil samples will not be collected below the water table. Revised sentence to read; "The boreholes will be drilled to approximately 5 - 7 ft bgs.".
13	3.1.7.1		Please elaborate on why you are sampling down to 24 feet bgs when the container is 2-4 feet bgs and only 10 feet long. Also, further elaborate on why you are analyzing for VOC, SVOC, TPH, and TAL metals when the site is a radioactive site and that is all that was known to be used at the site based on the historical findings.	Based on the description presented in the text (obtained from the Site 42 PA/SI Reference 5) the concrete cylinder is 10 ft long and 5.5 ft in diameter. The 10 ft long concrete cylinder is attached to an opening (cylindrical pipe) that is 8 ft long and 1.5 ft in diameter making the entire burial vault 18 ft long buried at a depth of 2 to 4 ft bgs. Therefore, it is assumed that the bottom of the burial vault is 22 ft bgs hence, the 22 to 24 ft bgs sample interval. As previously discussed, NMED requires a complete suite of analytical parameters to prove that a site is "clean" for NFA approval.

RESPONSE TO COMMENTS
Voluntary Corrective Measures Work Plan
Multiple Sites
Holloman AFB, New Mexico

COMMENT NO.	SECTION	PAGE	COMMENT	RESPONSE
14	3.3		Recommend referencing where these SOPs can be located or even including them in this report.	Concur. As stated in the second sentence (1st para., Section 3.3), a copy of the HAFB Standard Operating Procedures is included in the *Basewide Quality Assurance Project Plan* (Bhate, 2003). The following sentence has been added to Work Plan after the third sentence. "Bound copies of the *Basewide Quality Assurance Project Plan* (Bhate, 2003a) and the *Bhate Standard Operating Procedures* (Bhate, 2002) are kept at the Bhate Field Office, Holloman AFB, NM." These SOPs are not being included in this Work Plan for several reasons; the NMED is familiar with the sample collection procedures for soil and groundwater and has audited sampling activities in the past.
15	3.3.1		Recommend inserting a reference to the QAPP addendum for the preparatory methods that are being used for selected determinative methods.	Concur. The following sentence has been added after the second sentence (1st para., Sec. 3.3.1). "Additionally, the analytical preparation methods are summarized in Table 3-2 of the QAPP Addendum (see Appendix C of this Work Plan)."
16	3.3.2		Recommend inserting language about field screening that is also being done with the PID as stated in section 3.1.8.3. Is there language in HAFB SOP No. 6 regarding proper use of a PID?	Concur. Revised and added the following text in the second paragraph, Section 3.3.2; "Soils will be field screened in accordance with HAFB SOP No. 6 (*Procedure for Field Screening of Volatile Organics*) using an OVA equipped with a flame ionization detector (FID) or a photoionization detector (PID) to access the qualitative concentration of VOCs present in soil samples at 2-foot intervals. Refer to the manufacture's operating instructions for proper use and specific calibration procedures."
17	3.3.4.2		Insert language and appropriate SOP for measuring the water levels for the groundwater elevations.	Concur. The following sentence has been added after the second sentence (Section 3.3.4.2). " The static water level for each well will be measured using a decontaminated electronic water level probe as per Bhate SOP No. 10, *Subsurface Water Investigation,* Section 2, Fluid Level Measurement and Recording".
18	3.5		Further explain what is meant by "pending laboratory analysis." Are you going to be sampling for TCLP? Try and better explain your decision logic for sampling for IDW versus your section on excavated material. It is hard to decipher the difference in how it is written. Look to write it for clarity.	Concur. The text in section 3.5 pertaining to IDW purged groundwater has been revised to read; "Purged groundwater from development and sampling activities will be collected in a 1,000 gallon portable tank and managed by Bhate. At the conclusion of sampling activities the water within the tank will be sampled for VOCs, SVOCs, TAL metals, PCBs, pesticides, herbicides, tritium, and perchlorate. The analytical results will be compared to the HAFB Wastewater Treatment Plant (WWTP) pretreatment standards. If all of the results are less than the pretreatment standards, the purge water will be discharged to the HAFB sanitary sewer system. If any of the results are above the WWTP pretreatment standards, the purge water will then be shipped offsite for compliant disposal. "

RESPONSE TO COMMENTS
Voluntary Corrective Measures Work Plan
Multiple Sites
Holloman AFB, New Mexico

COMMENT NO.	SECTION	PAGE	COMMENT	RESPONSE
19	4		Recommend thinking over and inserting some other decision logic as to how you are going to excavate and sample. You are stating that you are going to excavate at four sites when you have not yet gotten back the results. State what levels you are going to be using to decide on excavation. What are you going to do if these sites come back with numbers below those levels? We do not want to get ahead of ourselves with assumptions, yet if we want to make assumptions, it would be beneficial to make assumptions on both sides of the spectrums.	The sampling frequency for overburden, stock pile, and excavation sampling present in Table 4-1 is based on NMED guidance. Based on the analytical results obtained from previous investigations (presented in Section 2), the current SSLs (NMED, June 2006) have been exceeded for TPH and other chemicals of concern at each of the four sites (OT-03, OT-20, OT-37, and OT-45). It is assumed that source area excavation/removal based on the historical data will facilitate closure with NMED. The additional investigations being conducted at these sites will primarily assist in defining the source area boundaries at each site (OT-20, OT-37, and OT-45).
20	4.1		Please elaborate on why you are taking your TCLP soil samples prior to excavation versus post-excavation. Per 40 CFR 261, you may use your total values in lue of TCLP sampling. If you are planning on doing TCLP sampling, collect your sample post-excavation to get a representative sample of the waste. Soil that is in the ground in not necessarily considered waste.	As a condition of the HAFB Groundwater Discharge Permit (DP-1446) petroleum contaminated soil must be analyzed for by TCLP for VOCs, SVOCs and metals prior to treatment at the FT-31 landfarm. Additionally, a characterization TCLP sample is collected from the non-PCS source areas to meet the waste acceptance criteria for potential offsite disposal facilities.
21	5.1		Clarify if the excavation samples are going to be composite or not. Even if it is in the SOP, it would be beneficial for clarification if it is also stated here with a reference to the SOP.	Concur. The following sentence has been added to the text after the second sentence (Section 5.1), "Excavation soil samples for chemical analysis will be collected as discrete (grab) samples from the trackhoe bucket as per Bhate SOP No. 1, *Soil Sampling and Subsurface Investigations,* Section 7, *Test Pit and Trenching Procedures".*
22	7.1		This paragraph is talking about the laboratory analysis for TPH being below the SSL for the stockpiled soil and how it is being utilized for backfill. Please clarify better and try and stay consistent with all this language as to if the OVA is being used or if the off-site laboratory is being used.	Concur. For clarification, the last sentence has been revised to read, "If offsite laboratory analysis indicates concentrations are below the SSL for TPH (800 mg/kg) and the SSL for each individual VOC and SVOC constituent, the stockpiled soil will be used as backfill once the excavation activities are complete."
23	8.2		When referring to the sample labeling, also reference section 3.4 and not only the Basewide QAPP.	Concur. Removed reference to the Basewide QAPP and changed the last sentence in Section 8.2 to read, "Sample labeling will adhere to the format provided in Section 3.4 of this Work Plan."
24	Table 7-1		Please clarify in this table what the shaded and non-shaded areas stand for.	Concur. Added the following information to the Notes posted below the table: 1) Shaded areas indicate proposed waste streams 2) Non-shaded areas are not proposed waste streams.
25	Figure 3-4		Please describe in the legend what the orange hashed area represents.	Concur. Added a orange hatched rectangle labeled "Extent of Previous Excavation" to the legend in Figure 3-4

END OF COMMENTS

TABLES

Table 3-1
Proposed Additional Field Activities and Rationale
Accelerated Corrective Measures Work Plan
Holloman AFB, New Mexico
Bhate Project No. 9050361

Site Number/Name	Field Tasks	Sample Intervals	Well Specifications	Rationale
OT-20 Sewage Lagoons Disposal Trenches	1 Trench 10 feet east of fence: 150-ft x 2-ft x 4-ft	0 to 2-ft bgs in line with grit burial trenches for total of 3 soil samples	NA	Define eastern extent of the three sewage grit burial trenches Characterize grit (source area)
	9 Boreholes (~ 7 to 10 ft bgs) 2 Soil samples per hole	0 to 2-ft bgs and 4 -7 ft bgs within the capillary fringe (18 soil samples)	NA	Define boundaries of sewage grit trenches
	3 New monitoring wells	1 Groundwater sample per well (3 groundwater samples)	Well depth: ~ 10 to 15 ft bgs Screened interval: ~5 to 15 ft bgs	Determine and quantify the absence/presence of groundwater contamination
	If the investigation trench transects the grit trenches, a new trench will be dug to the east			Define extent of sewage grit burial trenches
OT-32 Collapsed Former Primate Research Institute Sewer Lines	12 Boreholes (~25 – 35 ft bgs) 2 Soil Samples per borehole	Highest organic vapor reading or mid-borehole depth (15 ft bgs) and within the capillary fringe (~30 ft bgs) for a total of 24 soil samples	NA	Determine the collapsed sewer line location(s) (potential contamination source areas) and the extent of contamination
	Install temporary wells in the 12 boreholes	1 groundwater sample from each well (12 groundwater samples)	Well depth: ~25 to 35 ft bgs Screened interval: ~25 to 35 ft bgs	Determine and quantify the absence/presence of groundwater contamination
OT-38 Test Sled Maintenance Area	3 Boreholes within the perimeter of the former cesspool area (~20 ft bgs) 3 Soil Samples per borehole	5-ft bgs, 10 –ft bgs, and capillary fringe (~18 ft bgs) for a total of 9 soil samples	NA	Characterize the contaminants from the former cesspool (source area)
	3 DPT Boreholes along leach pipe @ 10 ft bgs 2 Soil samples per borehole	3-5 ft and 8-10 ft for a total of 6 soil samples	NA	Characterize potential contamination from the leach pipe
	Sample 3 existing monitoring wells (MW-38-01 through MW-38-03)			To determine the current groundwater quality

Table 3-1 continued
Additional Field Activities and Rationale
Accelerated Corrective Measures Work Plan
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Site Number/Name	Field Tasks	Sample Depths	Well specifications	Rationale
OT-45 Old AGE Refueling Station	15 DPT Boreholes (~ 5 ft bgs) 1 Soil sample per borehole	Capillary fringe (~4.5 ft) for a total of 15 soil samples	NA	Delineate the extent of remaining Petroleum Contaminated Soil
	1 round of groundwater samples from five existing monitoring wells (MW1, MW3, MW4, MW5, MW7)			Evaluate current groundwater site conditions
SS-12 Northeast Fuel Line Spill Site	15 Boreholes (~ 5 - 7 ft bgs) 1 Soil sample per borehole	Visible gray staining or zone with highest organic vapor reading – If no staining or high reading, collect sample from capillary fringe (~5 ft bgs) (15 soil samples)	NA	Delineate extent of PCS (source area)
	Collect 1 round of groundwater samples from the three existing monitoring wells (WL-12-01 through WL-12-03)			Determine current groundwater quality at site
SS-18 Chromic Acid Spill Area	3 Boreholes (~10 ft bgs) 1 Soil sample per borehole	Zone with visible yellow staining (if no stain sample from capillary fringe) (~5 ft bgs) 3 soil samples	NA	Quantify extent of contamination in the source area
	3 Boreholes to be completed as Monitoring Wells (~15 ft bgs)	Zone with visible yellow staining or collect sample from capillary fringe (~5 ft bgs)	Well Depth: ~15 ft bgs Screened interval: ~4 to 15 ft bgs	Delineate outward extent of soil contamination
	Collect one round of groundwater samples from each well (3 new wells and one existing well, 18W1) for a total of 4 groundwater samples			Characterize the groundwater onsite
RW-42 Radioactive Waste Burial Site	4 Boreholes (~24 ft bgs) 3 Soil samples per borehole	Highest Radiation and/or organic vapor reading - if no significant readings, samples will be taken from 8 to10 ft, 14 to 16 ft and 22 to 24 ft bgs	NA	Qualitatively and quantitatively assess the absence/presence of a variety of contaminants (to determine if there is a source area)
	3 New monitoring wells	Collect 1 round of samples from each well (3 groundwater samples)	Well Depth: ~55 ft bgs Screened Interval: ~45 to 55 ft bgs	Characterize groundwater quality at site

Table 3-1 continued
Proposed Additional Field Activities and Rationale
Accelerated Corrective Measures Work Plan
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Site Number/Name	Field Tasks	Sample Depths	Well specifications	Rationale
OT-37 Early Missile Testing Site	Transformer Pads: 8 Boreholes (2 per pad) approximately 8 to 10 ft bgs (2 soil samples per borehole)	0 to 2-ft bgs and mid-borehole (based on highest organic vapor reading)	NA	Define the extent of soil contamination around the four concrete transformer pads.
	Launch Pad Facilities: 8 Boreholes (2 per facility) ~30 to 40 ft bgs (2 samples per borehole)	12 to 17 ft bgs and 27 to 32 ft bgs	NA	Characterize potential soil contamination associated with each launch pad facility
	Install four new monitoring wells (1 per facility)	Collect 1 round of groundwater samples from the 4 new wells and 6 existing wells	Well depth ~ 45 ft bgs Screened interval: ~25 to 45 ft bgs	Characterize the groundwater quality at the site.

Notes: ft = feet, bgs = below ground surface, NA = Not Applicable, DPT = Direct Push Technology

Table 3-2
Analytical Methods and Analyses Per Site
Accelerated Corrective Measures Work Plan
Holloman AFB, New Mexico
Bhate Project No. 9050361

Soil Sample Parameters	Method	OT-20	OT-32	OT-38	OT-45	SS-12	SS-18	RW-42	OT-37
VOCs	8260B	21	24	15	15	15	6	12	16
SVOCs	8270C	21	24	15	15	15	6	12	16
TPH (DRO/GRO/ORO)	8015M	21	24	15	15	15	6	12	32
8 RCRA Metals	6010B and 7471A	21	-	15	-	15	-	-	16
TAL Metals	6010B and 7471A	-	24	-	-	-	6	12	-
PCBs	8082	21	-	15	-	-	-	-	32
Organochlorine Pesticides	8081A	21	-	-	-	-	-	-	-
Chlorinated Herbicides	8151A	21	-	-	-	-	-	-	-
Tritium	906.0M	-	24	-	-	-	-	12	-
Perchlorate	6860	-	-	-	-	-	-	-	16
Hexavalent Chromium	7196A	-	-	-	-	-	6	-	-

Geotechnical Soil Sample Parameters	Method	OT-20	OT-32	OT-38	OT-45	SS-12	SS-18	RW-42	OT-37
Moisture Content	EPA 160.3M	2	2	2	2	2	2	2	2
Dry Bulk Density	ASTM D2937	2	2	2	2	2	2	2	2
Specific Gravity	ASTM D1429	2	2	2	2	2	2	2	2
Fractional Organic Carbon	ASTM D2974	2	2	2	2	2	2	2	2

Groundwater Sample Parameters	Method	OT-20	OT-32	OT-38	OT-45	SS-12	SS-18	RW-42	OT-37
VOCs	8260B	3	12	3	5	3	4	3	10
SVOCs	8270C	3	12	3	5	3	4	3	10
TDS	160.1	3	12	3	5	3	4	3	10
8 RCRA Metals	6010B and 7470A	3	-	3	-	3	-	-	10
TAL Metals	6010B and 7470A	-	12	-	-	-	4	3	-
PCBs	8082	3	-	3	-	-	-	-	10
Organochlorine Pesticides	8081A	3	-	-	-	-	-	-	-
Chlorinated Herbicides	8151A	3	-	-	-	-	-	-	-
Tritium	906.0M	-	12	-	-	-	-	3	-
Perchlorate	6860	-	-	3	-	-	-	-	10

Notes:
VOCs = Volatile Organic Compounds
SVOCs = Semi-volatile Organic Compounds
TPH = Total Petroleum Hydrocarbons
DRO = Diesel Range Organics
GRO = Gasoline Range Organics
ORO = Oil Range Organics
RCRA = Resource Conservation and Recovery Act
TAL = Target Analyte List
PCBs = Polychlorinated biphenyls
TDS = Total Dissolved Solids

Table 3-3
Sample Containers by Sample Media
Accelerated Corrective Measures Work Plan
Holloman AFB, New Mexico
Bhate Project No. 9050361

MEDIA	ANALYTE GROUP (Method)										
	TPH DRO/GRO/ORO (8015M)	**VOCs (8260B)**	**SVOCs (8270C)**	**TAL Metals or 8 RCRA Metals (6010B/7470A/ 7471A)**	**Organochlorine Pesticides (8081A)**	**Chlorinated Herbicides (8151A)**	**PCBs (8082)**	**Perchlorate (6860)**	**Tritium (906.0M)**	**Cr VI (7196A)**	**TDS (160.1)**
Soil	8 oz glass jar	Encore	4 oz glass jar	8 oz glass jar	4 oz glass jar	4 oz glass jar	4 oz glass jar	NA	4 oz glass jar	4 oz glass jar	NA
	1	3	1	1	1	1	1	NA	1	1	NA
Groundwater	40-mL vials (pre-tared)	40-mL vials	1-L amber	0.5-L Plastic	1-L amber	1-L amber	1-L amber	0.5-L Plastic	0.5-L Plastic	NA	0.5-L Plastic
	1	3	1	1	1	1	1	1	1	NA	1

Notes:

TPH = Total Petroleum Hydrocarbons
DRO = Diesel Range Organics
GRO = Gasoline Range Organics
ORO = Oil Range Organics
VOCs = Volatile Organic Compounds
SVOCs = Semi-volatile Organic Compounds
TAL = Target Analyte List
RCRA = Resource Conservation Recovery Act
PCBs = Polychlorinated Biphenyls
Cr VI = Hexavalent Chromium
TDS = Total Dissolved Solids
oz = Ounce
mL = Milliter
L = Liter
NA = Not Applicable

Table 4-1
Excavation Sampling Frequency and Analysis
Accelerated Corrective Measures Work Plan
Holloman AFB, New Mexico
Bhate Project No. 9050361

Sample Type	Contamination Profile	Purpose	Frequency	Method/ Analyses	Requested Analyses Time
Overburden	Un-impacted Soils	Initial Field Screening	Every 25 cubic yds OR every 10 cubic yds IF the total excavation < 25 cubic yds	OVA / VOCs (OT-03 and OT-45)	Real Time
		Field Confirmatory	Every 50 cubic yds OR every 25 cubic yds IF total excavation < 50 cubic yds	UVF / TPH	
Stock Pile (Overburden)	Un-impacted Soils	Backfill Characterization (Lab validation)	Every 200 cubic yds OR every 100 cubic yds IF total excavation < 100 cubic yds	Laboratory/ TPH, VOCs, and SVOCs (OT-03 and OT-45)	24 hours
Excavation Confirmation[1]	Clean wall denoting extent of excavation	Closure	2 every 18 linear feet at mid-depth within contamination zone, minimum of 1 per side wall if < 18 linear feet	Laboratory/ TPH, VOCs, and SVOCs (OT-03 and OT-45); TPH, VOCs, SVOCs, and PCBs (OT-37); PCBs, organochlorine pesticides, and chlorinated herbicides (OT-20)	7 days

Notes:

[1] The analytical methods for excavation confirmation sampling are based on historical site specific data. The list of excavation confirmation sampling parameters for each site could increase based on the findings of the additional investigations.

yds = Yards

OVA = Organic vapor analyzer

VOCs = Volatile Organic Compounds

UVF = Ultra violet flourometer

TPH = Total Petroleum Hydrocarbons

SVOCs = Semi-volatile Organic Compounds

PCBs = Polychlorinated Biphenyls

Table 5-1
Excavation Sample Collection Information
Accelerated Corrective Measures Work Plan
Holloman AFB, New Mexico
Bhate Project No. 9050361

Soil Collection Information	ANALYTE METHOD										
	VOC (8260B)	Metals (6010B/7470A/ 7471A)	SVOC (8270C)	TPH (8015M)	Soil Moisture	TCLP VOC (1311/8260B)	TCLP SVOC (1311/8270C)	Organochlorine Pesticides (8081A)	Chlorinated Herbicides (8151A)	PCBs (8082)	TCLP Metals (1311/6010/ 7000)
Container	Encore	8 oz glass jar	4 oz glass jar	Non-preserved 40-mL vial (Terra-core)	4 oz glass jar	8 oz glass jar	8 oz glass jar	4 oz glass jar	4 oz glass jar	4 oz glass jar	8 oz glass jar
Container Quantity	3	1	1	1	1	1	1	1	1	1	1
Holding Time	48 hours	180 days	7 days	7 days	14 days	14 days	14 days	14 days	14 days	14 days	180 days

Notes:
oz = Ounce
mL = Milliliter
TPH = Total Petroleum Hydrocarbons
VOCs = Volatile Organic Compounds
SVOCs = Semi-Volatile Organic Compounds
TCLP = Toxicity Characteristic Leaching Procedure

Table 5-2 **Excavation Sample Analysis and Methodologies** Accelerated Corrective Measures Work Plan Holloman AFB, New Mexico Bhate Project No. 9050361	
Analysis	**Soil and Groundwater**
RCRA Metals	EPA Methods 6010B and 7471A
VOCs	EPA Method 8260B
(SVOCs)	EPA Method 8270C
TPH (GRO/DRO/ORO)	EPA Method 8015M
PCBs	EPA Method 8082
Organochlorine Pesticides	EPA Method 8081A
Chlorinated Herbicides	EPA Method 8151A
TCLP VOCs	EPA Method 1311/8260B
TCLP SVOCs	EPA Method 1311/8270C
TCLP Metals	EPA Method 1311/6010/7000

Notes:
TPH = Total Petroleum Hydrocarbons
VOCs = Volatile Organic Compounds
SVOCs = Semi-Volatile Organic Compounds
GRO = Gasoline Range Organics
DRO = Diesel Range Organics
ORO = Oil Range Organics
TCLP = Toxicity Characteristic Leaching Procedure
EPA = Environmental Protection Agency
PCBs = Polychlorinated Biphenyls

Table 7-1
Proposed Waste Streams
Accelerated Corrective Measures Work Plan
Holloman AFB, New Mexico
Bhate Project No. 9050361

Activity	Waste Stream			
	PPE	Soil	Water	Debris
Equipment Decontamination				
Excavation				

Notes:

1) Shaded areas indicate proposed waste streams.

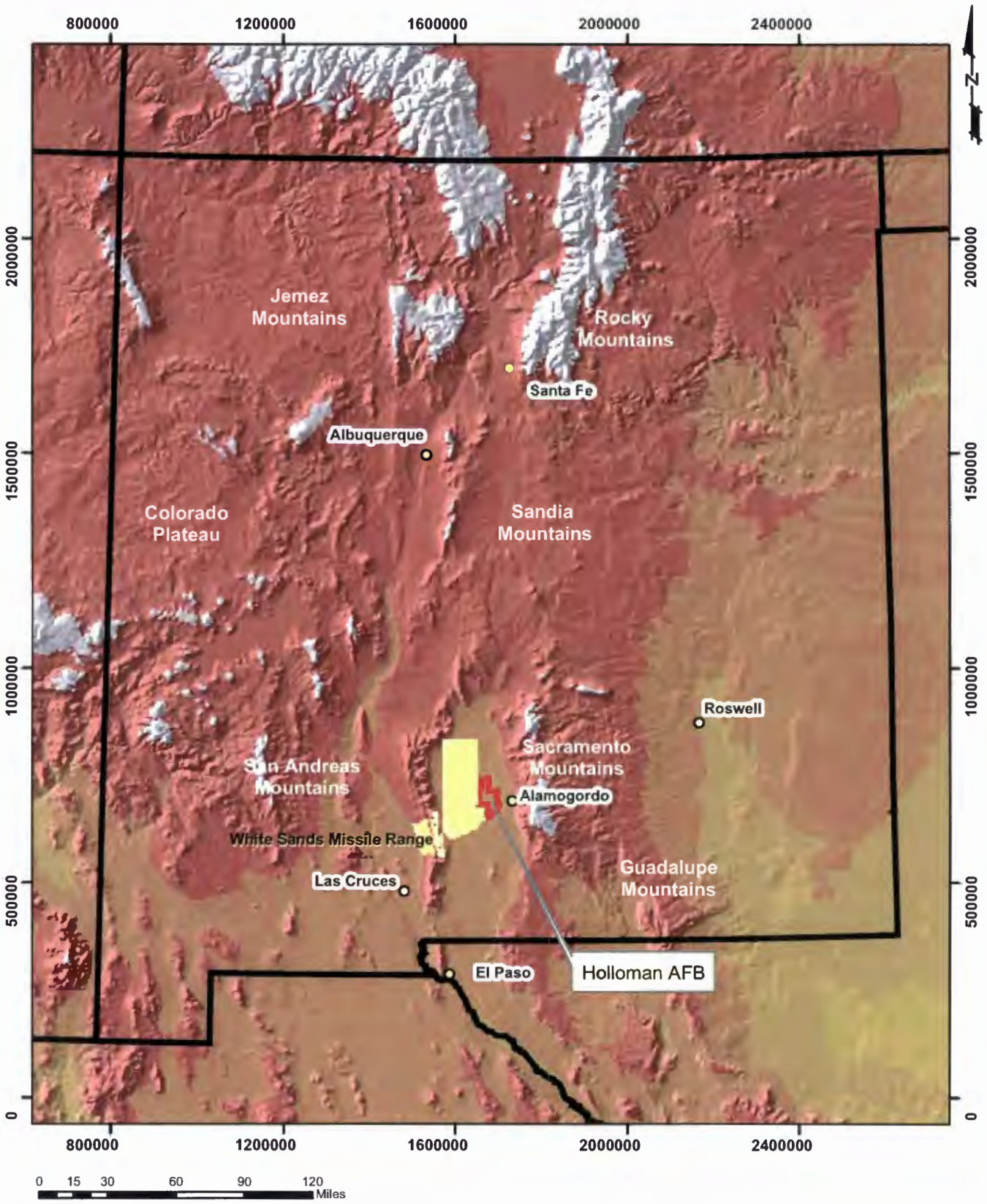
2) Non-shaded areas are not proposed waste streams.

PPE = Personal protective equipment

Table 10-1 **Key Personnel and Responsibilities** Accelerated Corrective Measures Work Plan Holloman AFB, New Mexico Bhate Project No. 9050361		
Name	**Project Title/Assigned Role**	**Phone Numbers**
Mr. John Hymer	Site Manager/SSHO	Work: (505) 491-9171
Mr. Jim Moore, P.G.	Field Team Leader/Senior Geologist (Additional Investigation)	Work: (303) 929-4840
Mr. Frank Gardner, P.G.	Bhate Program Manager	Work: (303) 386-6454
Mr. Jim Moore, P.G.	Project Manager	Work: (303) 929-4840
Mr. Brian Muller, CIH, CHMM	Health and Safety Specialist	Work: (205) 918-4000

Notes:
P.G. = Professional Geologist
SSHO = Site Safety and Health Officer
CIH = Certified Industrial Hygienist
CHMM = Certified Hazardous Materials Manager

FIGURES



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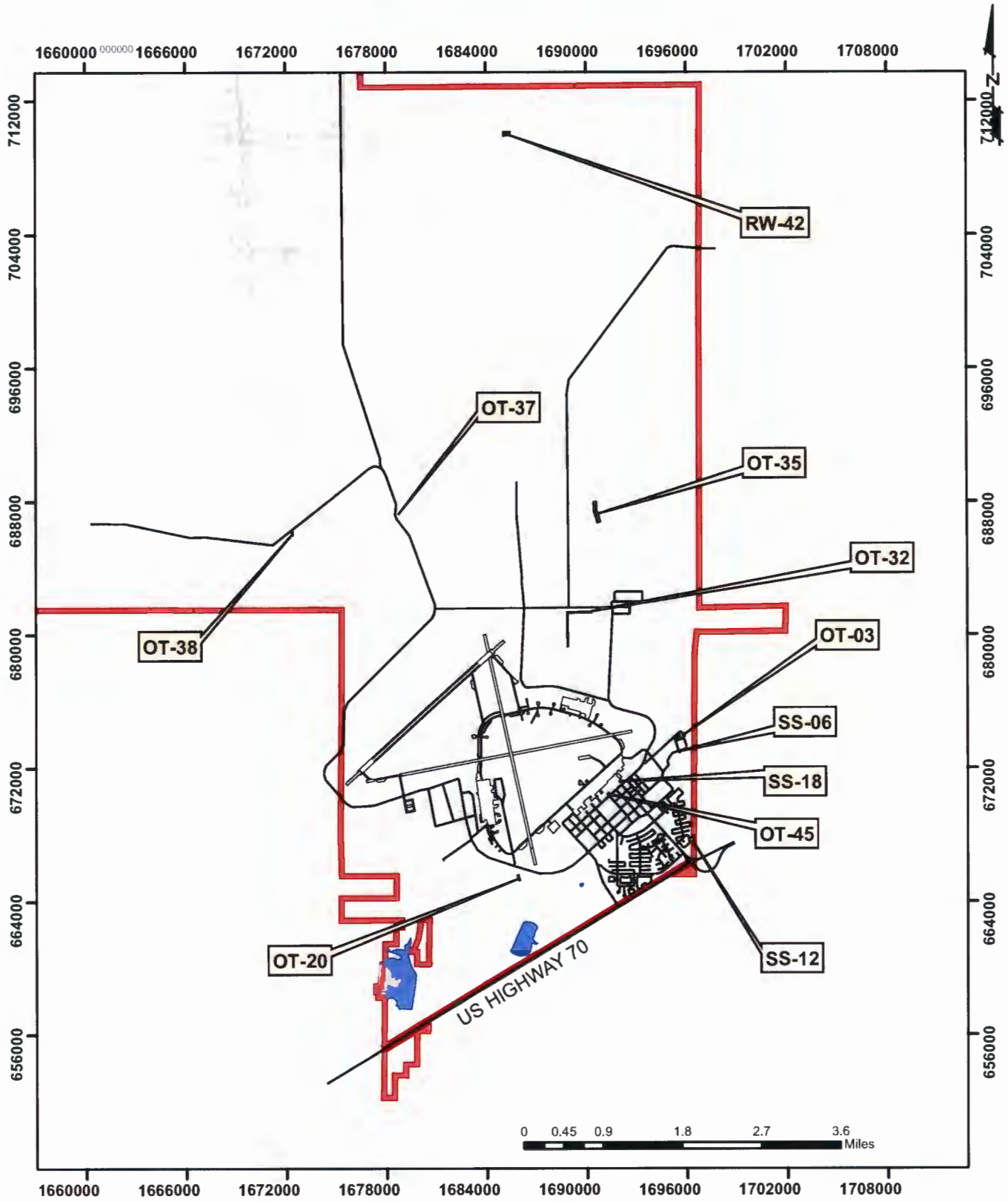
Holloman AFB, NM Location Map				Accelerated Corrective Measures Work Plan Holloman AFB, New Mexico
PROJECT NO.	SCALE	DATE	DRAWN BY: SP	
9050361	Shown	06/06/06	DRAWING NO: Figure 1-1	Figure 1-1



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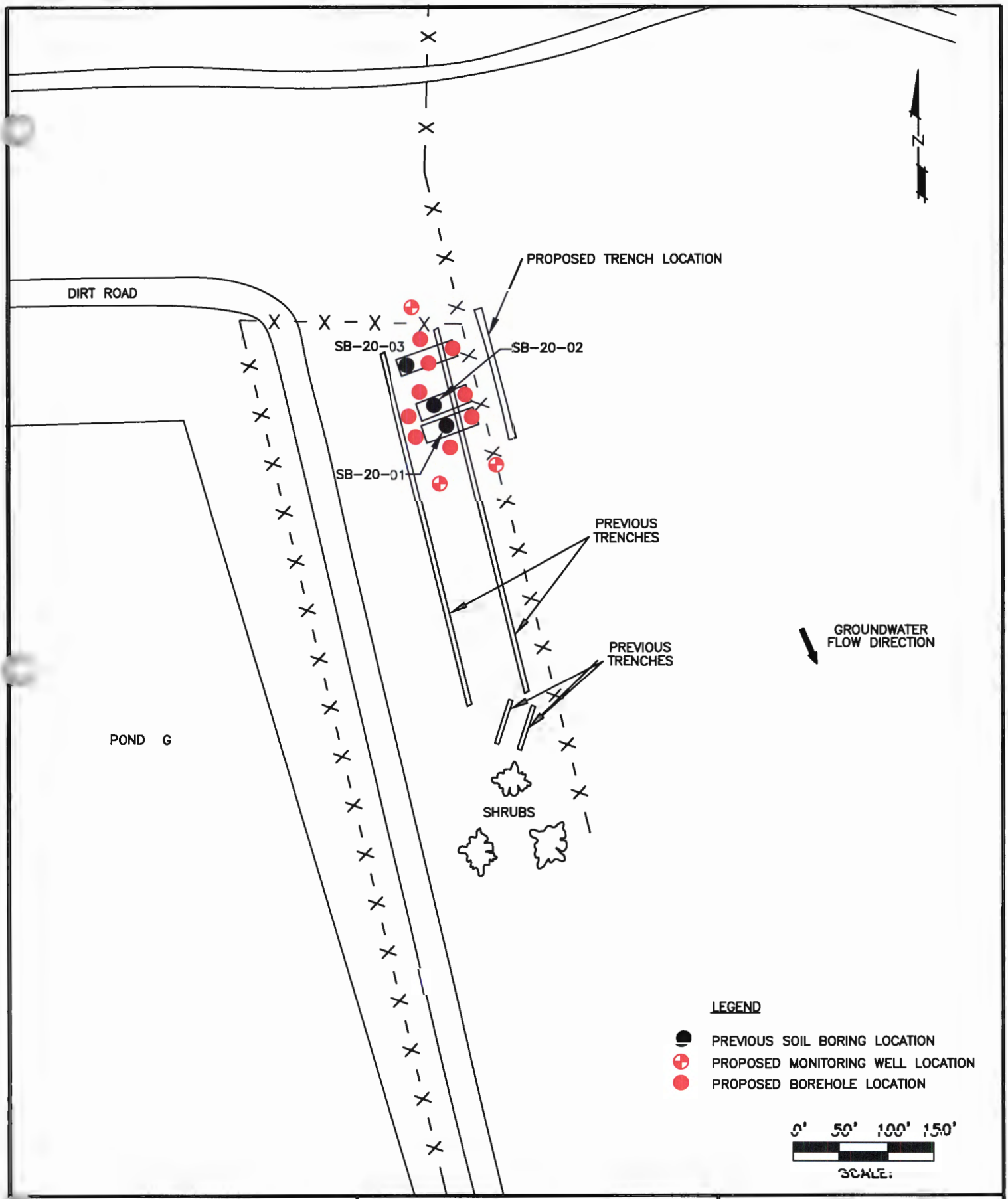
Site Location Map

PROJECT NO.	SCALE	DATE	DRAWN BY:
9050361	Shown	06/06/06	SP
			DRAWING NO: Figure 2-1

Accelerated Corrective Measures
Work Plan
Holloman AFB, New Mexico

Figure 2-1



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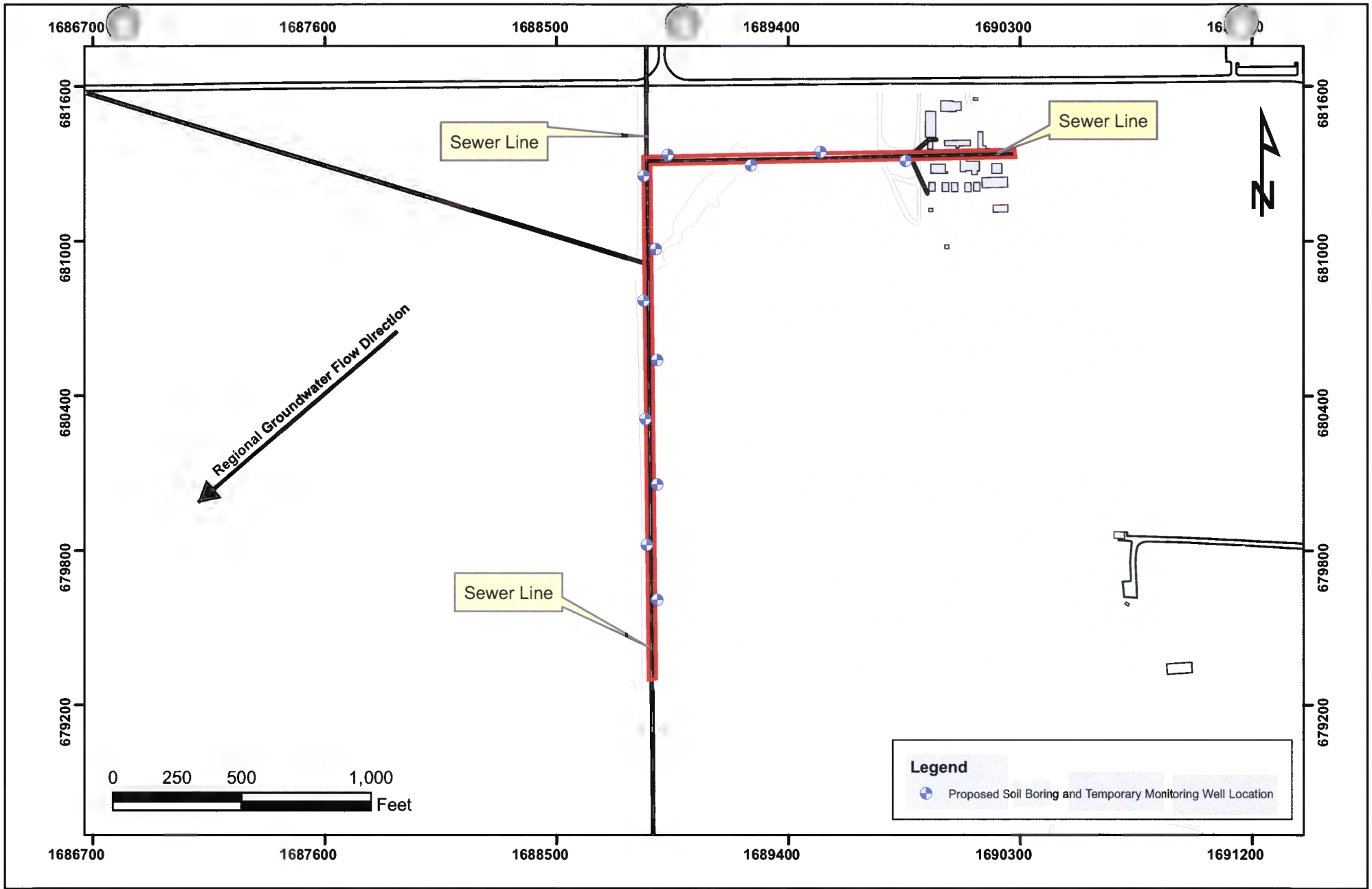
OT-20 PROPOSED TRENCH, SOIL BORING, AND MONITORING WELL LOCATIONS

PROJECT NO.	SCALE	DATE	DRAWN BY: TES/MRM
9050361	AS SHOWN	6/8/06	DRAWING NO: Figure 3-1

Accelerated Corrective Measures Work Plan
Holloman AFB, New Mexico

Figure 3-1



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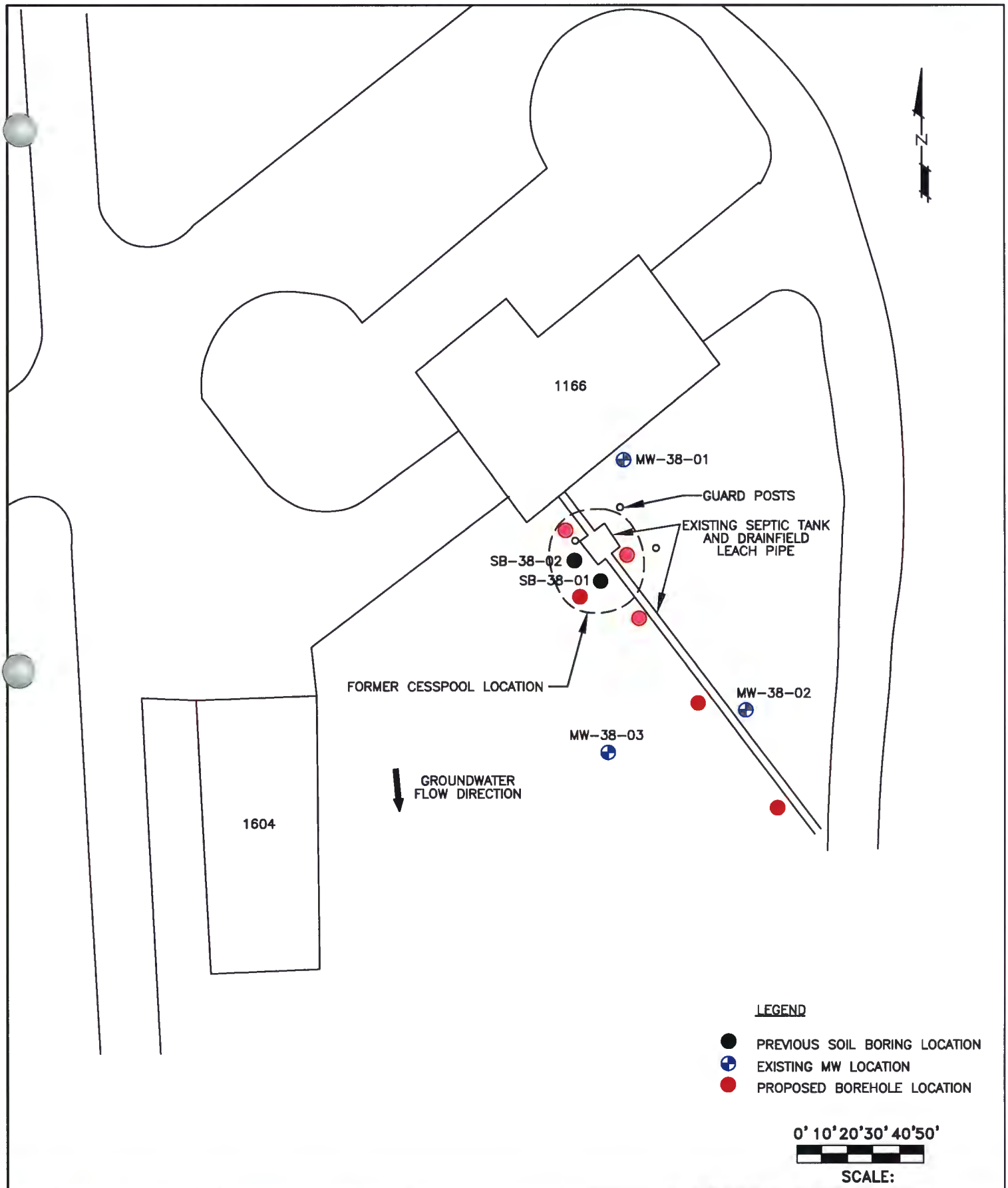
OT-32 Proposed Soil Boring and Temporary Monitoring Well Locations

PROJECT NO.	SCALE	DATE	DRAWN BY: SP/CM
9050361	1"=500'	06/13/06	DRAWING NO: fig3-2

Accelerated Corrective Measures Work Plan
Holloman AFB, New Mexico

Figure 3-2



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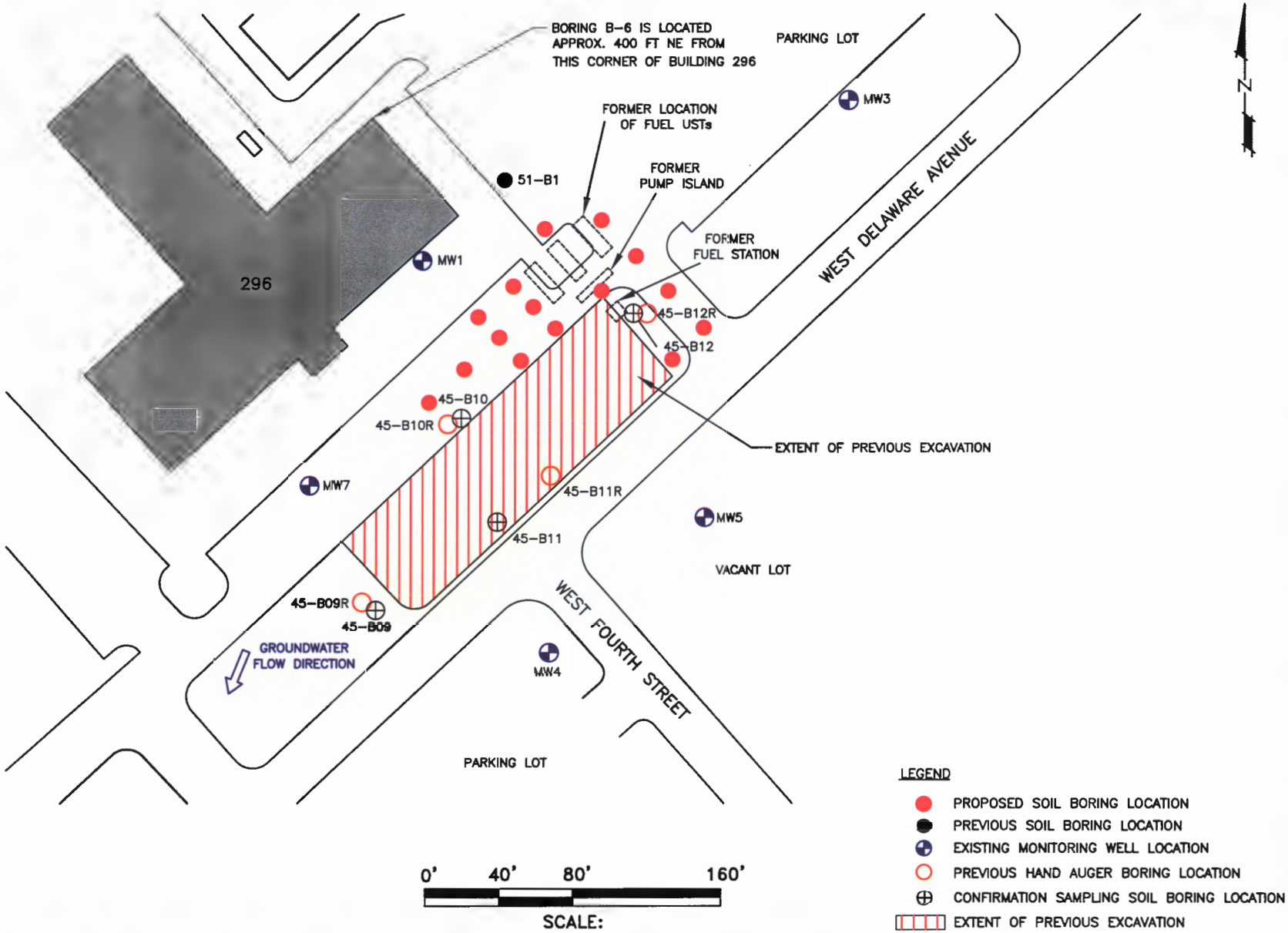
OT-38 PROPOSED SOIL BORING LOCATIONS

PROJECT NO.	SCALE	DATE	DRAWN BY: TES/MRM
9050361	AS SHOWN	6/8/06	DRAWING NO: Figure 3-3

Accelerated Corrective Measures Work Plan
Holloman AFB, New Mexico

Figure 3-3



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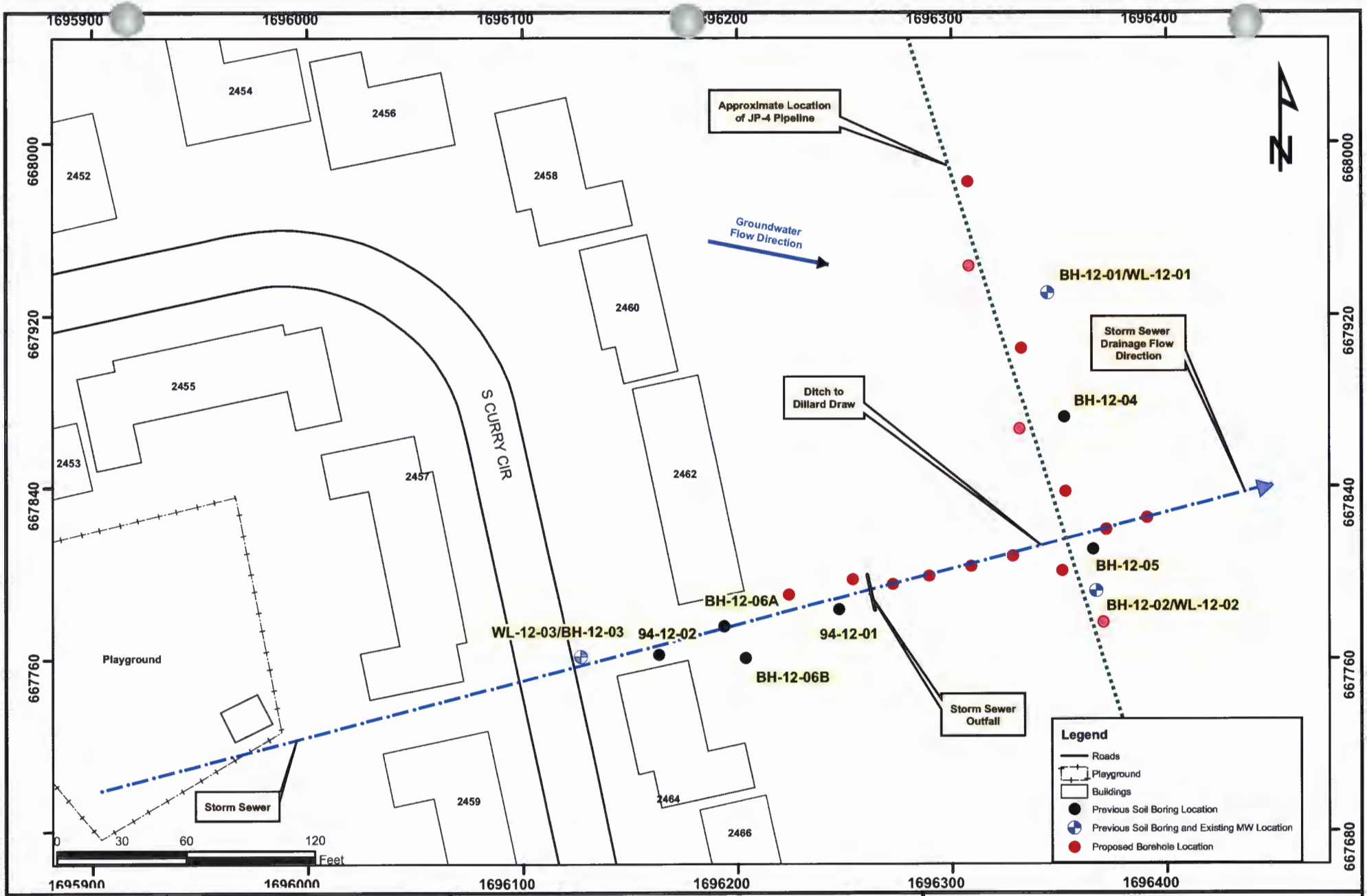
OT-45 PROPOSED SOIL BORING LOCATIONS

PROJECT NO.	SCALE	DATE	DRAWN BY: TES/MRM
9050361	AS SHOWN	6/9/06	DRAWING NO: Figure 3-4

Accelerated Corrective Measures Work Plan
Holloman AFB, New Mexico

Figure 3-4



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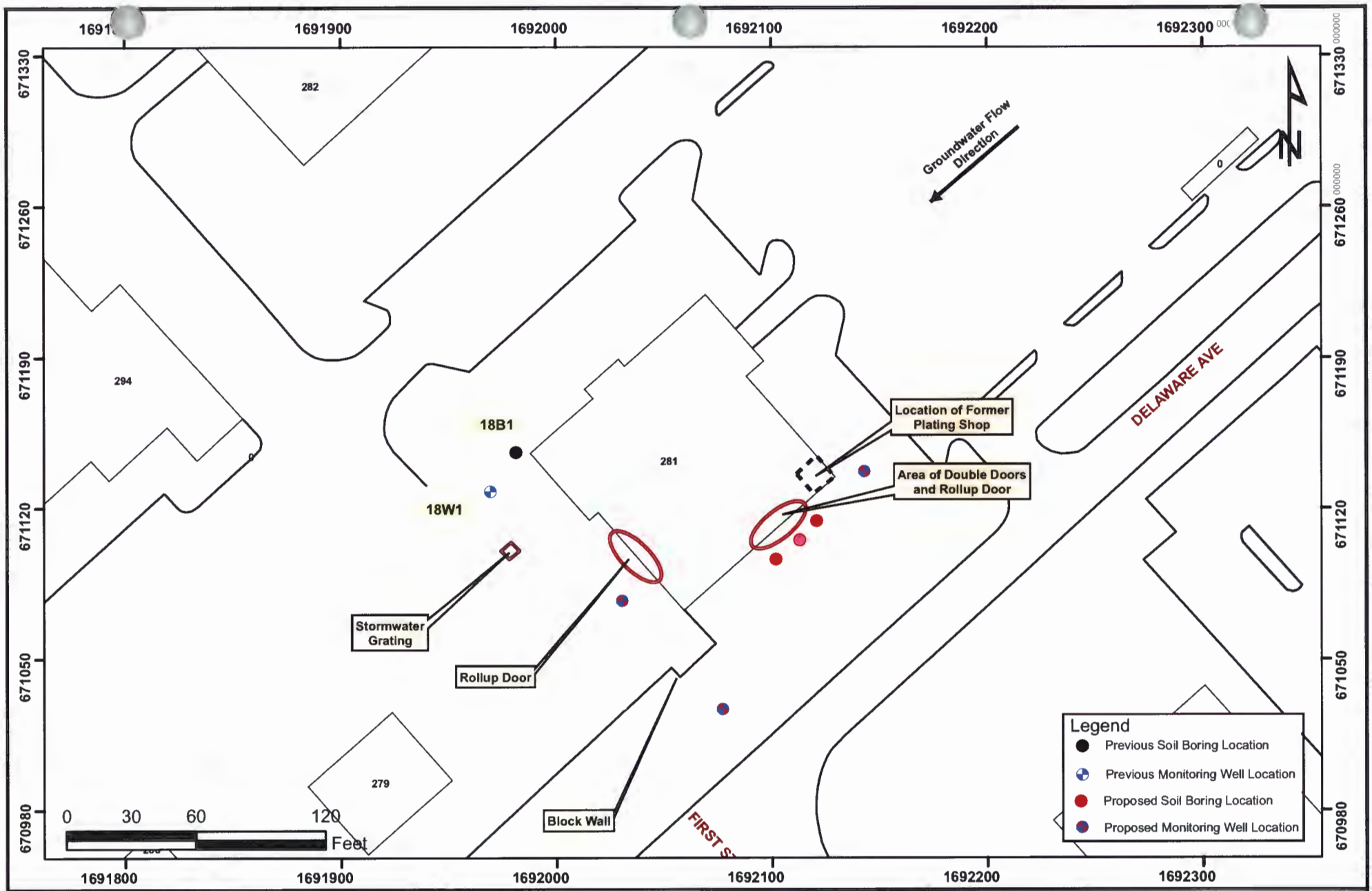
SS-12 Proposed Soil Boring Locations

PROJECT NO.	SCALE	DATE	DRAWN BY:
9050361	1"=60'	06/06/06	CM
			DRAWING NO: fig3-5

Accelerated Corrective Measures Work Plan
Holloman AFB, New Mexico

Figure 3-5



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SS-18 Proposed Soil Boring and Monitoring Well Locations

PROJECT NO.	SCALE	DATE	DRAWN BY:
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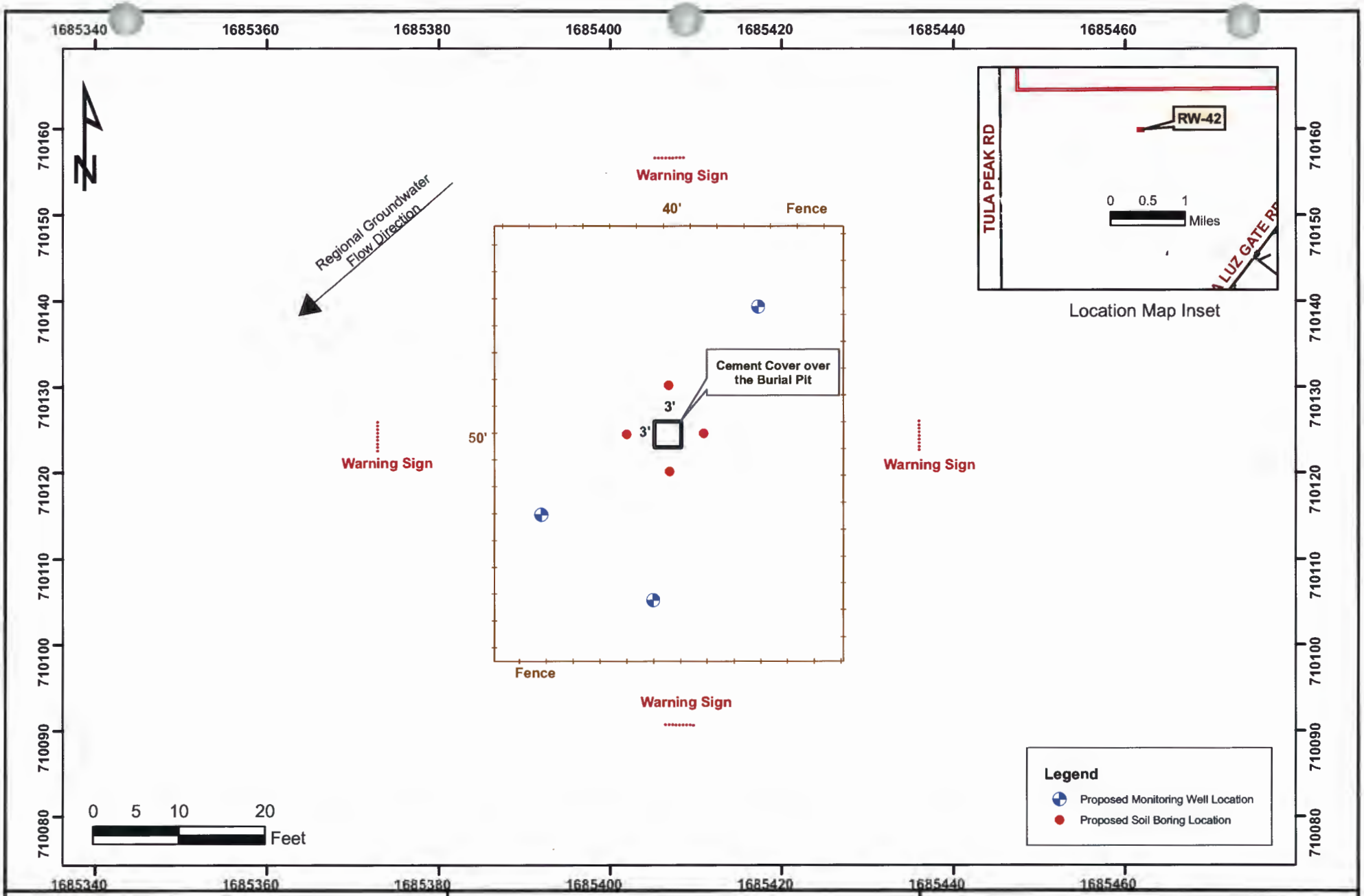
			DRAWING NO: fig3-6

Accelerated Corrective Measures Work Plan
Holloman AFB, New Mexico

Figure 3-6



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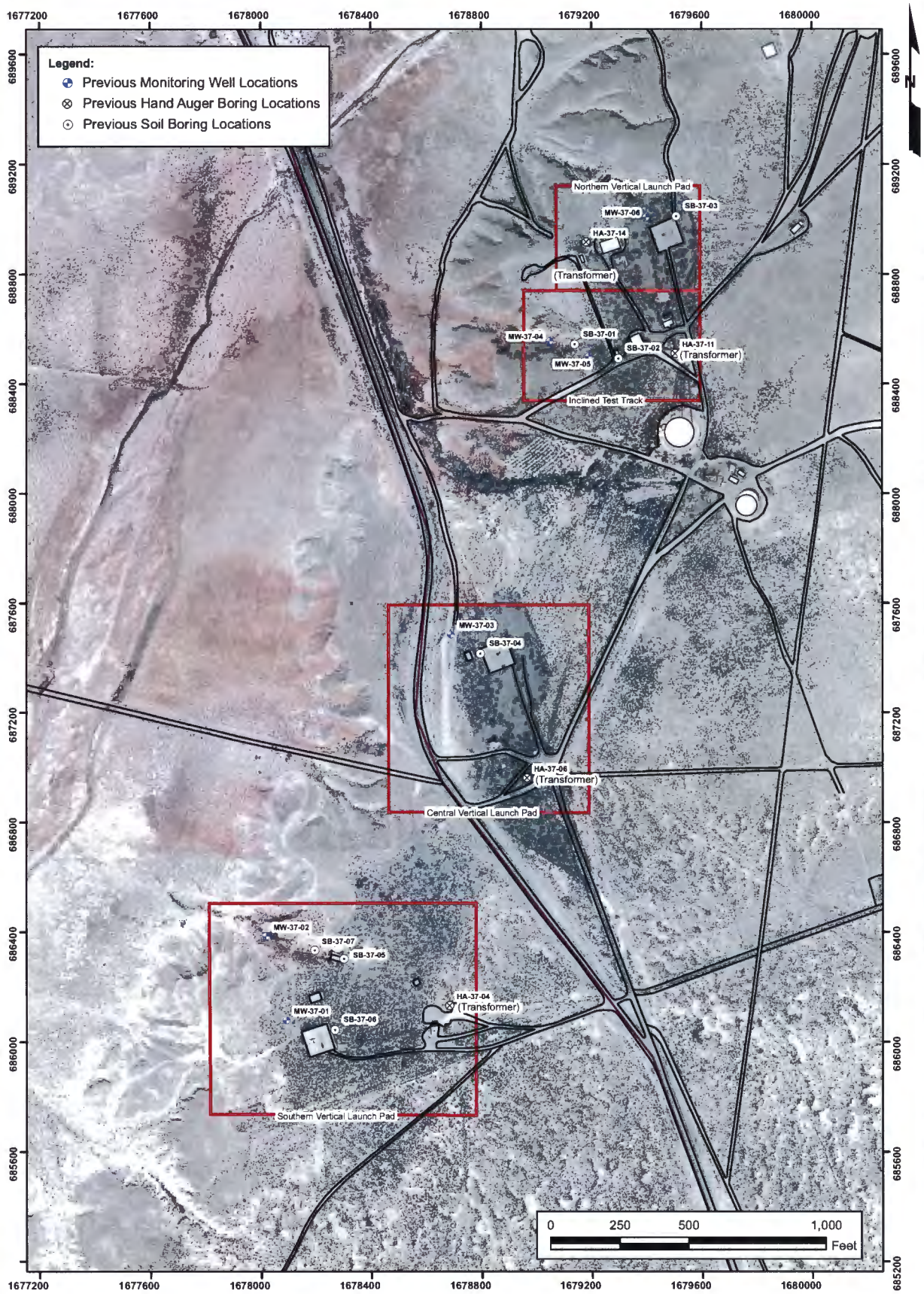
RW-42 Proposed Soil Boring and Monitoring Well Locations

9050361	1"=15'	06/06/06	SP/CM
			fig3-7

Accelerated Corrective Measures Work Plan
Holloman AFB, New Mexico

Figure 3-7



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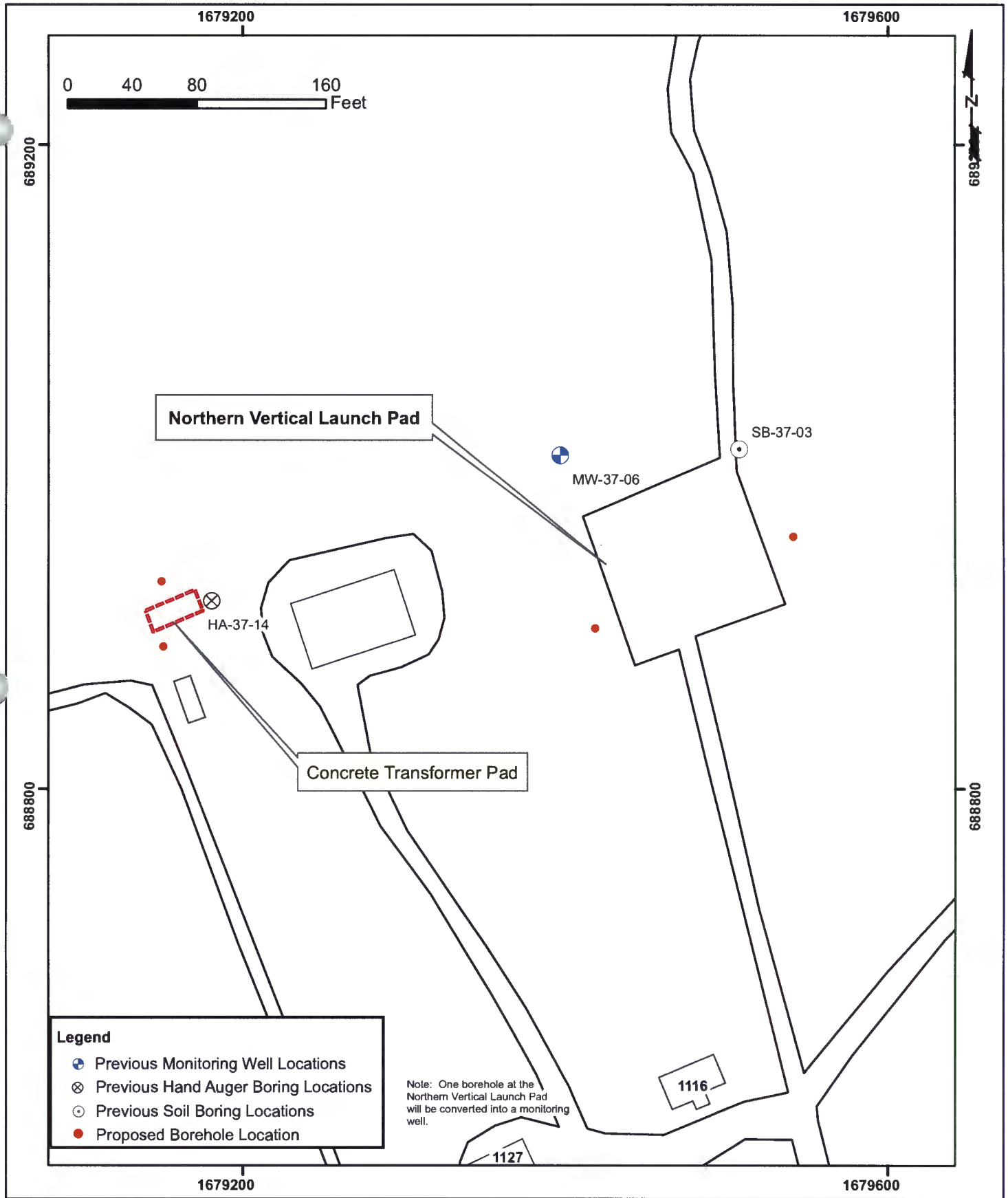
OT-37 Site Map with Previous Sample Locations

PROJECT NO.	SCALE	DATE	DRAWN BY:
9050361	AS SHOWN	8/18/06	MRM/CM
			DRAWING NO: Figure 3-8

Accelerated Corrective Measures Work Plan
Holloman AFB, New Mexico

Figure 3-8



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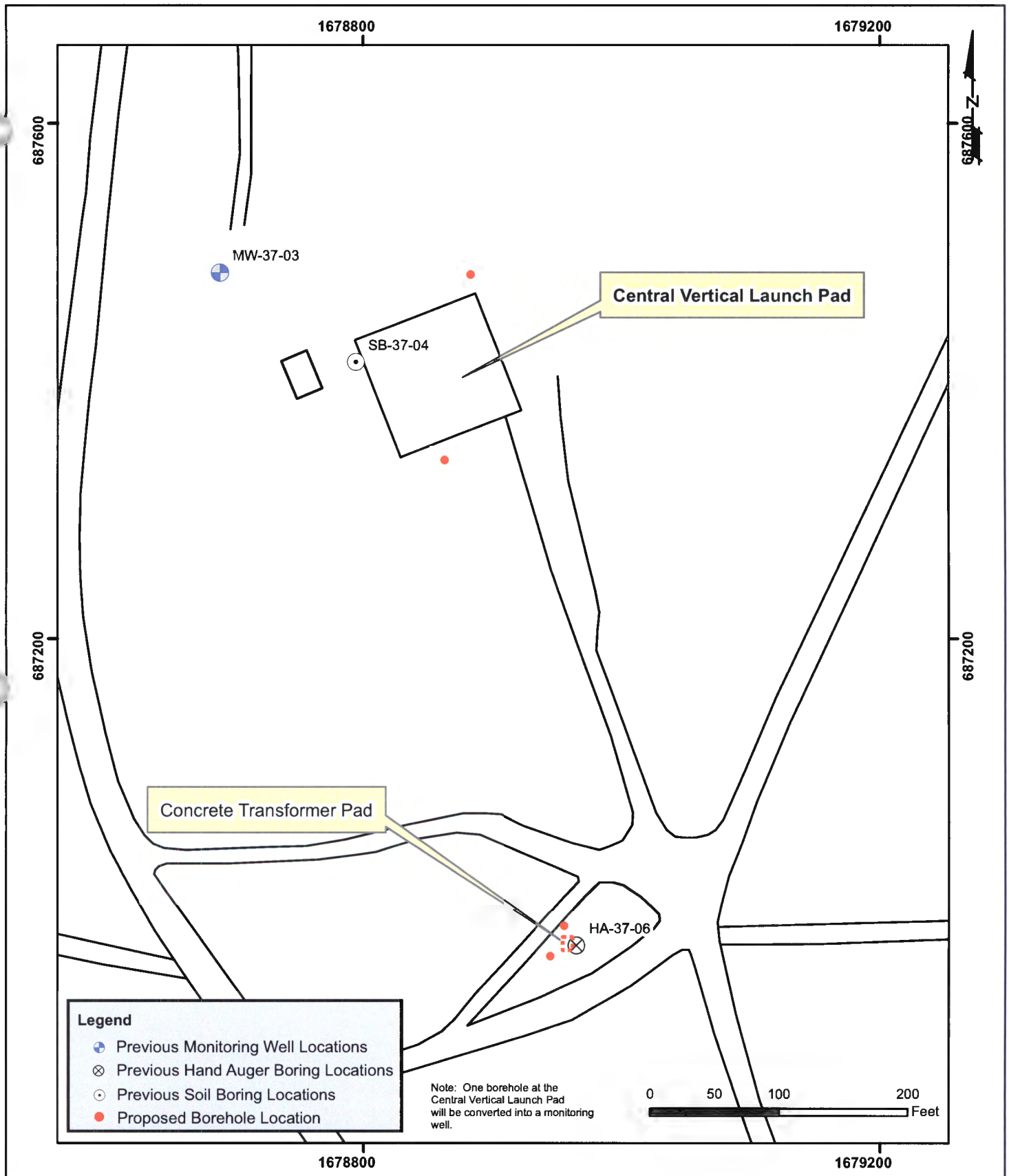
OT-37 Northern Vertical Launch Pad Proposed Soil Boring and Monitoring Well Locations

PROJECT NO.	SCALE	DATE	DRAWN BY: cm
9050361	1"=80'	8/18/06	DRAWING NO: Figure 3-9

Accelerated Corrective Measures Work Plan
Holloman AFB, New Mexico

Figure 3-9



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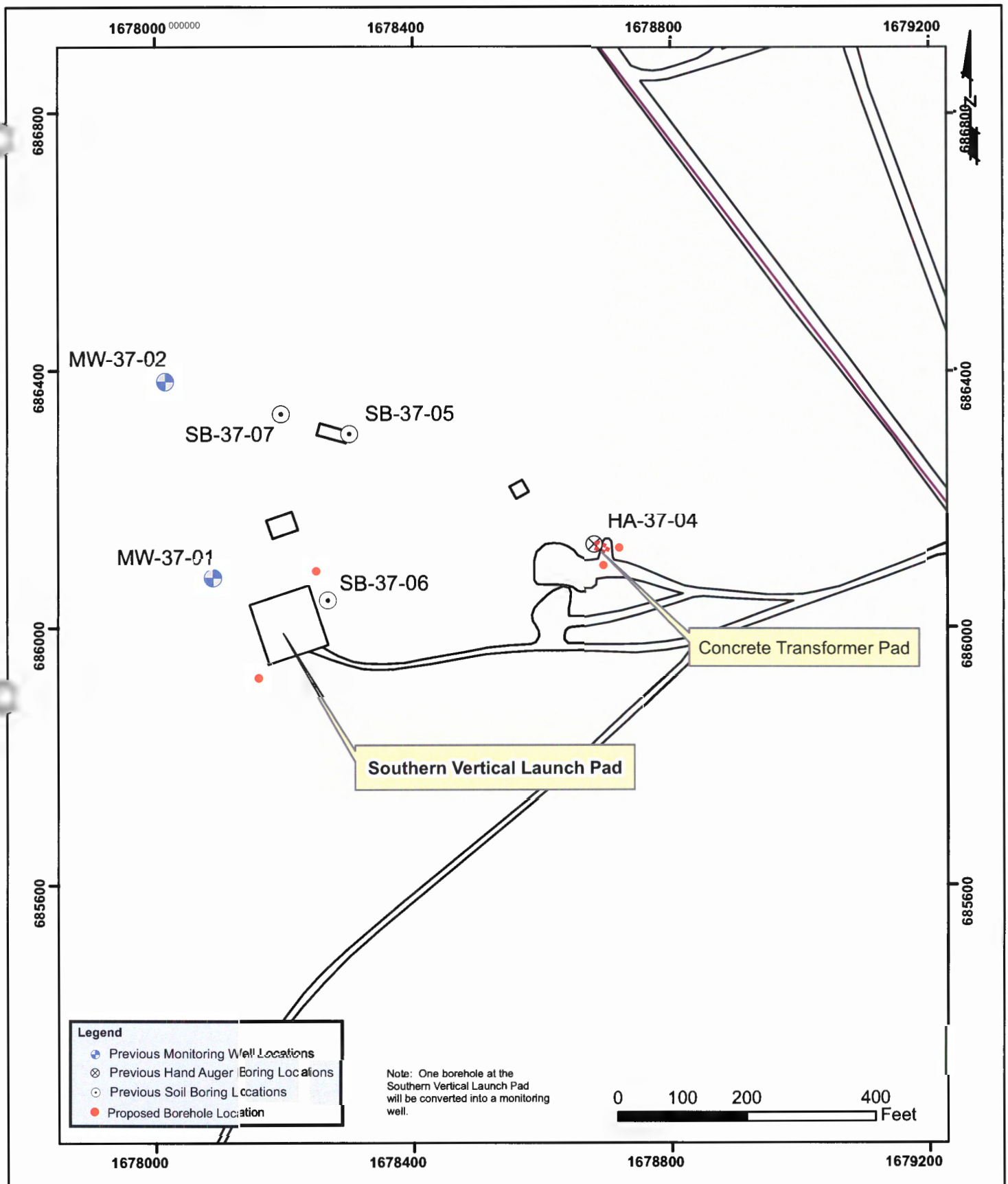
OT-37 Central Vertical Launch Pad Proposed Soil Boring and Monitoring Well Locations

PROJECT NO.	SCALE	DATE	DRAWN BY: cm
9050361	1"=100'	8/18/06	DRAWING NO: Figure 3-10

Accelerated Corrective Measures Work Plan
Holloman AFB, New Mexico

Figure 3-10



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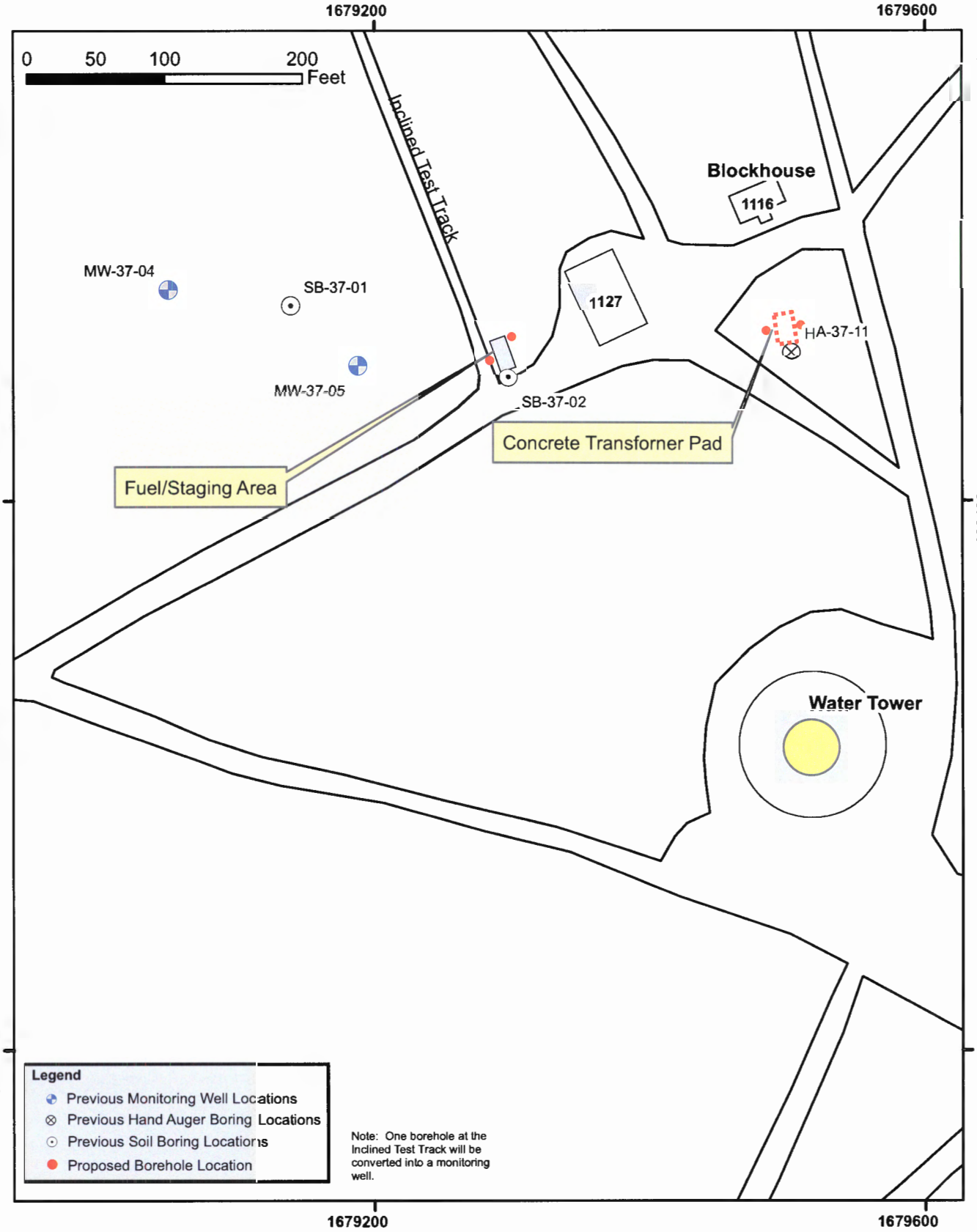
OT-37 Southern Vertical Launch Pad Proposed Soil Boring and Monitoring Well Locations

PROJECT NO.	SCALE	DATE	DRAWN BY: cm
9050361	1"=200'	8/18/06	DRAWING NO: Figure 3-11

Accelerated Corrective Measures Work Plan
Holloman AFB, New Mexico

Figure 3-11



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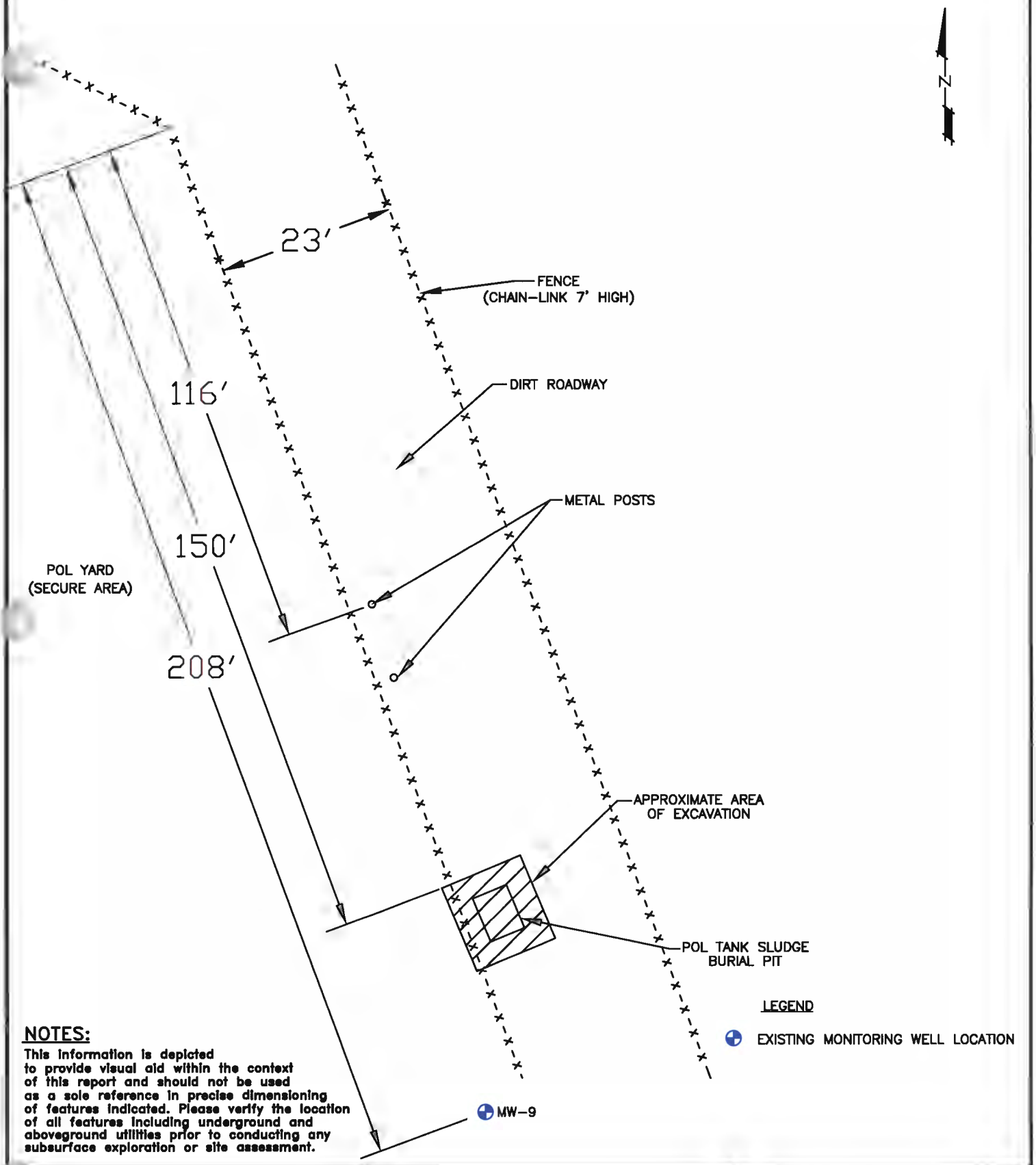
OT-37 Inclined Test Track Proposed Soil Boring and Monitoring Well Locations

PROJECT NO.	SCALE	DATE	DRAWN BY: cm
9050361	1"=100'	8/18/06	DRAWING NO: Figure 3-12

Accelerated Corrective Measures Work Plan
Holloman AFB, New Mexico

Figure 3-12



NOTES:

This information is depicted to provide visual aid within the context of this report and should not be used as a sole reference in precise dimensioning of features indicated. Please verify the location of all features including underground and aboveground utilities prior to conducting any subsurface exploration or site assessment.

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RING,

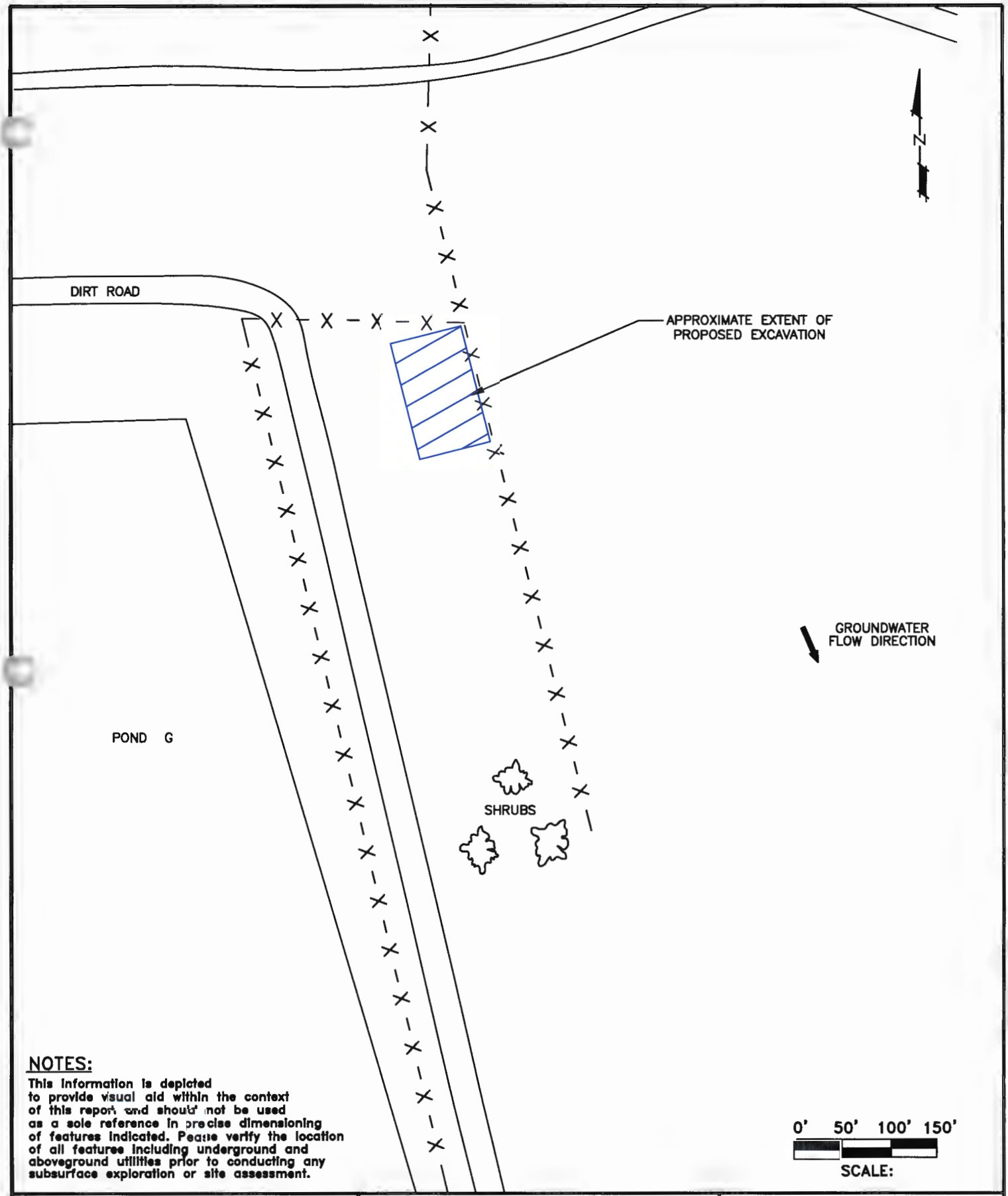
PROPOSED EXCAVATION AREA
FOR OT-03

PROJECT NO.	SCALE	DATE	DRAWN BY
9050361	NTS	6/9/06	TES

DRAWING NO: 9050361-04NEW

Accelerated Corrective Measures
Work Plan
Holloman AFB, New Mexico

Figure 4-1



NOTES:

This information is depicted to provide visual aid within the context of this report and should not be used as a sole reference in precise dimensioning of features indicated. Please verify the location of all features including underground and aboveground utilities prior to conducting any subsurface exploration or site assessment.

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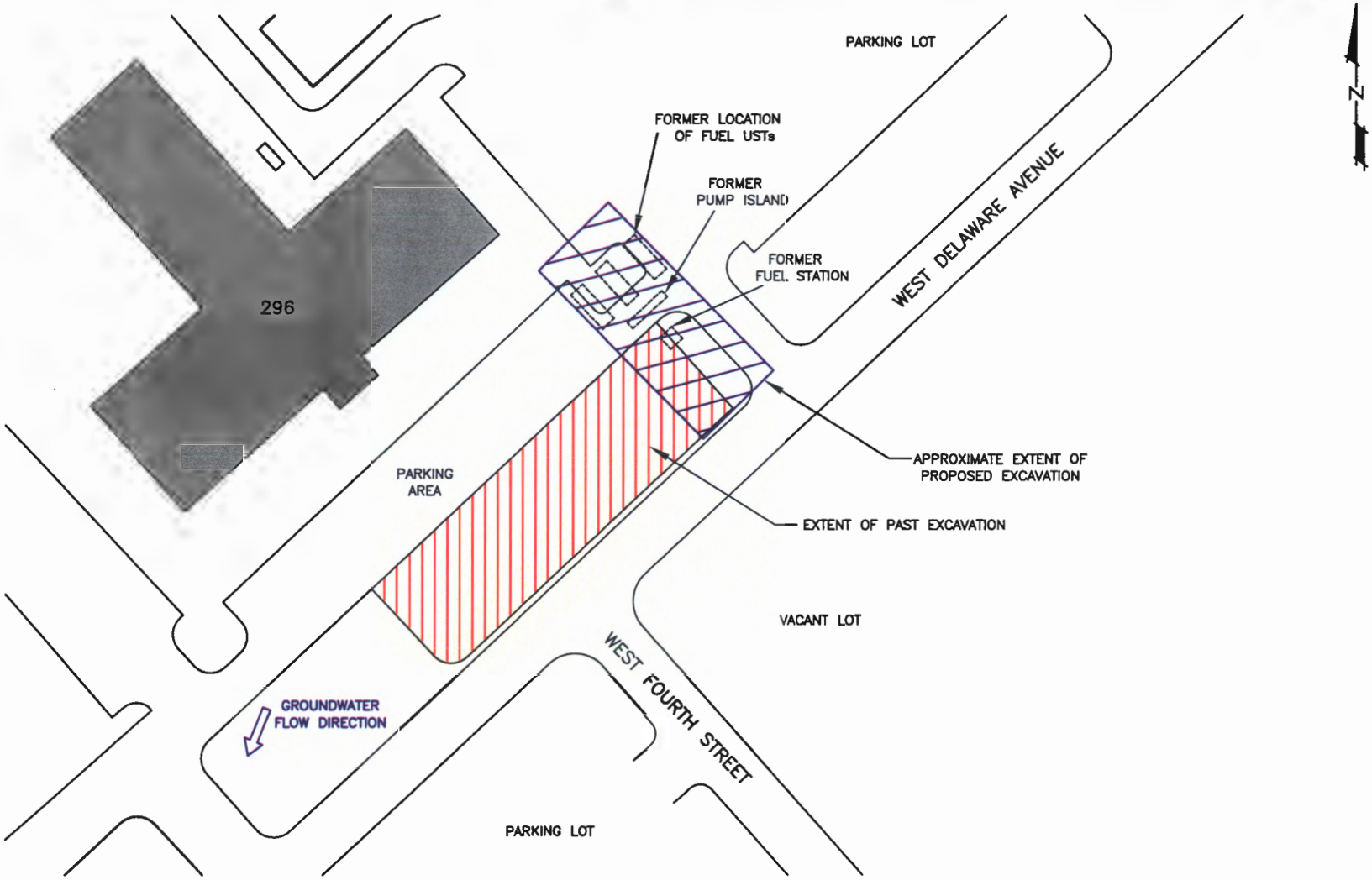
PROPOSED EXCAVATION AREA FOR OT-20

PROJECT NO.	SCALE	DATE	DRAWN BY: TES
9050361	AS SHOWN	7/12/06	DRAWING NO: 9050361-4.2

Accelerated Corrective Measures Work Plan
Holloman AFB, New Mexico

Figure 4-2



NOTES:

This information is depicted to provide visual aid within the context of this report and should not be used as a sole reference in precise dimensioning of features indicated. Please verify the location of all features including underground and aboveground utilities prior to conducting any subsurface exploration or site assessment.

0' 40' 80' 160'

SCALE:

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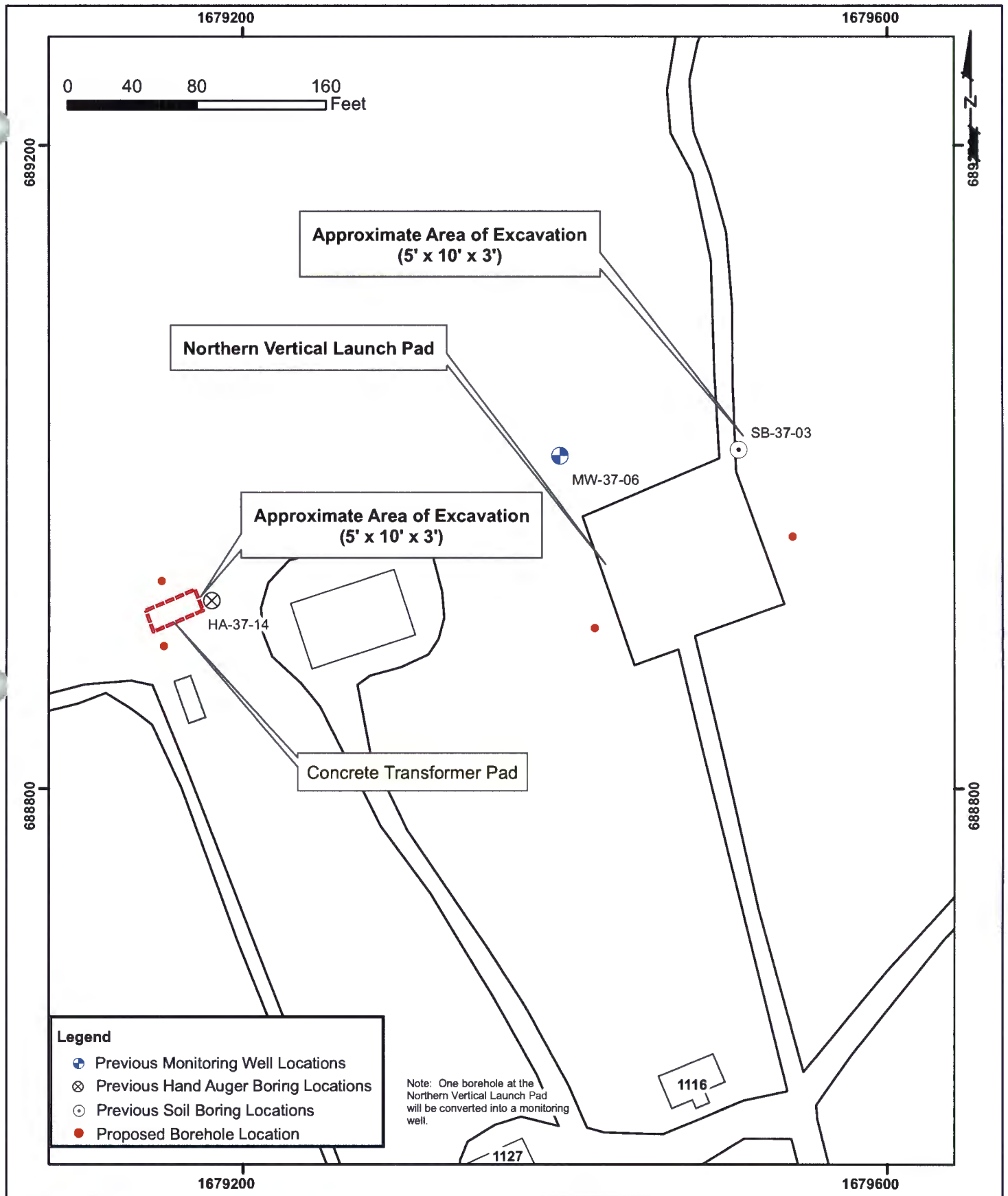
PROPOSED EXCAVATION AREA FOR OT-45

PROJECT NO.	SCALE	DATE	DRAWN BY:
9050361	AS SHOWN	6/9/06	TES/MRM
			DRAWING NO: 9050361-4.3

Accelerated Corrective Measures Work Plan
Holloman AFB, New Mexico

Figure 4-3



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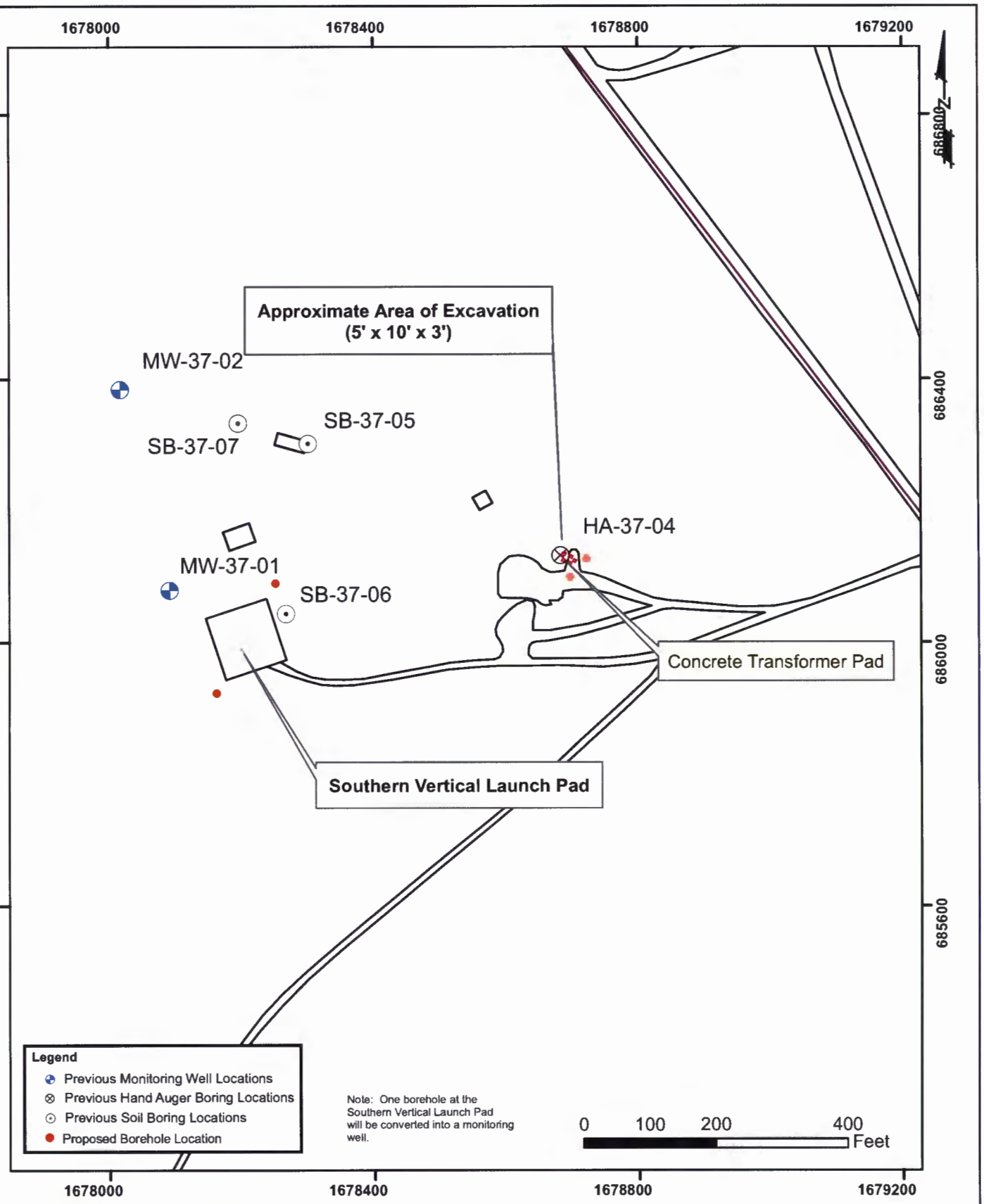
Proposed Excavation Areas OT-37 for the Northern Vertical Launch Pad

PROJECT NO.	SCALE	DATE	DRAWN BY: cm
9050361	1"=80'	8/18/06	DRAWING NO: Figure 4-4

Accelerated Corrective Measures Work Plan
Holloman AFB, New Mexico

Figure 4-4



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Proposed Excavation Area OT-37 for the Southern Vertical Launch Pad

PROJECT NO.	SCALE	DATE	DRAWN BY: cm
9050361	1"=200'	8/18/06	DRAWING NO: Figure 4-5

Accelerated Corrective Measures Work Plan
Holloman AFB, New Mexico

Figure 4-5

APPENDIX A

HISTORICAL DATA FROM PREVIOUS INVESTIGATIONS

Appendix A-1-1

Letter Report regarding *Evaluation of P.O.L. Tetraethyl Lead Disposal Site*, R.J. Andreoli, 2Lt, USAF, BSC, August 1980.

File: 178-5
R.L.

203

DEPARTMENT OF THE AIR FORCE
USAF HOSPITAL HOLLOMAN (TAC)
HOLLOMAN AIR FORCE BASE, NEW MEXICO 88330

REPLY TO ATTN OF: SGPM (Capt Sprester) 26 August 1980

SUBJECT: Evaluation of P.O.L. Tetraethyl Lead Disposal Site

TRP Sub No 3

TO: SGP
SGD
TTH/CCE
TTH/CC
49 SUP/CC
IN TURN

1. Capt Forrest Sprester and Lt Robert Andreoli, Bioenvironmental Engineers, collected six soil samples from the Holloman AFB Land Disposal site for POL tank sludges on 19 Jan 80. The purpose of the sampling was to determine the concentration of lead in the soil and compare the results to Environmental parameters established by the U.S. Environmental Protection Agency.

2. BACKGROUND. The land disposal site is located outside the east perimeter fence of the POL storage facilities. It has been utilized in the past to dispose of the sludge from fuel storage tanks (AVGAS, JP-4, Mo-Gas) after cleaning. The exact size of the disposal area has not been determined or the quantity of sludge disposed of. The white soil surrounding the site was highly gypsiferous having a pH of 8-10.

3. PROCEDURE.

a. The soil samples were collected from the surface, two foot, and three foot depths. Four of the samples were obtained from the center of the disposal site and two outside of the marked area. A plan view of the sample locations is shown on Sketch 1.

b. A ship auger (one inch diameter) was used to obtain the soil at depths of two and three feet.

c. The soil was placed in 150 milliliter glass containers and shipped to the USAF Occupational Environmental Health Laboratory, Brooks AFB, TX. for analysis for lead.

d. A visual inspection of the area was made and a photograph of the disposal site was taken.

e. A soil sample was obtained at a distance of 30 feet from the disposal site. This sample was supposed to be used to establish a baseline for lead in the soil for comparison. However, the lead content was not indicative of normal soils.

Readiness is our Profession

SIGN

4. VISUAL FINDINGS. The contents of the pit at the disposal site consisted of well-weathered rags, some iron fragments, and dark red, stained soil. The soil was easily penetrated using the auger to a depth of three feet with the stained soil found throughout the three foot depth. It is assumed that the contamination extends beyond the three foot soil horizon. The soil immediately beyond the edge of the stained soil was penetrated only with a good deal of effort and was found to be moist.

5. CHEMICAL ANALYSES. The findings of the chemical analysis are listed on Table 1.

Table 1

Chemical Analyses for Lead of Soil Samples for Fuel Sludge Land Disposal Site, Holloman AFB, New Mexico

Sample No.	Sample Depth	Lead Content Parts per Million by Weight	Lead Content Parts per Million by Weight Typical*	Range*
1	Surface	3750		
2	Three feet	1500		
3	Two feet	152		
4	Surface	1500	10	2-200
5	Two feet	172		
6	Surface	550		
7	Three feet	157		
8	Surface	372		
Mean Value		1019		

*The Environmental Research Laboratory, Solid and Hazardous Waste Research Division, Cincinnati, Ohio

The sample locations are shown in Profile on Sketch 2.

6. DISCUSSION OF RESULTS.

a. The common lead content of the land disposal site and its surroundings exceed any natural lead concentrations reported in the literature. Soil studies for Four Corners, New Mexico indicated a maximum of 5.8 parts per million background concentration. Statistical studies in field geochemistry have reported

mean values up to 28 parts per million. As can be seen from Table 1, the mean value for the eight samples was 1019 parts per million.

b. Lead is a highly toxic element. However, lead poisoning from natural sources such as plants is very unlikely. The most hazardous and most difficult to detect without sensitive chemical analysis equipment is through consuming water contaminated with lead.

c. The disposal site does not comply with the New Mexico regulation for disposal for tetraethyl lead. Under the Resource Conservation and Recovery Act (RCRA) Subtitle C, the disposal site is considered a toxic waste site that does not meet the minimum criteria required to protect the environment. An exemption could have been applied for prior to 1979 for the site but under RCRA the exemption would have become null and void. According to Mr. Raymond Cisneros, New Mexico Environmental Improvement Division, the site must be properly closed as soon as possible to eliminate further surface contamination.

7. CONCLUSION AND RECOMMENDATION.

a. The lead content of the soils at the tetraethyl lead disposal site was far above what is normally found in nature. Due to site location it does not pose an immediate health hazard but does clearly violate Federal and State Environmental Regulations. The lead contaminated soil should be excavated and placed in 55 gallon drums. The estimated quantity of highly contaminated soil will likely fill three or four drums. The filled drums should be clearly marked as to their content and disposed of through a licensed toxic waste disposal contractor. The surrounding soil that has been contaminated by lead carried by runoff waters, an area estimated to be 50 feet in diameter, should be scrapped down to a depth of at least six inches and the soil trucked to the base sanitary landfill for disposal. The area that has been excavated and scrapped should again be sampled for lead content. All records of closure must be maintained for a minimum of five years. The excavated area should then be backfilled with soil to its original contour.

b. The extent of the migration of the lead has been kept to a minimum due to the small amount of rainfall in the Holloman area and the very low permeability of the soil. The only way to assure that the contamination will not continue to spread is to dispose of the material as stated above. The method described will comply with Federal and State Regulations. Once the material has been removed, the signs must be removed and the Base Master Plan must be modified to reflect the action taken to eliminate the disposal area.

c. Prior to removal of the lead, notify the Base Bioenvironmental Engineer and Environmental Coordinator of the actions intended. The Bioenvironmental Engineer will provide information on protective equipment required by the workers who will be working directly with the contaminated soils. The Environmental Coordinator can provide assistance in disposal of the containers through a contractor.

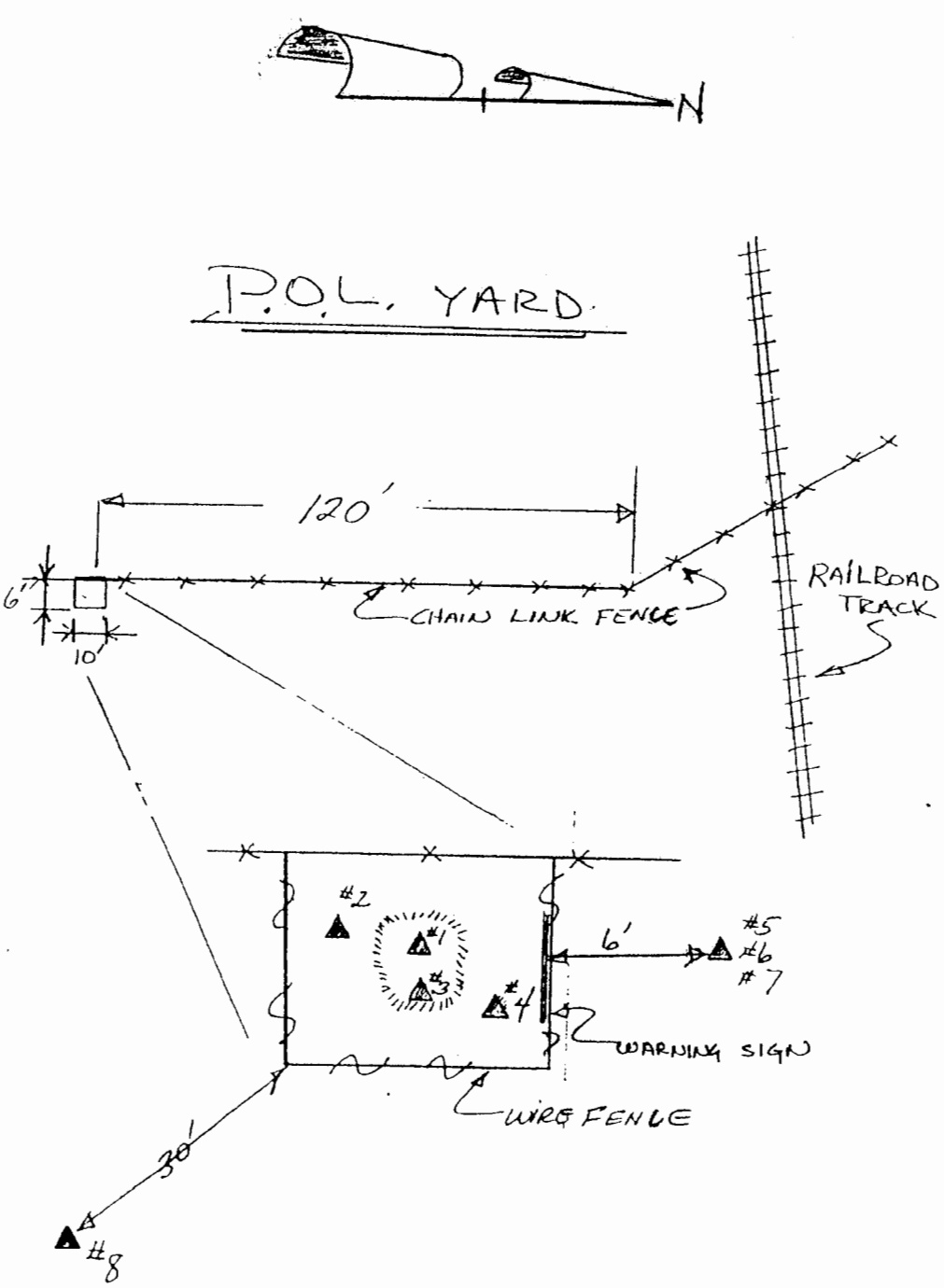
8. Should you have any questions pertaining to the above, please call Environmental Health at Extension 3303.

ROBERT J. ANDREOLI, 2Lt, USAF, BSC
Chief, Environmental Services

Cy to: 49CSG/CC
49CSG/JA
TTH/SEG
49CSG/DEEV

2 Atch
1. Sketch 1 - Planview of Sample Locations
2. Sketch 2 - Profile View of Sample Locations

USAF HOSPITAL/SGPM
HOLLOMAN AFB, NEW MEXICO

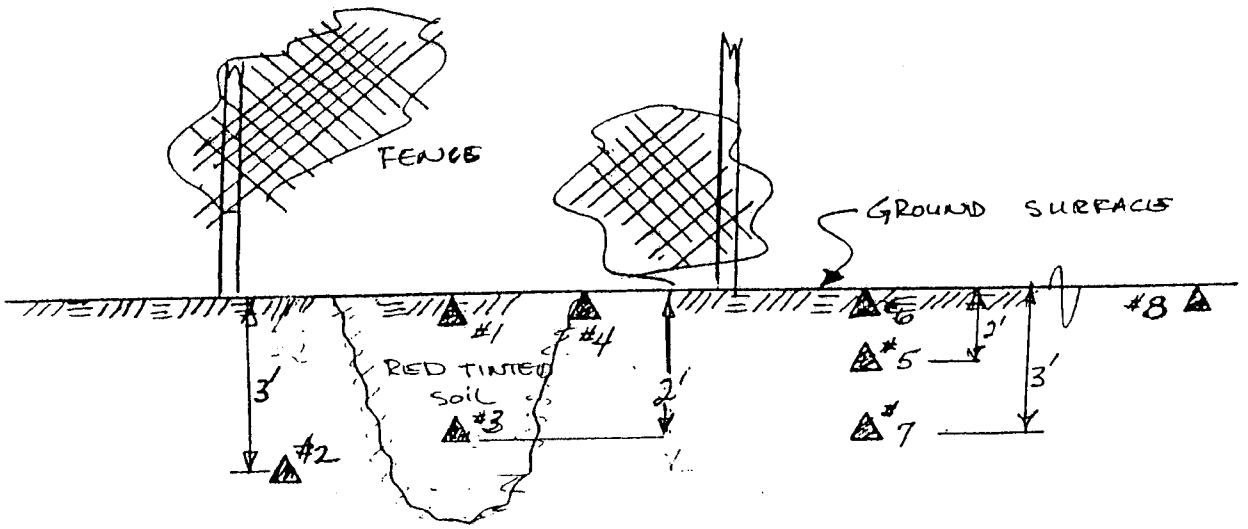


SKETCH No. 1

Plan View of Sample Locations of
the Land Disposal Site

Scale: None
Drwn by: Capt Sprester

USAF HOSPITAL/SGPM
HOLLOMAN AFB, NEW MEXICO



SKETCH No. 2

Profile View of Sample Locations of the Land Disposal Site

Scale: None
Drwn by: Capt Sprester
January 1980

Appendix A-1-2

Draft Final Remedial Investigation (RI) Report, Investigation, Study and Recommendation for 29 Waste Sites, Holloman Air Force Base, NM, Radian Corporation, June 1992.

RADIAN
CORPORATION

DCN 92-269-004-16-07
RCN 269-004-16-06

(Mailing Address)
P.O. Box 201088
Austin, TX 78720-1088
(Shipping Address)
8501 North Mopac Blvd.
Austin, TX 78759
(512)454-4797

REMEDIAL INVESTIGATION (RI) REPORT

INVESTIGATION, STUDY AND RECOMMENDATION FOR 29 WASTE SITES HOLLOMAN AIR FORCE BASE, NM

Volume I

DRAFT FINAL

Prepared for:

49 SG/CEV
Holloman Air Force Base, NM

Prepared by:

Radian Corporation
8501 North MoPac Blvd.
P.O. Box 201088
Austin, Texas 78720-1088

Under Contract No. DACW45-89-D-0515 with:

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

June 1992

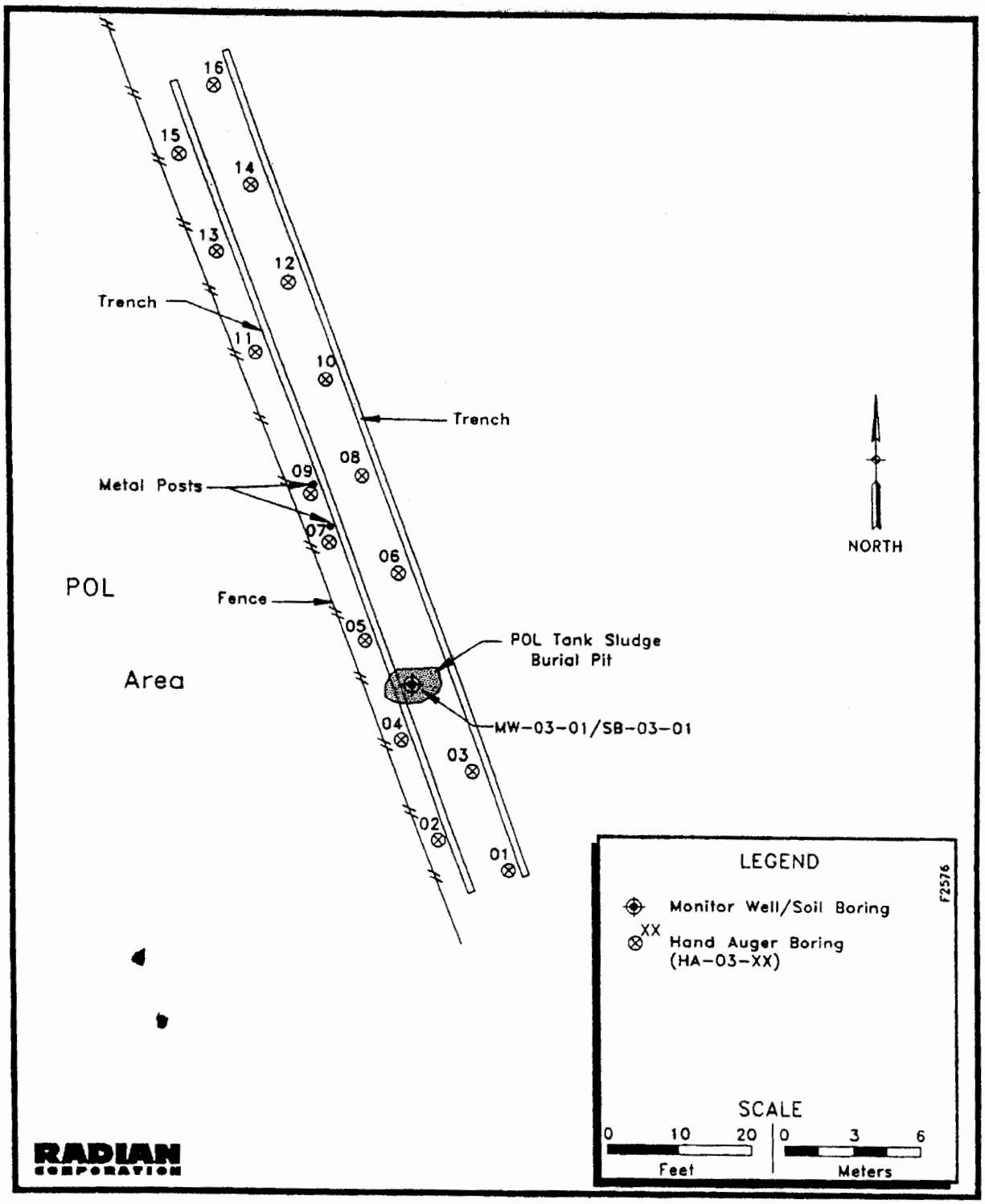


Figure 4-5. Trench, Hand Auger Boring, Soil Boring, and Monitor Well Locations for Site 3

Table 4-15

Lead Concentrations in Surface Sampling Adjacent to POL Tank Sludge Burial Pit, Site 3

			SW7421 - Lead (mg/kg)	
Location	Sample ID	Depth	Result	(DL)
HA-03-01	91JULH003-003	0 - 2 ft	4.3	(0.26)
HA-03-02	91JULH003-004	0 - 2 ft	4.8	(0.27)
HA-03-03	91JULH003-005	0 - 2 ft	5.2	(0.25)
HA-03-04	91JULH003-006	0 - 2 ft	3.2	(0.26)
HA-03-05	91JULH003-007	0 - 2 ft	2.4	(0.28)
HA-03-06	91JULH003-008	0 - 2 ft	3.9	(0.25)
HA-03-07	91JULH003-009	0 - 2 ft	2.9	(0.28)
HA-03-08	91JULH003-010	0 - 2 ft	2.3	(0.30)
HA-03-09	91JULH003-011	0 - 2 ft	38	(2.8)
HA-03-10	91JULH003-012	0 - 2 ft	7.8	(0.56)
HA-03-11	91JULH003-013	0 - 1.5 ft	5.5	(0.27)
HA-03-12	91JULH003-014	0 - 2 ft	2.8	(0.29)
HA-03-13	91JULH003-015	0 - 1.5 ft	5.4	(0.28)
HA-03-14	91JULH003-016	0 - 1.7 ft	1.7	(0.31)
HA-03-15	91JULH003-017	0 - 2 ft	3.3	(0.31)
HA-03-16	91JULH003-018	0 - 2 ft	2.4	(0.29)

Table 4-16

Concentrations of Inorganic and Organic Analytes in Site 3 Soil Samples

DRILLING LOG

HOLE NO. MW-03-01

PROJECT HOLLOMAN AFB RI/FS

INSPECTOR HTH

SHEET 2 OF 2 SHEETS

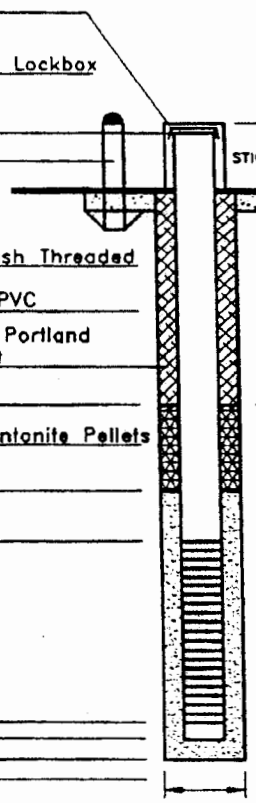
a	DEPTH b	DESCRIPTION OF MATERIALS c	FIELD SCREENING RESULTS d	GEOTECH SAMPLE OR CORE BOX NO. e	ANALYTICAL SAMPLE NO. f	BLOW COUNTS g	REMARKS/RECOVERY h
		CLAY, as above.					5.0/5.0 ft
	11						
	12	SANDY CLAY: light brown (5YR6/4), dry, medium to low plasticity. (CL)					Water level at 16.5 ft. bgl.
	13	SILTY SAND: medium grey (N5), dry, poorly graded, very fine grained, stained grey, chemical odor. (SM)	DH=140ppm				
	14						
	15						
	16						
	17	SAND: medium grey (N5), wet, fine to medium grained, medium graded, bedding planes. (SP)	DH=150ppm	MW-003-001			GEOTECHNICAL SAMPLE: 16.5-19.0 ft
	18						
	19						
	20						
	21						4.0/4.0 ft
	22	SAND, as above.					
	23						
	24						TD= 25 ft
	25						
	26						

F2307

ELEVATION GROUND WATER			PROJECT HOLLOMAN AFB RI/FS
DATE INSTALLED 05 SEPT 91	STARTED 1430	COMPLETED 1830	LOCATION (Coordinates or Station) 3
ELEVATION TOP OF CASING 4094.18			SIGNATURE OF INSPECTOR/INSTALLER HTH
DRILLING METHOD HOLLOW STEM AUGER			WELL NO. (as shown on drawing: title and file number) MW-03-01

MONITORING WELL CONSTRUCTION DIAGRAM

(ALL MEASUREMENTS FROM GROUND SURFACE)



PROTECTIVE CASING

TYPE OF PROTECTIVE CASING: Steel Lockbox

TOP OF WELL

PROTECTIVE POSTS

STICK-UP: 2.6 ft.

GROUND SURFACE

CASING DIAMETER: 2 in.

CONCRETE PAD MIN. 4.0" THICKNESS

TYPE OF PIPE JOINTS: Flush Threaded

TYPE OF BLANK CASING: PVC

13.3 ft. LENGTH OF SOLID PIPE

BACKFILL/GROUT MIX ETC. Type I Portland Cement

TOP OF SEAL 5.7 ft. bgl

TYPE OF SEAL: 1/4" Bentonite Pellets

TOP OF FILTERPACK 8.7 ft. bgl

TOP OF SCREEN 10.7 ft. bgl

9.5 ft. WELL SCREEN LENGTH

FILTER PACK

BOTTOM OF WELL 20.6 ft. bgl

BOTTOM OF BORING 24.0 ft. bgl

BORING DIAMETER 7.5 in.

SCREEN INFORMATION

SCREEN DIA.: 2 in.

SLOT WIDTH: 0.010 in.

SCHEDULE: 40

MATERIAL: ☒ PVC ☐ STAINLESS STEEL ☐ OTHER (DESCRIBE)

FILTERPACK MATERIAL

TYPE: 16-40 Colorado Silica Sand

BACKFILL METHOD: Tremie through auger

WELL DEVELOPMENT

METHOD: See well development record

TIME SPENT DEVELOPING:

VOLUME OF WATER REMOVED:

VOLUME OF WATER ADDED:

DESCRIPTION OF PREDEVELOPMENT WATER:

DESCRIPTION OF POST DEVELOPMENT WATER:

WATER LEVEL SUMMARY

WATER LEVEL MEASUREMENTS

DATE/TIME/LEVEL 05 SEPT 91/1600/13.3 ft bgl

04 NOV 91/1533/14.15 ft. bmp

DEPTH FROM TOP CASING AFTER DEVELOPMENT:

F2324

Appendix A-2-1

Portions of: *Draft Final Remedial Investigation (RI) Report, Investigation, Study and Recommendation for 29 Waste Sites, Holloman Air Force Base, NM,* Radian Corporation, June 1992

RADIAN CORPORATION

DCN 92-269-004-16-07
RCN 269-004-16-06

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REMEDIAL INVESTIGATION (RI) REPORT

INVESTIGATION, STUDY AND RECOMMENDATION FOR 29 WASTE SITES HOLLOMAN AIR FORCE BASE, NM

Volume I

DRAFT FINAL

Prepared for:

49 SG/CEV
Holloman Air Force Base, NM

Prepared by:

Radian Corporation
8501 North MoPac Blvd.
P.O. Box 201088
Austin, Texas 78720-1088

Under Contract No. DACW45-89-D-0515 with:

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

June 1992

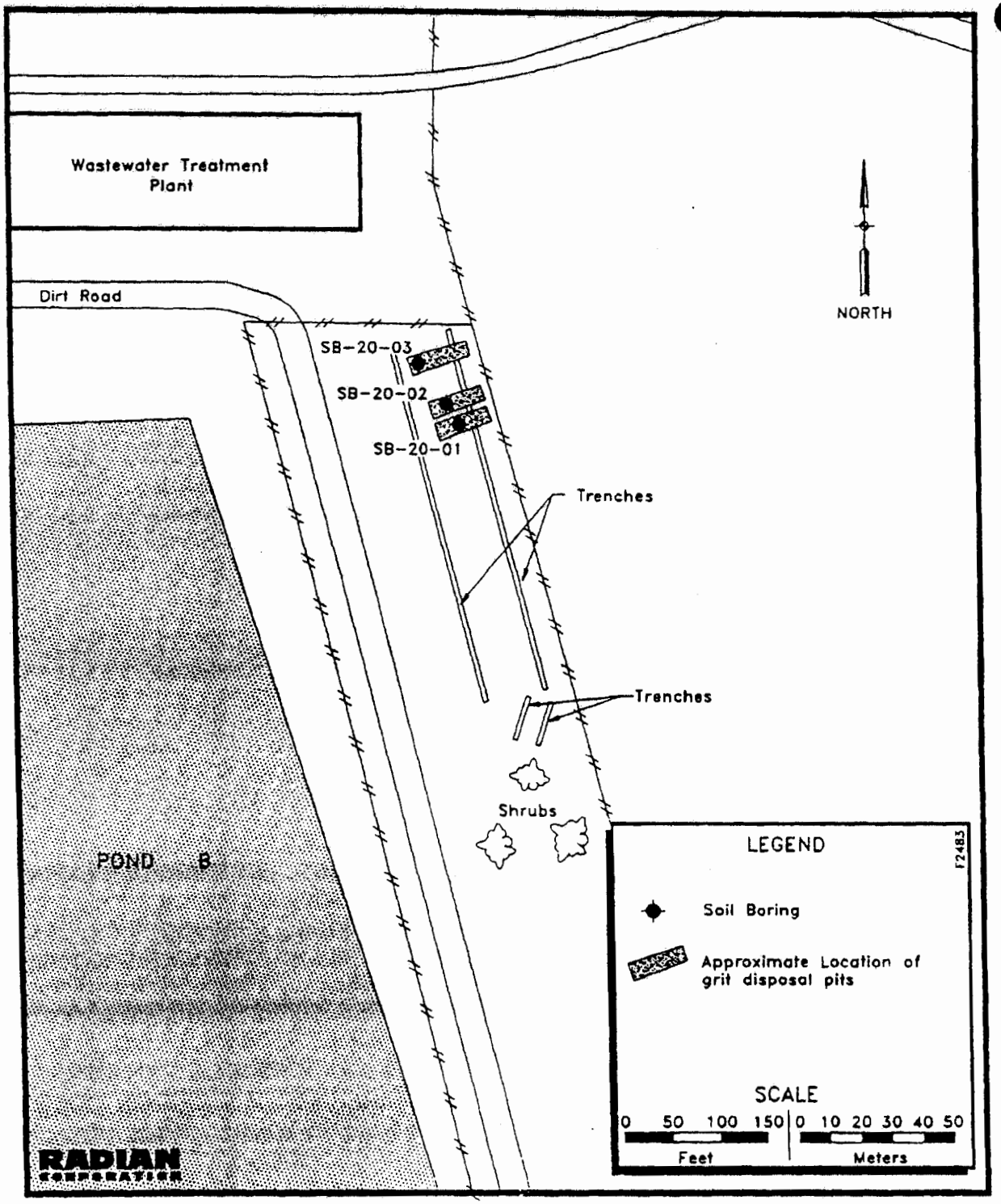


Figure 4-28. Trench and Soil Boring Locations for Site 20

Table 4-43

Concentrations of Inorganic Analytes in Site 20 Waste and Soil Samples

Location:	SB-20-01				SB-20-02				SB-20-03	
Sample ID: Depth:	91TUL1020-001 0 - 2 ft		91TUL1020-002 2 - 4 ft		91TUL1020-003 0 - 1.3 ft		91TUL1020-004 1.3 - 2 ft		91TUL1020-005 0 - 0 ft	
Analyte	Result	(DL)	Result	(DL)	Result	(DL)	Result	(DL)	Result	(DL)
SW6010 - Metals (mg/kg)										
Cadmium	2.5 @	(0.91)	ND	(0.96)	1.6 @	(0.97)	ND	(1.0)	1.4 @	(0.95)
Chromium	20	(1.8)	7.6 @	(1.9)	11	(1.9)	4.2 @	(2.0)	11	(1.9)
Copper	140	(3.6)	ND	(3.8)	98	(3.9)	ND	(4.0)	ND	(3.8)
Nickel	9.7 @	(3.6)	6.4 @	(3.8)	8.6 @	(3.9)	4.5 @	(4.0)	7.7 @	(3.8)
Silver	35	(1.8)	ND	(1.9)	15	(1.9)	ND	(2.0)	ND	(1.9)
Zinc	180	(3.6)	18 @	(3.8)	200	(3.9)	15 @	(4.0)	34	(3.8)
SW7060 - Arsenic (mg/kg)	2.2 @	(1.5)	ND	(1.7)	2.3 @	(1.6)	2.4 @	(1.7)	ND	(1.7)
SW7421 - Lead (mg/kg)	48	(2.8)	1.7	(0.33)	34	(3.0)	1.3 @	(0.32)	5.4	(0.32)
SW7471 - Mercury (mg/kg)	1.7	(0.056)	ND	(0.060)	2.5	(0.060)	ND	(0.060)	ND	(0.060)
SW7740 - Selenium (mg/kg)	0.86 @	(0.46)	ND	(0.54)	0.67 @	(0.50)	ND	(0.54)	ND	(0.53)

NOTE: Table presents only constituents detected in soil at this site.
@ = Measured result is less than five times the detection limit.
ND = Not Detected, at the reported detection limit.

Table 4-44

Concentrations of Organic Analytes in Site 20 Waste and Soil Samples

Location:	SB-20-01				SB-20-02				SB-20-03	
Sample ID: Depth:	91JUL3H020-001 0 - 2 ft		91JUL3H020-002 2 - 4 ft		91JUL3H020-003 0 - 1.3 ft		91JUL3H020-004 1.3 - 2 ft		91JUL3H020-005 0 - 8 ft	
Analyses	Result	(DL)	Result	(DL)	Result	(DL)	Result	(DL)	Result	(DL)
SW8080 - Organochlorine Pesticides and PCBs (μg/kg)										
4,4'-DDE	52 X	(6.2)	ND	(0.68)	ND	(130)	ND	(0.68)	ND	(67)
Aldrin	32 X	(6.2)	ND	(0.68)	ND	(130)	ND	(0.68)	ND	(67)
Endosulfan II	ND	(19)	ND	(2.0)	ND	(390)	ND	(2.0)	430 X@	(200)
Endrin Aldehyde	48 X@	(12)	ND	(1.4)	ND	(260)	ND	(1.4)	ND	(130)
Heptachlor epoxide	18 X@	(6.2)	ND	(0.68)	ND	(130)	ND	(0.68)	5000 X	(67)
PCB-1254	990 C	(120)	ND	(14)	2200 J	(2600)	ND	(14)	4800 C@	(1300)
gamma-BHC	24 C@	(6.2)	ND	(0.68)	ND	(130)	ND	(0.68)	ND	(67)
SW8150 - Chlorinated Herbicides (μg/kg)										
Dicamba	ND	(17)	ND	(18)	ND	(18)	ND	(18)	220	(18)
SW8240 - Volatile Organics (μg/kg)										
Benzene	ND	(120)	ND	(140)	ND	(130)	ND	(140)	6.8 J	(130)
Methylene chloride	480 B@	(120)	760 B	(140)	570 B@	(130)	450 B@	(140)	320 B@	(130)
Toluene	35 JB	(120)	19 JB	(140)	11 JB	(130)	12 JB	(140)	45 JB	(130)
Xylenes	ND	(120)	ND	(140)	ND	(130)	ND	(140)	25 J	(130)
SW8240 - Volatile Organics, TIC List (μg/kg)										
Octanal	ND	()	ND	()	ND	()	ND	()	180	()

NOTE: Table presents only constituents detected in soil at this site.
X = SW8080--Presence of analyte confirmed by second column analysis, but quantitation was not confirmed; ND = Not Detected, at the reported detection limit; @ = Measured result is less than five times the detection limit; C = Presence and quantitation of analyte confirmed by second column analysis; J = Detected below the detection limit; B = Analyte detected in laboratory blank analysis, no blank subtraction performed; TIC = Tentatively identified compound.

Table 4-45

Soil Analytes Detected Above Risk-Based Action Levels at Site 20

Analyte	Location ID	Result	Action Level
Soil Results (mg/kg)			
Heptachlor epoxide	SB-20-03	5 X	0.08
Lead	SB-20-01	48	32
Lead	SB-20-02	34	32
PCB-1254	SB-20-01	0.99 C	0.09
PCB-1254	SB-20-02	2.2 J	0.09
PCB-1254	SB-20-03	4.8 C@	0.09

Note: Result units were changed to match action level units for this table.

X = SW8080--Presence of analyte confirmed by second column analysis, but quantitation was not confirmed.
C = Presence and quantitation of analyte confirmed by second column analysis.
J = Detected below the detection limit.
@ = Measured result is less than five times the detection limit.

DRILLING LOG

HOLE NO. SB-20-01

1. COMPANY NAME	RADIAN CORPORATION
2. DRILLING SUBCONTRACTOR	SOUTHWEST ENG INC
SHEET 1 OF 1 SHEETS	
3. PROJECT	HOLLOMAN AFB RI/FS FOR 29 SITES
4. LOCATION	20
5. NAME OF DRILLER	ART VALTIERRA
6. MANUFACTURER'S DESIGNATION OF DRILL	HOLLOW-STEM AUGER
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT	BOREHOLE DIA.: 7.5"
8. HOLE LOCATION	665374.56(Y), 545686.32(X)
9. SURFACE ELEVATION	4042.78
10. DATE STARTED	11 SEP 91
11. DATE COMPLETED	11 SEP 91
12. OVERBURDEN THICKNESS	
13. DEPTH GROUNDWATER ENCOUNTERED	
13. DEPTH DRILLED INTO ROCK	
16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED	
14. TOTAL DEPTH OF HOLE	4.0 ft.
17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY)	

18. GEOTECHNICAL SAMPLES	DISTURBED	UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES

20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY %

22. DEPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR
			GROUT	TAC

a	DEPTH b	DESCRIPTION OF MATERIALS c	FIELD SCREENING RESULTS d	GEOTECH SAMPLE OR CORE BOX NO. e	ANALYTICAL SAMPLE NO. f	BLOW COUNTS g	REMARKS/RECOVERY h
		FILL: to 0.4 ft composed of SILT, moderate orange pink (5YR 8/4), soft, (ML)				1,3,2,3	2.0/2.0 ft
	1	WASTE grit: moderate brown (5YR 4/4), dry, soft, well graded. SILT: layer 0.7 to 1.3 ft then WASTE to 1.9 ft, then			91JULH020-001		
	2	SILT: moderate orange pink (5YR 8/4), soft, non-plastic, slightly moist. (ML)			91JULH020-002	1,4,4,5	2.0/2.0 ft
	3	SILTY SAND: light brown (5YR 6/4), soft, moist, poorly graded. (SM)					
	4						TD= 4.0 ft
	5						
	6						
	7						
	8						
	9						

DRILLING LOG

HOLE NO. SB-20-02

F2539

1. COMPANY NAME	RADIAN CORPORATION
2. DRILLING SUBCONTRACTOR	SOUTHWEST ENG INC
SHEET 1 OF 1 SHEETS	
3. PROJECT	HOLLOMAN AFB RI/FS FOR 29 SITES
4. LOCATION	20
5. NAME OF DRILLER	ART VALTIERRA
6. MANUFACTURER'S DESIGNATION OF DRILL	HOLLOW-STEM AUGER
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT	BOREHOLE DIA.: 7.5"
8. HOLE LOCATION	665397.04(Y), 545673.24(X)
9. SURFACE ELEVATION	4042.90
10. DATE STARTED	11 SEP 91
11. DATE COMPLETED	11 SEP 91
12. OVERBURDEN THICKNESS	
13. DEPTH DRILLED INTO ROCK	
14. TOTAL DEPTH OF HOLE	2.0 ft.
15. DEPTH GROUNDWATER ENCOUNTERED	
16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED	
17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY)	
18. GEOTECHNICAL SAMPLES	DISTURBED / UNDISTURBED
19. TOTAL NUMBER OF CORE BOXES	
20. SAMPLES FOR CHEMICAL ANALYSIS	VOC / METALS / OTHER (SPECIFY) / OTHER (SPECIFY) / OTHER (SPECIFY)
21. TOTAL CORE RECOVERY	%
22. DEPOSITION OF HOLE	BACKFILLED / MONITORING WELL / OTHER (SPECIFY): GROUT
23. SIGNATURE OF INSPECTOR	TAC

a	DEPTH b	DESCRIPTION OF MATERIALS c	FIELD SCREENING RESULTS d	GEOTECH SAMPLE OR CORE BOX NO. e	ANALYTICAL SAMPLE NO. f	BLOW COUNTS g	REMARKS/RECOVERY h
	1	FILL & WASTE: mixed layers FILL, silt: light brown (5YR 6/4) WASTE grit: moderate brown (5YR 4/4) to 1.3 then			91JULH020-003	2,4,5,6	2.0/2.0 ft
	2	SANDY SILT: light brown (5YR 6/4), soft, moist, non-plastic, gypsum mottling. (ML)			91JULH020-004		TD= 2.0 ft
	3						
	4						
	5						
	6						
	7						
	8						
	9						

PROJECT HOLLOMAN AFB RI/FS FOR 29 SITES HOLE NO. SB-20-02

DRILLING LOG

HOLE NO. SB-20-03

1. COMPANY NAME	RADIAN CORPORATION
2. DRILLING SUBCONTRACTOR	SOUTHWEST ENG INC
SHEET 1 OF 2 SHEETS	
3. PROJECT	HOLLOMAN AFB RI/FS FOR 29 SITES
4. LOCATION	20
5. NAME OF DRILLER	ART VALTIERRA
6. MANUFACTURER'S DESIGNATION OF DRILL	HOLLOW-STEM AUGER
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT	BOREHOLE DIA.: 7.5"
8. HOLE LOCATION	665441.28(Y), 545643.53(X)
9. SURFACE ELEVATION	4042.15
10. DATE STARTED	11 SEP 91
11. DATE COMPLETED	11 SEP 91
12. OVERBURDEN THICKNESS	
15. DEPTH GROUNDWATER ENCOUNTERED	7.5 ft bgl
13. DEPTH DRILLED INTO ROCK	
16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED	
14. TOTAL DEPTH OF HOLE	11.0 ft.
17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY)	
18. GEOTECHNICAL SAMPLES	DISTURBED / UNDISTURBED
19. TOTAL NUMBER OF CORE BOXES	
20. SAMPLES FOR CHEMICAL ANALYSIS	VOC / METALS / OTHER (SPECIFY) / OTHER (SPECIFY) / OTHER (SPECIFY)
21. TOTAL CORE RECOVERY	%
22. DEPOSITION OF HOLE	BACKFILLED / MONITORING WELL / OTHER (SPECIFY): GROUT
23. SIGNATURE OF INSPECTOR	TAC

a	DEPTH b	DESCRIPTION OF MATERIALS c	FIELD SCREENING RESULTS d	GEOTECH SAMPLE OR CORE BOX NO. e	ANALYTICAL SAMPLE NO. f	BLOW COUNTS g	REMARKS/RECOVERY h
		SILTY SAND: light brown (5YR 6/4), soft, moist, fine grained. (SM)				1,1,2,1	2.0/2.0 ft
	1	WASTE: composed of fecal masses, tampon applicators, black-grey waxey balls, minor silt.			91JULH020 -005		sample composited from 0.9 ft to 7.5 ft
	2	WASTE: black (N1), waxy sludge, abundant hair, toothpaste cap.				0,0,0,0	2.0/2.0 ft
	3						VOAs sample collected from 2.0 ft to 4.0 ft
	4	WASTE: black (N1) sludge to 4.4 ft, then SILTY SLUDGE: medium grey (N1) to 4.9 ft,				0,0,0,5	2.0/2.0 ft
	5	SLUDGE: black (N1) to 5.4 ft, then					
		SILTY SAND: light brown (5YR 6/5), wet, soft, fine grained, gypsum crystals. (SM)					
	6	WASTE: black sand, sludge to 6.5 ft, grey sand to 7.4 ft, then black.				?,?,2,2	2.0/2.0 ft
	7	wet sandy sludge.					
	8						water at 7.5 ft bgl
	9	SILTY SAND: light brown (5YR 6/4), soft, saturated, fine grained. (SM)				1,2,2,2	2.0/2.0 ft outside of SS covered with waste

DRILLING LOG

HOLE NO. SB-20-03

PROJECT HOLLOMAN AFB RI/FS

INSPECTOR TAC

SHEET 2 OF 2 SHEETS

a	DEPTH b	DESCRIPTION OF MATERIALS c	FIELD SCREENING RESULTS d	GEOTECH SAMPLE OR CORE BOX NO. e	ANALYTICAL SAMPLE NO. f	BLOW COUNTS g	REMARKS/RECOVERY h
	11						TD= 11.0 ft
	12						
	13						
	14						
	15						
	16						
	17						
	18						
	19						
	20						
	21						
	22						
	23						
	24						
	25						
	26						
	27						

PROJECT HOLLOMAN AFB RI/FS FOR 29 SITES

HOLE NO. SB-20-03

F2540

Appendix A-3-1

Portions of: *Installation Restoration Program Records Search For Holloman Air Force Base, New Mexico*, CH_2M Hill, August 1983

File: 17A
R.L.

181

INSTALLATION RESTORATION PROGRAM RECORDS SEARCH

For
Holloman Air Force Base, New Mexico

CH2M HILL

Prepared for

AIR FORCE ENGINEERING AND SERVICES CENTER
DIRECTORATE OF ENVIRONMENTAL PLANNING
TYNDALL AIR FORCE BASE, FLORIDA 32403
AND
TACTICAL AIR COMMAND
DIRECTORATE OF ENGINEERING AND ENVIRONMENTAL PLANNING
LANGLEY AIR FORCE BASE, VIRGINIA 23665

AUGUST 1983

INSTALLATION RESTORATION PROGRAM RECORDS SEARCH

FOR

HOLLOMAN AIR FORCE BASE, NEW MEXICO

Prepared for

AIR FORCE ENGINEERING AND SERVICES CENTER
DIRECTORATE OF ENVIRONMENTAL PLANNING
TYNDALL AIR FORCE BASE, FLORIDA 32403

AND

TACTICAL AIR COMMAND
DIRECTORATE OF ENGINEERING AND ENVIRONMENTAL PLANNING
LANGLEY AIR FORCE BASE, VIRGINIA 23665

Prepared by

CH2M HILL
7201 N.W. 11th Place
Gainesville, Florida

August 1983

Contract No. F08637-80-G0010-0019

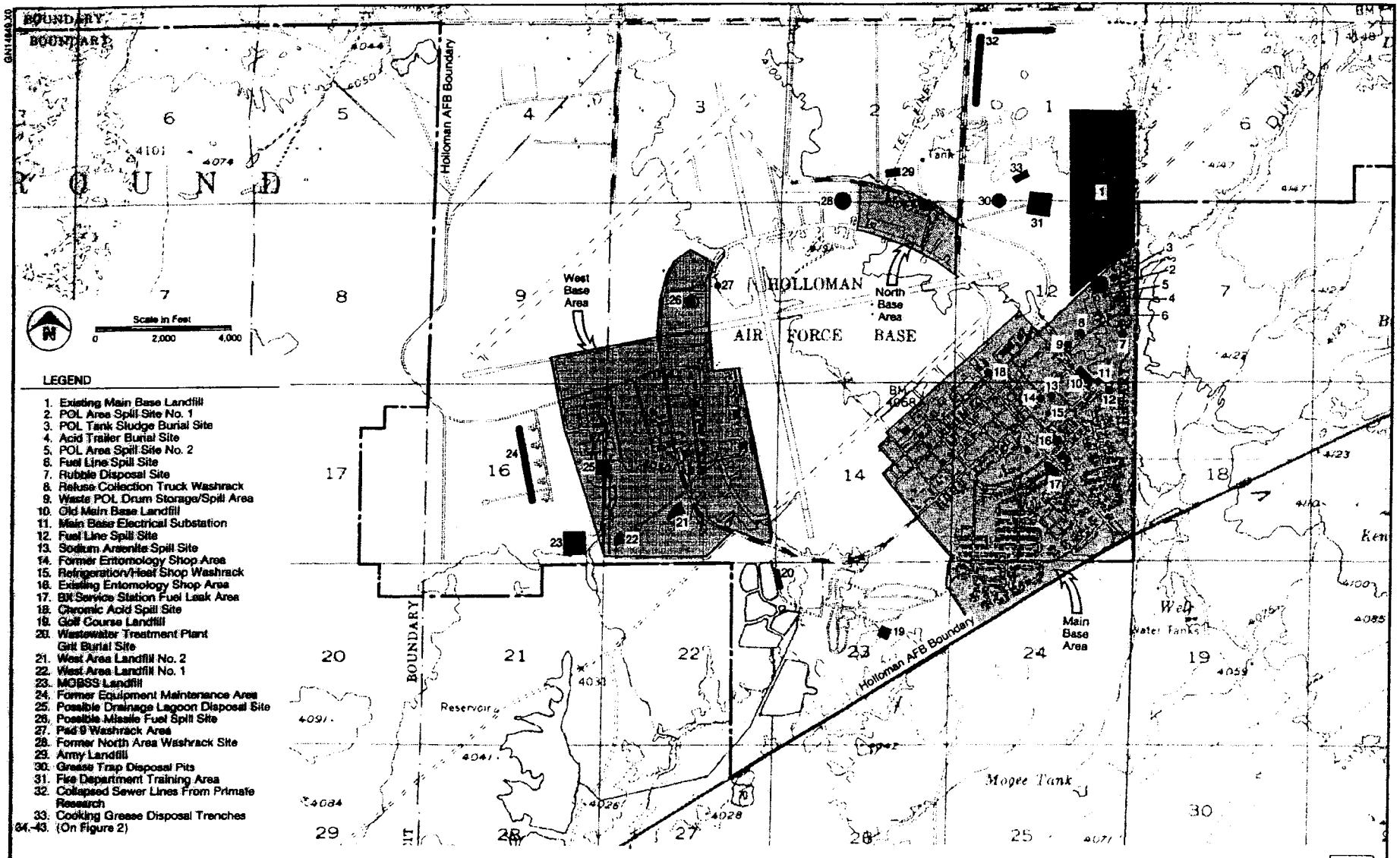


FIGURE 1.
Identified Disposal and Spill Sites at Holloman AFB.

s. Site No. 30--Grease Trap Disposal Area

The grease trap disposal pits (overall score of 43) are located west of the fire department training area. From 1972 to 1979, shallow trenches were dug and reportedly received wastes from base grease traps, oil/water separators and grit from the wastewater treatment system. One interviewee indicated that quantities of various pesticides (diazinon, malathion, pyrethrum) were also disposed of here, but this could not be verified.

The site was assigned a waste characteristics score of 70 due to the large suspected quantities of hazardous materials that may have been disposed of at the site. A pathways subscore of 48 was assigned primarily because the nearest surface water is located more than 2,000 feet from the site.

t. Site no. 32--Collapsed Sewer Lines from the Primate Research Area

Approximately 3,000 to 4,000 feet of sewer lines from the primate research institute were suspected of being corroded, with certain portions thought to be totally collapsed from the early 1960's to 1981 when the lines were repaired. During the period when the lines were badly corroded/collapsed, quantities of carbon-14, iodine and tritium tracers as well as solvents were suspected of exfiltrating into the groundwater. The quantities of solvents and radioactive isotopes utilized by the institute is small, however, no specific information was available as to the amounts of these materials that could have entered the shallow ground water.

Due to the fact that small confirmed quantities of hazardous waste were discharged into the soils and groundwater around the sewer lines, the site was assigned a waste characteristics subscore of 60. Primarily due to a surface drainage ditch being less than 50 feet from the sewer lines a pathways subscore of 57 was assigned.

u. Site No. 33--Cooking Grease Disposal Trenches

During the helicopter overflight conducted at the base, survey team members observed several shallow trenches located north and west of the fire department training area. Bioenvironmental engineering personnel later identified these trenches as being the disposal site for cooking greases from base kitchens. Since no hazardous waste is known to be disposed of at this site, the area was not rated.

v. Site No. 34--Spent Munition Burial Site

Excavation pits are utilized for the disposal of all spent munitions rounds detonated by the EOD. The pits are examined carefully to ensure no live rounds of ammunition are contained in them prior to backfilling. Since no hazardous waste materials are associated with the disposal operations, it was not rated.

w. Site No. 35--Spent Solvent Disposal Area

One interviewee indicated that spent solvents and radioactive tracers were disposed of on the ground near the Central Inertia Guidance Test Facility and ignited. This disposal practice was said to have occurred intermittently since the 1950's.

Appendix A-3-2

Portions of: *Installation Restoration Program Phase II – Confirmation/Quantification Stage 1, Report (April 1984 to March 1985) for Holloman Air Force Base, New Mexico 88330,* Dames & Moore, March 6, 1987

INSTALLATION RESTORATION PROGRAM
PHASE II - CONFIRMATION/QUANTIFICATION
STAGE 1

REPORT (APRIL 1984 TO MARCH 1985)

FOR

HOLLOMAN AIR FORCE BASE
NEW MEXICO 88330

HEADQUARTERS TACTICAL AIR COMMAND
COMMAND SURGEON'S OFFICE (HQ TAC/SGPB)
BIOENVIRONMENTAL ENGINEERING DIVISION
LANGLEY AIR FORCE BASE, VIRGINIA 23665-5001

MARCH 6, 1987

PREPARED BY

DAMES & MOORE
1550 NORTHWEST HIGHWAY
PARK RIDGE, ILLINOIS 60068

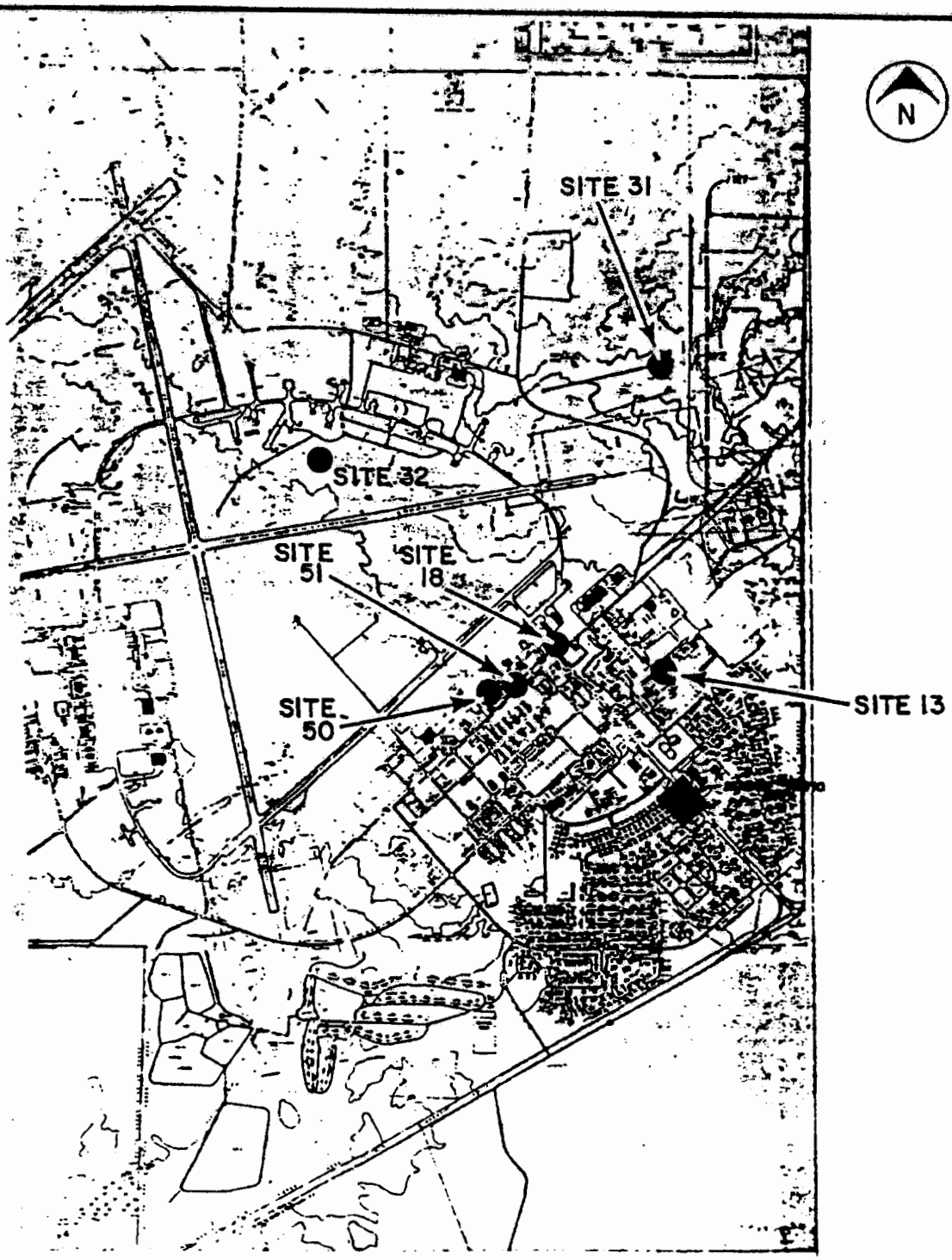
USAF CONTRACT NO. F33615-83-D-4002, DELIVERY ORDER NO. 0025

APPROVED FOR PUBLIC RELEASE; DISTRIBUTION IS UNLIMITED

USAFOEHL TECHNICAL PROGRAM MANAGER

LT. COL. EDWARD BARNES
USAFOEHL/TS

USAF OCCUPATIONAL & ENVIRONMENTAL HEALTH LABORATORY (USAFOEHL)
TECHNICAL SERVICES DIVISION (TS)
BROOKS AIR FORCE BASE, TEXAS 78235-5501



Scale in Feet (Approximate)

0 2000 4000 6000

DRAWING REFERENCE:
TITLED: SURVEY PLAT
BY: BURKE/COLLINS/ASSOCIATES PC
ENGINEERS-SURVEYORS
ALAMOGORDO, NEW MEXICO
DRAWING NO.: 84372
DATE: 10-18-84

SITE LOCATIONS MAP

Dames & Moore

Figure 2

TABLE 1

CHEMICAL SAMPLING EVENTS
HOLLOMAN AFB, NEW MEXICO
PHASE II, STAGE 1

SITE	OIL & GREASE, TOC[a] AND TOX	PHENOLICS	PESTICIDES[b]	TRACE METALS	C^{14} AND TRITIUM
1	3W	3W	3W	3W[c]	—
50	1W, 5S	1W, 5S	1W	—	—
51	1W, 6S	1W, 6S	—	—	—
13	—	—	—	1W[d], 6S[e]	—
18	—	—	—	1W[f], 6S[g]	—
32	8S	—	—	—	8S
31	1W, 9S	1W, 9S	—	1W[h], 9S[i]	—

Note: W = water sample, S = soil sample.

[a]Soils not analyzed for TOC.

[b]Aldrin, DDT isomers, dieldrin, endrin, heptachlor, heptachlor epoxide, lindane, methoxychlor, diazinon, malathion, parathion.

[c]Arsenic, chromium, cadmium, lead, nickel, silver.

[d]Arsenic.

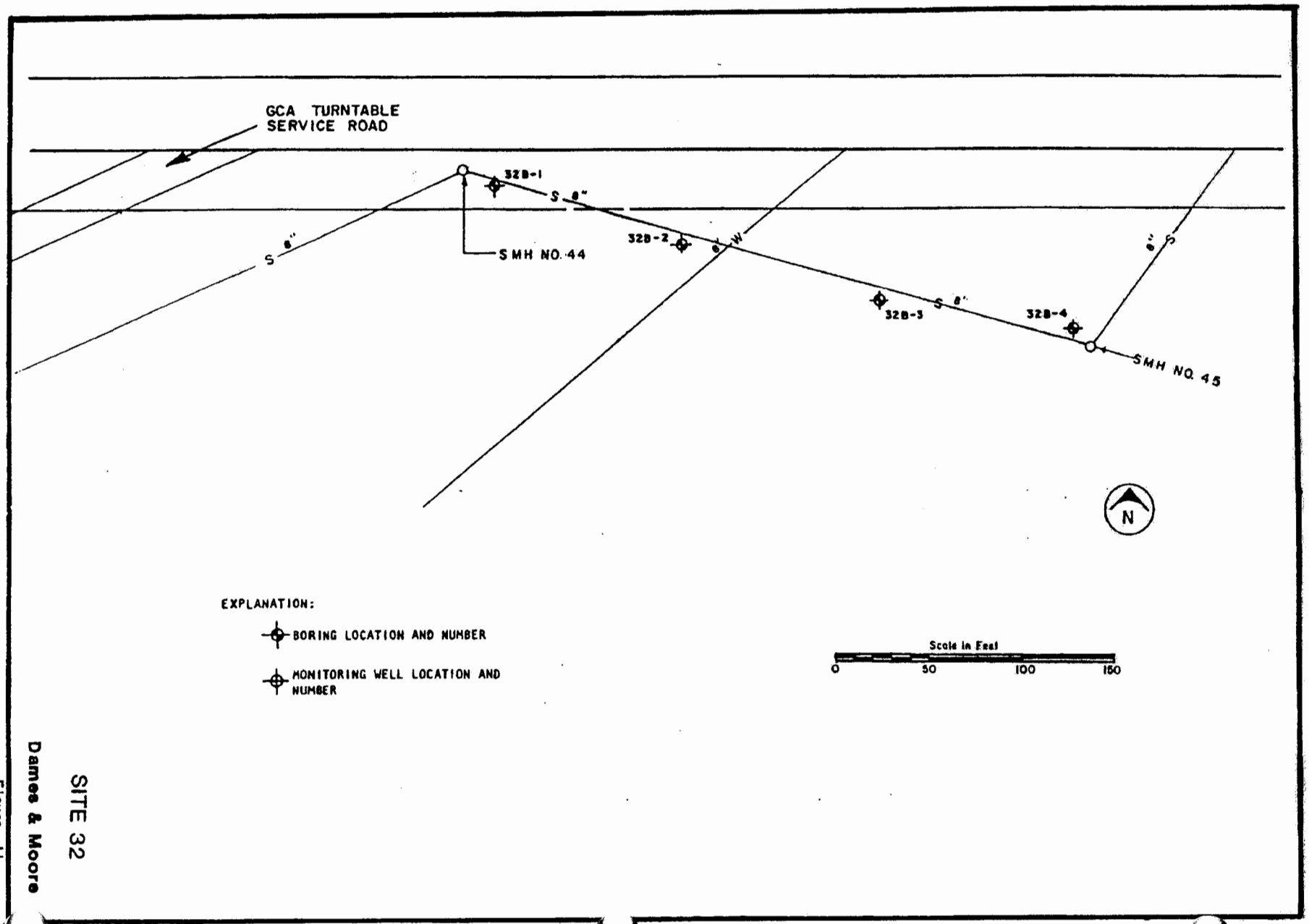
[e]Total arsenic by EP toxicity extraction.

[f]Total chromium and hexavalent chromium.

[g]Total chromium and hexavalent chromium by EP toxicity extraction.

[h]Total lead.

[i]Total lead by EP toxicity extraction.



SITE 32

Dames & Moore

Figure 11

TABLE 5

SUMMARY OF CONSTITUENTS ABOVE DETECTION LIMITS IN SOIL SAMPLES
(CORRECTED FOR PERCENT MOISTURE)

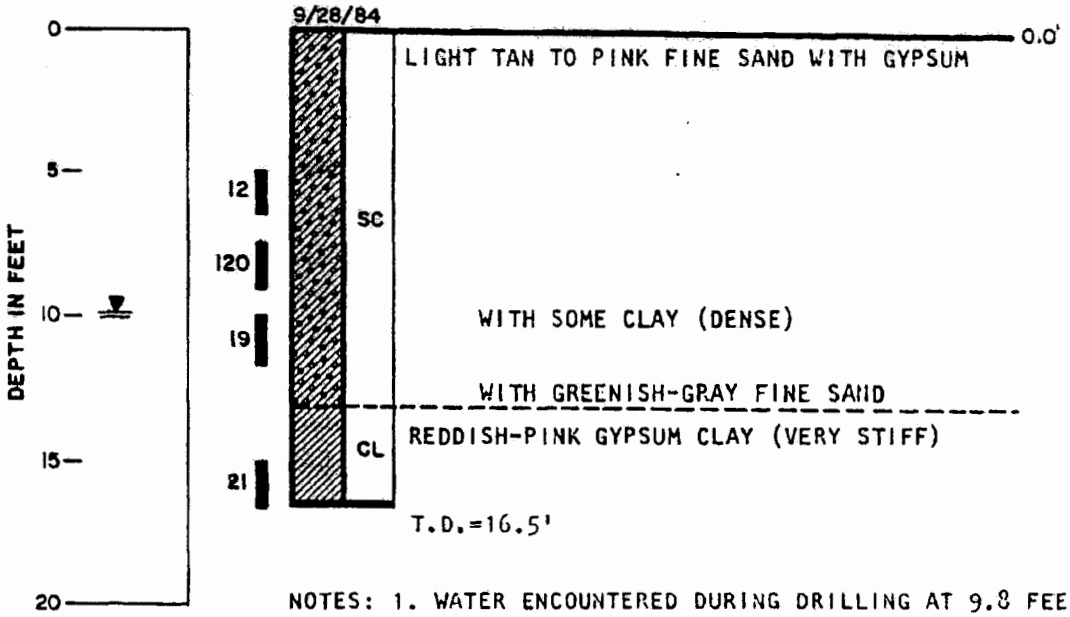
BORING/WELL NO. AND DEPTH	PARAMETER					
	CARBON-14 (pCi/g)	ARSENIC[a] (mg/L)	LEAD[a] (mg/L)	OIL AND GREASE (mg/kg)	TOX (mg/kg)	PHENOLICS (mg/kg)
Standard[b]	—	5.0	5.0	—	—	—
Detection Limit	—	0.01	0.01	7	5.0	1
13B1, 0-1'	—	0.04	—	—	—	—
31B1, 5-6.5'	—	—	c	c	8.2	c
31B1, 7.5-9'	—	—	c	40	c	c
31B2, 2.5-4'	—	—	c	c	7.7	c
31B2, 5-6.5'	—	—	c	25	7.5	c
31B2, 7.5-9'	—	—	c	32	7.4	c
31W1, 2.5-4'	—	—	c	c	8.1	1
31W1, 5-6.5'	—	—	c	44	42.5	c
31W1, 7.5-9'	—	—	c	c	7.1	c
51B1, 5-6.5'	—	—	—	39	7.0	c
51B1, 7.5-9'	—	—	—	c	30.3	c
51B1, 10-11.5'	—	—	—	c	9.0	c
51W1, 5-6.5'	—	—	—	c	50.0	c
51W1, 10-11.5'	—	—	—	c	6.4	c
32B1, 10-11.5'	240±194	—	—	c	c	—
32B2, 7.5-9'	c	—	—	16	c	—
32B2, 10-11.5'	c	—	—	c	24.7	—
32B3, 10-11.5'	c	—	—	c	7.7	—
32B4, 7.5-9'	—	—	—	9	c	—
32B4, 10-11.5'	c	—	—	15	8.0	—
50B1, 5-6.5'	—	—	—	1192	c	c
50B1, 7.5-9'	—	—	—	4265	c	c
50W1, 5-6.5'	—	—	—	160	c	17
50W1, 7.5-9'	—	—	—	3700	c	c
50W1, 10-11.5'	—	—	—	1143	c	c

[a]Samples have been extracted for EP toxicity according to Method 1310 published in USEPA Publication No. SW-846.

[b]Federal Resource Conservation and Recovery Act of 1982 and New Mexico Hazardous Waste Management Regulations are nearly identical.

[c]Denotes value less than the limit of detection.

HOLLOMAN AFB
BORING 32-B1



NOTES: 1. WATER ENCOUNTERED DURING DRILLING AT 9.8 FEET.

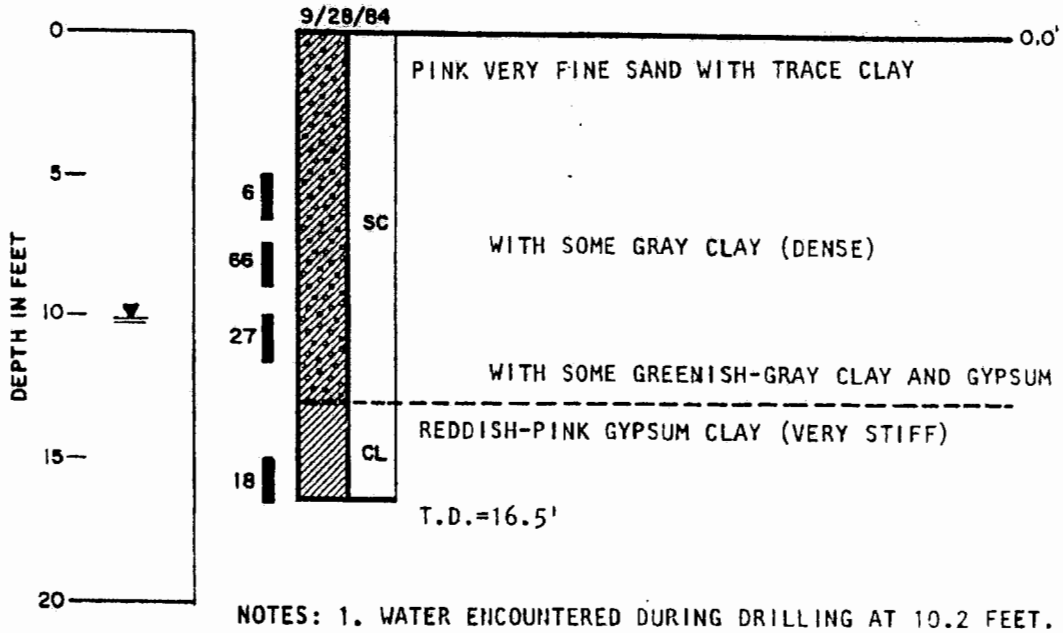
2. HNu READINGS WERE NOT RECORDED DUE TO EQUIPMENT MALFUNCTION.

LOG OF BORING

Dames & Moore

PLATE C-14

HOLLOMAN AFB
BORING 32-B2



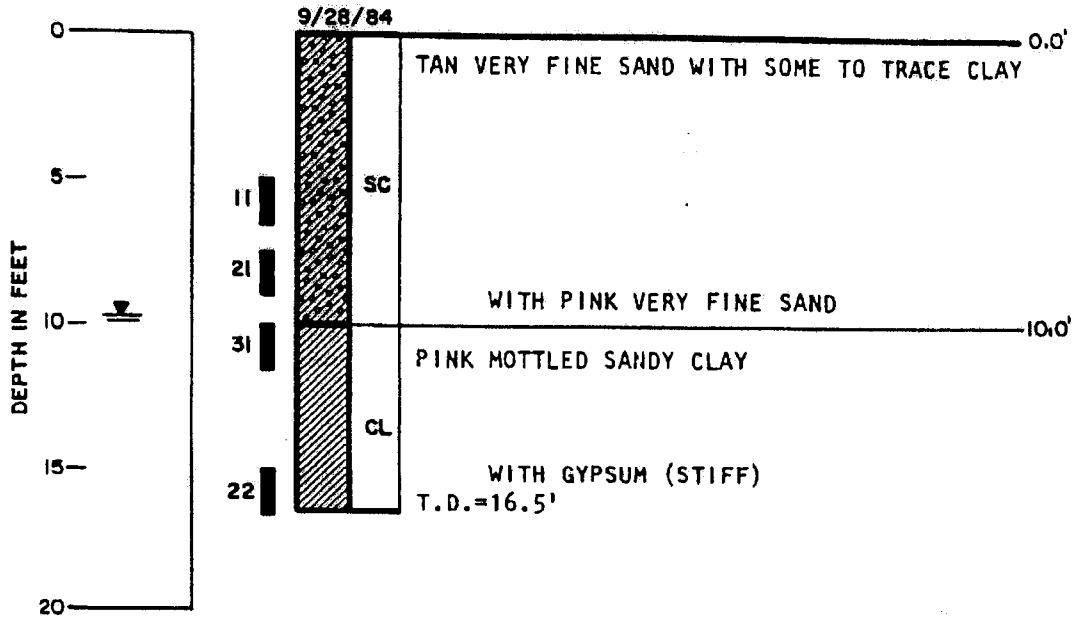
NOTES: 1. WATER ENCOUNTERED DURING DRILLING AT 10.2 FEET.

2. HNμ READINGS WERE NOT RECORDED DUE TO EQUIPMENT MALFUNCTION.

LOG OF BORING

Dames & Moore

HOLLOMAN AFB
BORING 32-B3



NOTES: 1. WATER ENCOUNTERED DURING DRILLING AT 9.7 FEET.

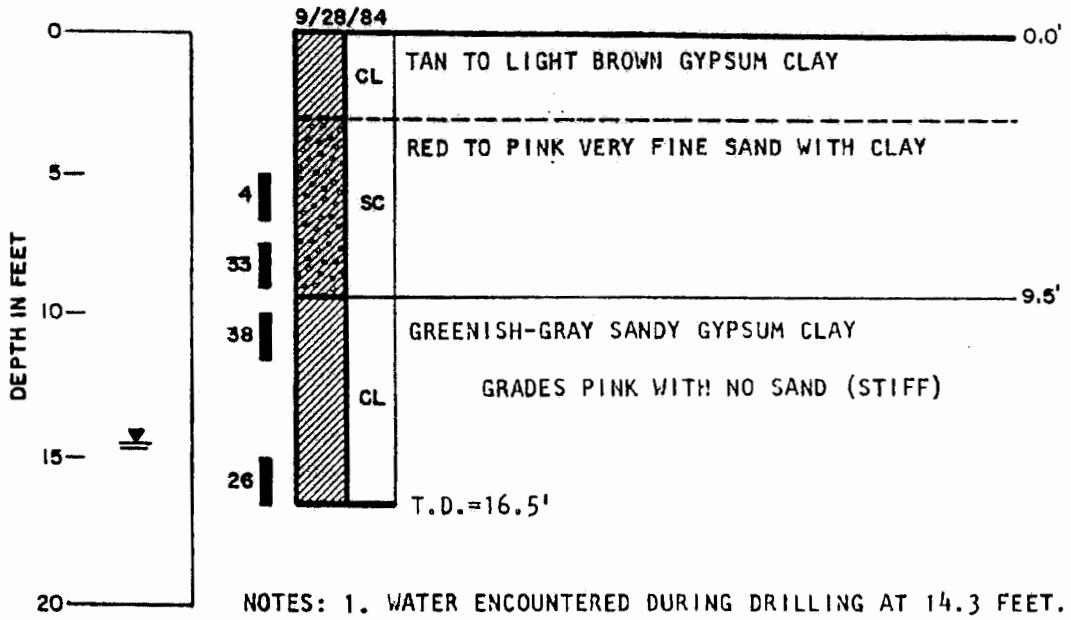
2. HNμ READINGS WERE NOT RECORDED DUE TO EQUIPMENT MALFUNCTION.

LOG OF BORING

Dames & Moore

PLATE C-16

HOLLOMAN AFB
BORING 32-B4



NOTES: 1. WATER ENCOUNTERED DURING DRILLING AT 14.3 FEET.

2. HN_4 READINGS WERE NOT RECORDED DUE TO EQUIPMENT MALFUNCTION.

LOG OF BORING

Dames & Moore

Appendix A-4-1

Portions of: *Chemical Data Acquisition Plan (CDAP), Investigation of Four Waste Sites, Holloman Air Force Base, NM,* Radian Corporation, 2 February 1993

DCN 93-269-069-23-01
RCN 269-069-23-04

CHEMICAL DATA ACQUISITION PLAN (CDAP)

INVESTIGATION OF FOUR WASTE SITES
HOLLOMAN AIR FORCE BASE, NM

Prepared for:

49 SG/CEV
Holloman Air Force Base, NM

and

HQ ACC/DEVC
Langley Air Force Base, VA

Prepared by:

Radian Corporation
8501 N. MoPac Boulevard
P.O. Box 201088
Austin, Texas 78720-1088
512/454-4797

Under Contract No. DACW45-91-D-0018 with:

US Army Corps of Engineers
Omaha District
Omaha, Nebraska

2 February 1993

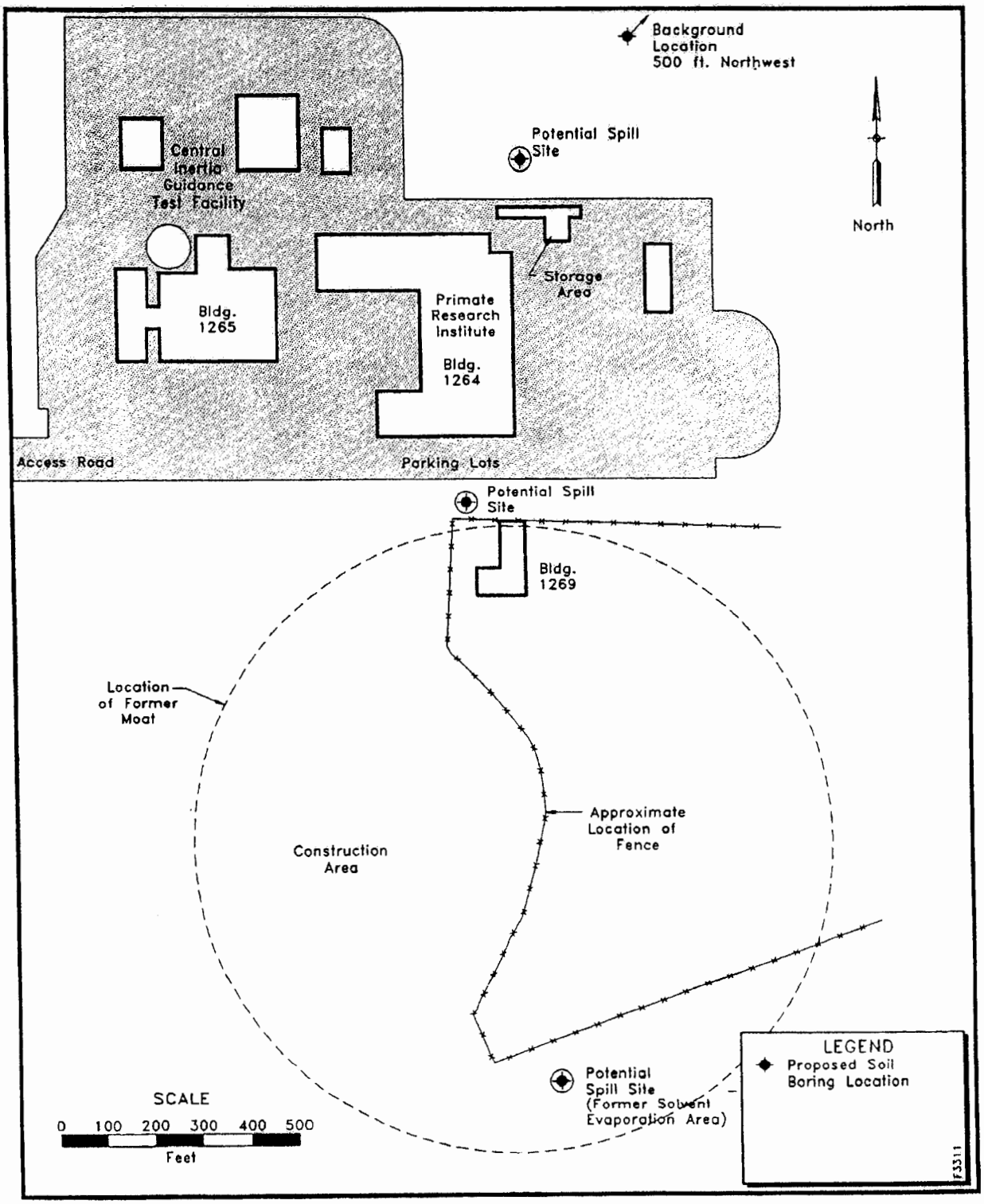


Figure 5-5. Site 35 Features and Proposed Soil Boring Locations

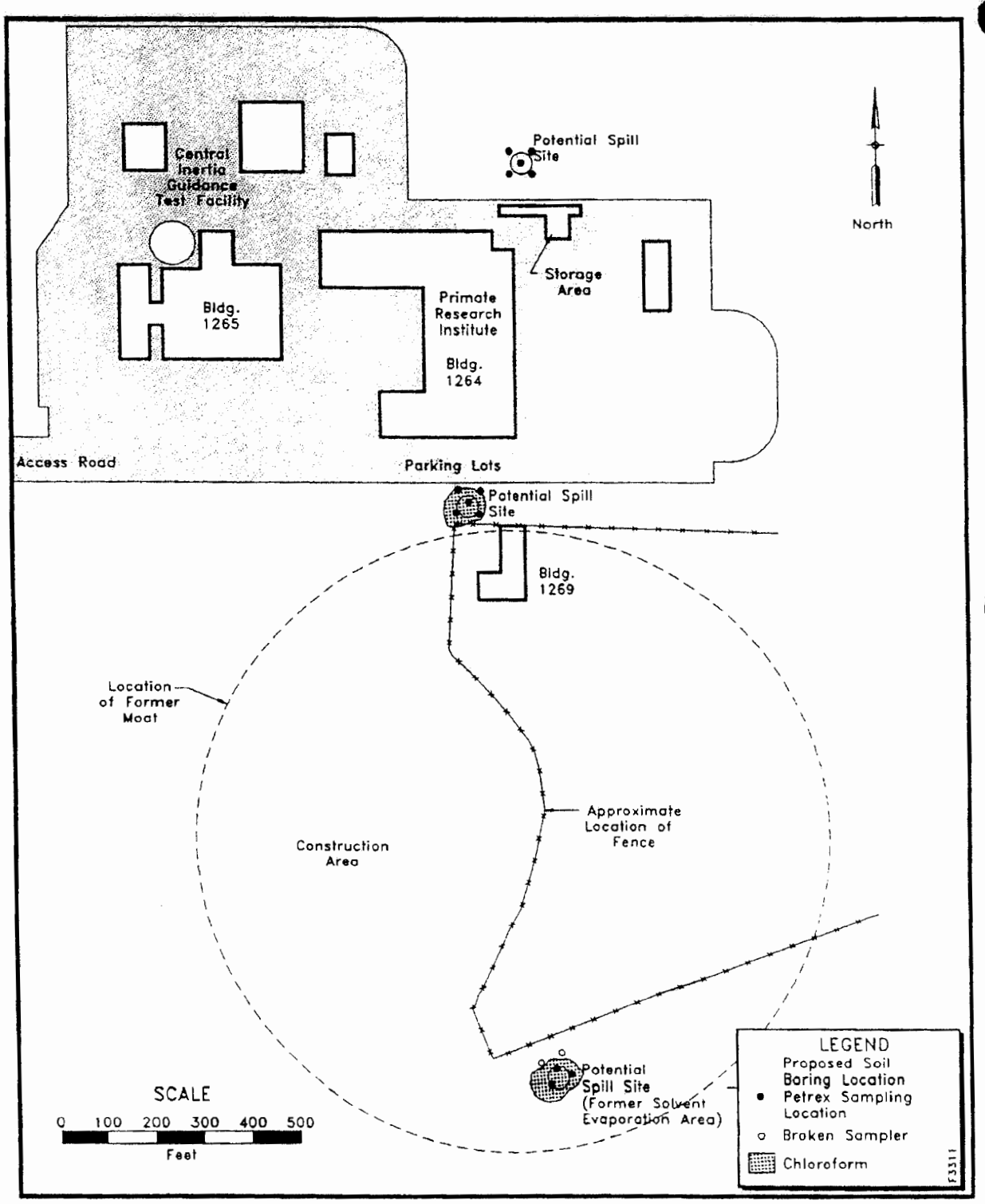
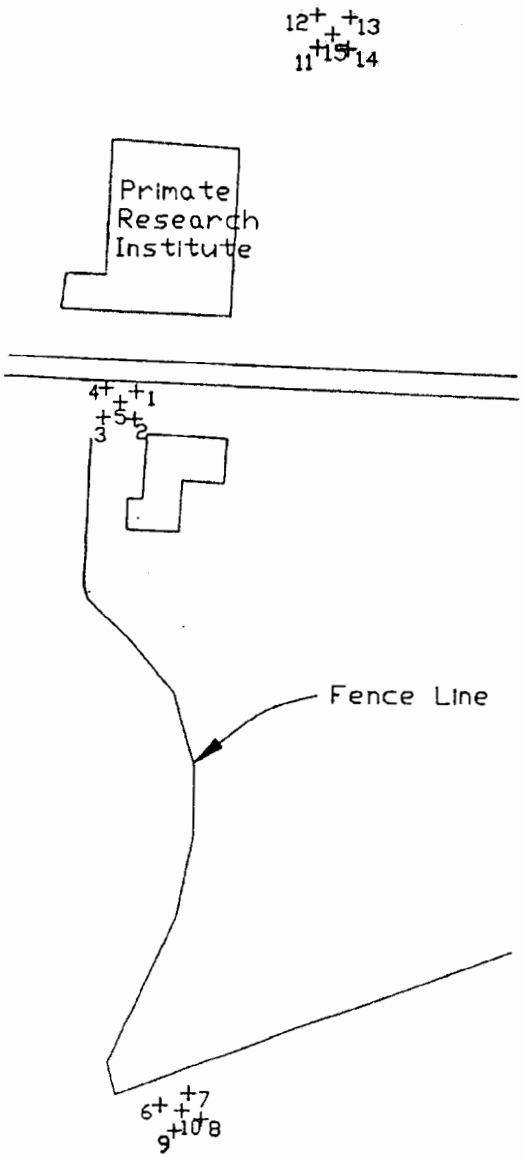


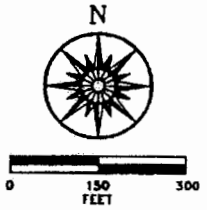
Figure 5-6. Passive Soil Gas Results Summary for Site 35

NERI
605 Parfet Street
Suite 100
Lakewood Colorado 80215
(303) 236-0090
176910E



LEGEND

+ Petrex Sample Location



Radian Corporation

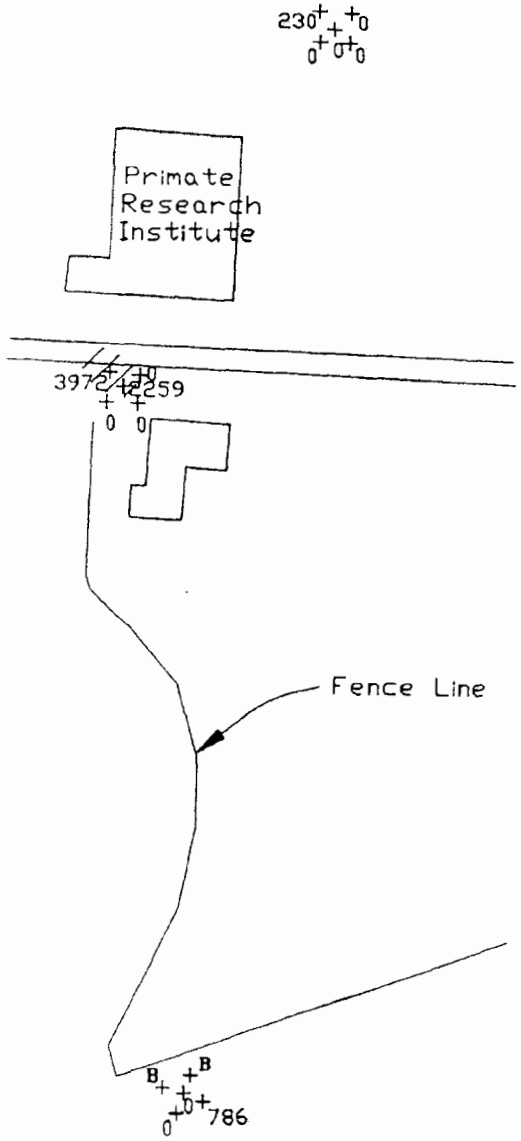
Sample Locations

Site 35
Holloman Air Force Base, Alamogordo, NM

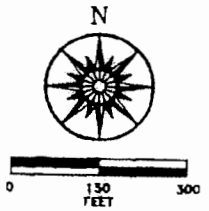
Plate 1

December 14, 1992

NERI
605 Parfet Street
Suite 100
Lakewood Colorado 80215
(303) 238-0090
176910E



LEGEND
Ion Counts:
≥ 2,000
+ Petrex Sample Location
B Broken Sampler, No Data



Radian Corporation

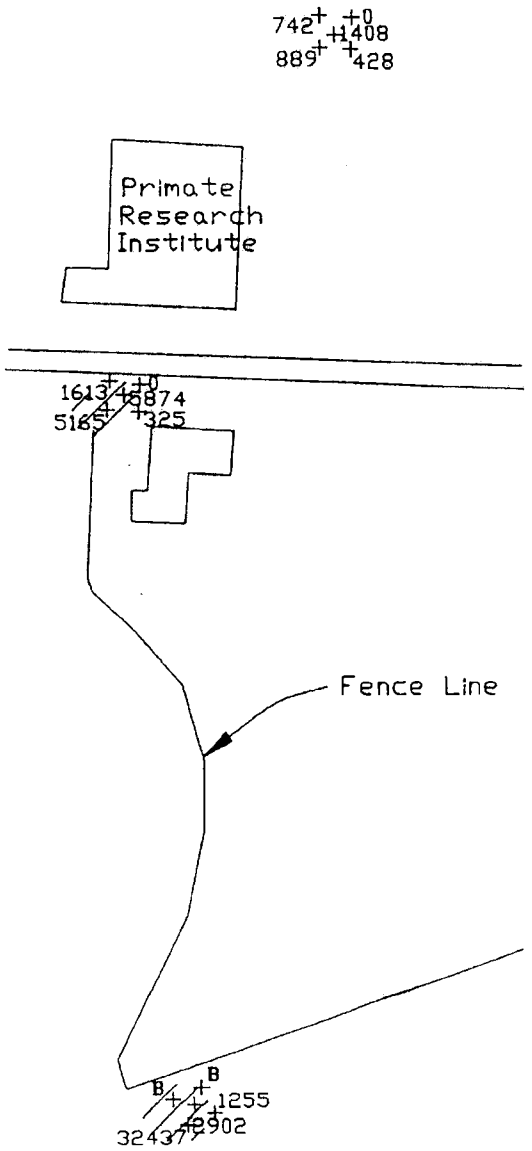
Relative Response
C_8 – C_{13} Petroleum Hydrocarbons

Site 35
Holloman Air Force Base, Alamogordo, NM

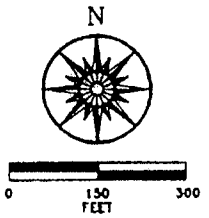
Plate 2

December 14, 1992

NERI
605 Parfet Street
Suite 100
Lakewood Colorado 80215
(303) 238-0090
176910E



LEGEND
Ion Counts:
≥ 2,000
+ Petrex Sample Location
B Broken Sampler, No Data



Radian Corporation

Relative Response

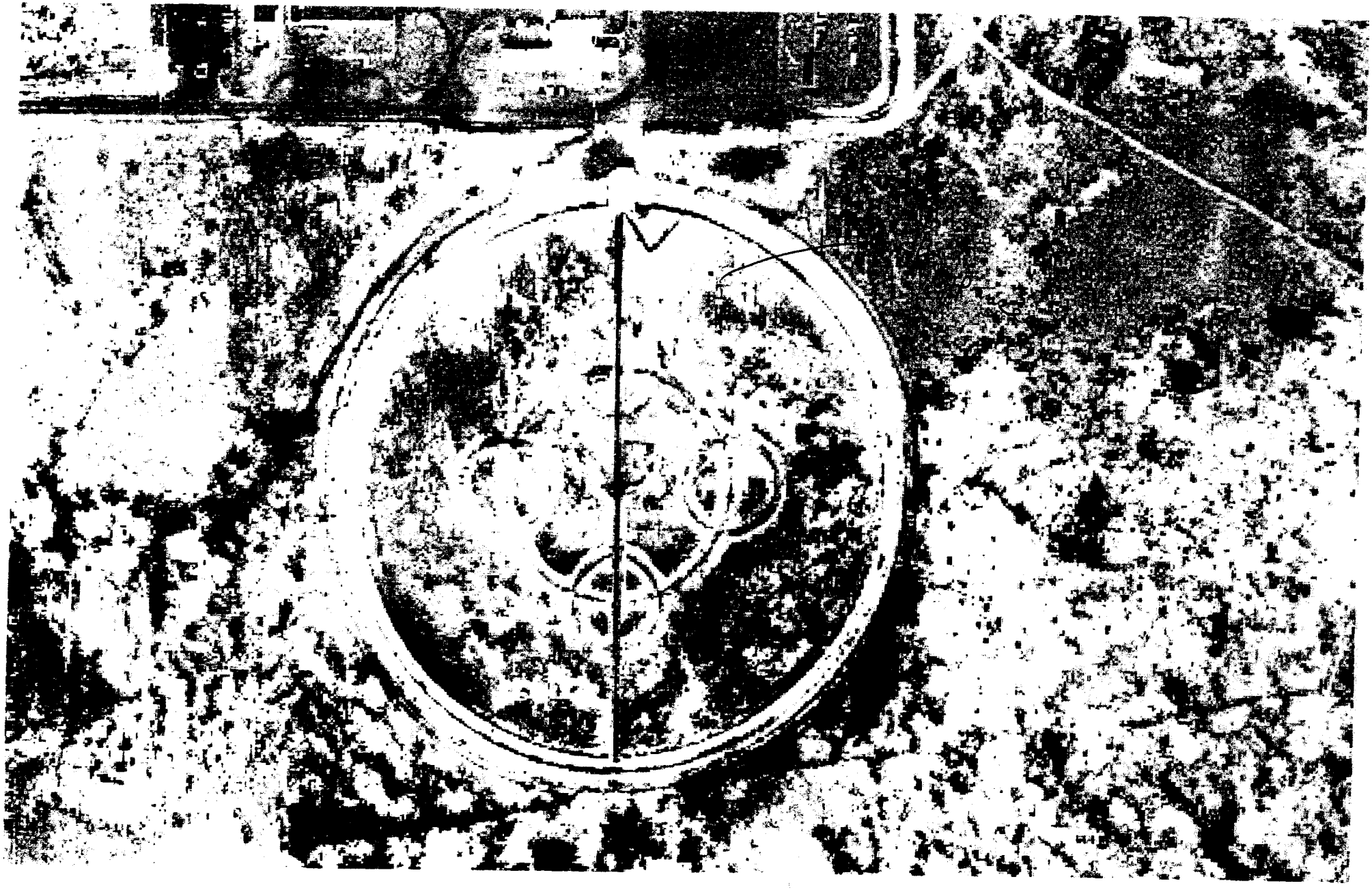
Chloroform

Site 35

Holloman Air Force Base, Alamogordo, NM

Plate 3

December 14, 1992



Appendix A-4-2

Portions of: *Draft Final Preliminary Assessment and Site Investigation Report, Investigation of Four Waste Sites, Holloman Air Force Base, NM,* Radian Corporation, November 1993

DCN 93-269-069-23-02
RCN 269-069-23-07

PRELIMINARY ASSESSMENT AND SITE INVESTIGATION REPORT

INVESTIGATION OF FOUR WASTE SITES HOLLOMAN AIR FORCE BASE, NM

DRAFT FINAL

Prepared for:

49 CES/CEV
Holloman Air Force Base, NM

and

HQ ACC/DEVC
Langley Air Force Base, VA

Prepared by:

Radian Corporation
8501 N. MoPac Boulevard
P.O. Box 201088
Austin, Texas 78720-1088
512/454-4797

Under Contract No. DACW45-91-D-0018 with:

US Army Corps of Engineers
Omaha District
Omaha, Nebraska

November 1993

Section 6
SITE OT-35—SPENT SOLVENT DISPOSAL AREA

Section 6 details the results of the IRP site investigation for Site OT-35.

6.1 Site Description

The Spent Solvent Disposal Area is located near the Primate Research Laboratory (PRL). Spent solvents containing radioactive tracers (carbon-14 and tritium) had reportedly been disposed of intermittently on the ground at the site since the 1950s. Information obtained during the literature search was supplemented by a site visit with Mr. Harry Ridge, a long-time PRL employee.

New PRL facilities have been under construction near the former solvent evaporation area since 1991. The area sustains heavy vehicle traffic and appears to have been graded. Site features are illustrated in Figure 6-1.

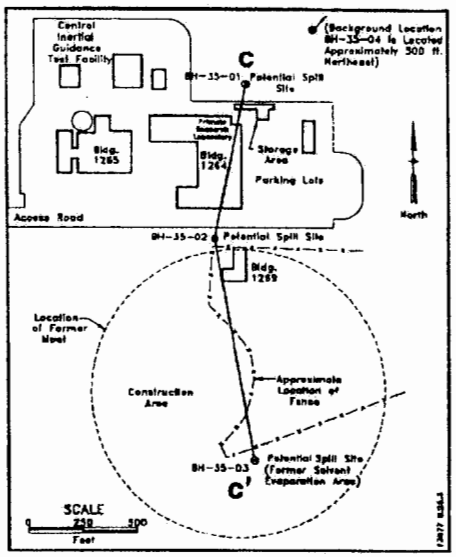


Figure 6–1 Site OT-35 Features

6.2 Site Investigation

This investigation focused on three principal areas of possible contamination:

1. An area of stressed vegetation behind Building 1264 (BH-35-01);
2. A slightly vegetated area near Building 1269 where stained soils were observed (BH-35-02); and
3. An area several hundred yards south of Building 1269 that was identified as the former solvent evaporation area where spent solvents were set out in evaporation pans for disposal (BH-35-03).

A total of six samples were collected at Site OT-35 and submitted for chemical analysis. Table 6–1 lists the nature of the contaminants of concen, types of samples collected, and a summary of results for Site OT–35. A background sample was collected approximately 500 ft northeast of the site and analyzed for alpha, beta, and gamma radioactivity only. Soil boring locations are shown in Figure 6-1. The results of soil analyses for radioactivity are summarized in Table 6–2.

Table 6-1
Site OT-35 Investigation Summary

Suspected Contaminants	Types of Samples Collected	Results Summary
Solvents with radioactive tracers	Two samples each from three soil borings at potential source areas	No VOCs detected; Gross alpha, beta, and gamma radioactivity detected at background levels.

6.3 Geology and Hydrogeology

The subsurface conditions at Site OT-35 were defined by direct sampling and observation of the drilling operations for three soil borings. Drilling logs located in Appendix B provide a detailed description of site stratigraphy.

To correlate and interpret site stratigraphy, cross section C-C′, shown in Figure 6-2, was constructed from the boring logs for Site OT-35. The location of the cross section is shown in Figure 6-1. Site stratigraphy consists primarily of two broadly defined lithologic units. The uppermost unit consists of 10 ft of silt and silty sand; 25 ft of clay underlies the uppermost unit. Interbedded lenses of sand and silt, ranging in thickness from 1 to 6 ft, occur within the clay layer. The clay layer grades into clayey sand in the southern portion of the site.

6.4 Conclusions

6.4.1 Presence or Absence of Contamination

Detected radioactivity levels were comparable to levels in the background sample. Radioactivity levels were also compared with *Waste Acceptance Criteria for Radioactive Solid Waste Disposal at SWSA-6* (Oak Ridge National Laboratory [ORNL], 1993). None of the radioactivity levels detected in Site OT–35 soils samples

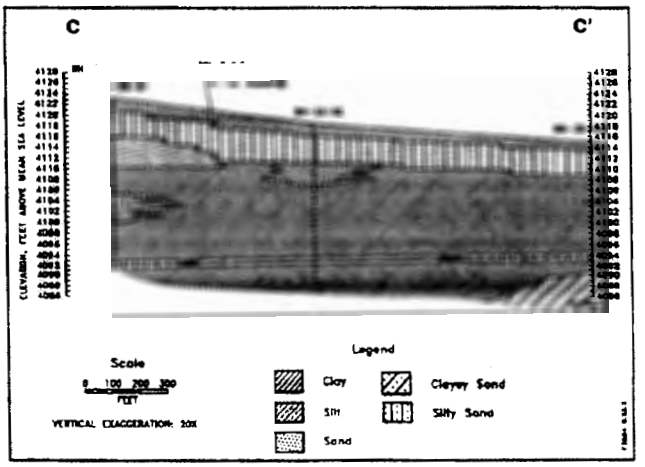


Figure 6–2. Site OT-35 Geologic Cross Section

Table 6-2
Concentrations of Inorganic Analytes in Site OT-35 Soils

		SW9310—Gross Alpha and Gross Beta (pCi/g)				E901.1—Gamma Radiation (pCi/g)	
		Gross Alpha		Gross Beta		Total Gamma	
Location	Depth (ft)	Result	(RL)	Result	(RL)	Result	(RL)
BH-35-01	0–2	21.21	(3.97)	19.08	(5.18)	0.33	(100)
	25–27	15.08	(3.83)	19.51	(5.15)	ND	(100)
BH-35-02	2.5–4.5	4.01	(3.52)	5.83	(5.43)	ND	(100)
	10–12	12.06	(3.51)	17.94	(5.47)	ND	(100)
BH-35-03	0–2	6.61	(3.16)	ND	(5.05)	ND	(100)
	5–7	ND	(3.0)	ND	(5.5)	ND	(100)
BH-35-04	0–2	7.87	(2.93)	5.95	(5.61)	ND	(100)

Note—RL = Reporting limit. ND = Not detected.

exceeded ORNL criteria. Radioactivity, therefore, is not a problem at the site. No VOCs were detected in site soil samples. There does not appear to be any contamination at the site.

6.4.2 Significance of Contamination

Although there does not appear to be any contamination at Site OT-35, Figure 6-3 is included to show possible migration pathways to human and ecological receptors had contamination been present.

6.5 Recommendations

There is no contamination at the site, and thus no risks to human health or the environment. Therefore, site closeout is recommended. Preparation of CERCLA proposed plans and decision documents for public review will be required for official site closeout.

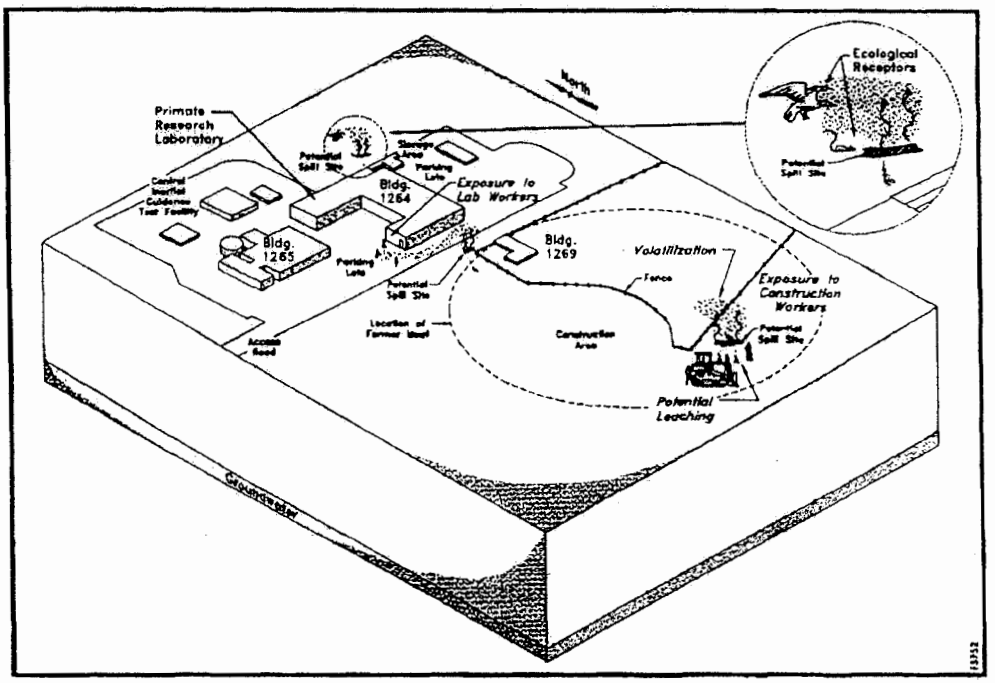


Figure 6–3 Site OT-35 Conceptual Site Model

DRILLING LOG

Project (PROJID)	Location (LOCID)	Inspector	Company (LOGCODE)	Date (LOGDATE)	Sheet 1 of 4
FOUR SITES (HOLL_4S)	BH-35-01	LEM	RADIAN (RAD)	21 FEB 93	

Depth	Graphic Log	Lithologic Description: Main Modifier	Predominant Lithology	Color	Munsell	Grain Size	Grading	Moisture	Plasticity	USCS Class (ASTM) [redacted]	[redacted] (VVL)	Blow Counts	Sample Interval	Recovery	Observations and Comments
		SANDY	SILT	BROWN	10YR 4/3	VF	P	D		ML	SDSL	1,2,3,4	0-2	1.5	
1															
2		SILTY	SAND	PALE YELLOW	2.5Y 8/3	F	P	D		SM	SDSL	3,8,13,10	2.5-4.5	1.3	
3															
4															
5												5,5,8,11	5-7	1.5	
6		SILTY	SAND	LT. YELLOW BRN	2.5Y 6/4	VF	P	D		SM	SDSL				
7			SAND	YELLOWISH BRN	10YR 5/4	VF	P	D		SP	SD	10,14,10,20	7.5-9.5	1.9	SOME SILT
8															
9															

F3721

DRILLING LOG

Project (PROJNO)	Location (LOCID)	Inspector	Company (LOGCODE)	Date (LOGDATE)	Sheet 2 of 4
FOUR SITES (HOLL_4S)	BH-35-01	LEN	RADIAN (RAD)	21 FEB 93	

Depth	Graphic Log	Lithologic Description: Main Modifier	Predominant Lithology	Color	Munsell	Grain Size	Grading	Moisture	Plasticity	USCS Class (ASTM)	[redacted] (VVL)	Blow Counts	Sample Interval	Recovery	Observations and Comments
												16,20,28,36	10-12	2	
11															
12															
13															
14		SILTY	CLAY	DK. YELLOW BRN	10YR 4/5			D	HIGH	CH	STCL	5,6,10,16	15-17	2	GYPSUM CRYSTALS
15															
16															
17															
18		SANDY	SILT	DK. YELLOW BRN	10YR 4/6	VF	P	D	LOW	ML	SDSL	8,9,10,9	20-22	2	
19															

F3721

DRILLING LOG

Project (PROJID)	Location (LOCID)	Inspector	Company (LOGCODE)	Date (LOGDATE)	Sheet 3 of 4
FOUR SITES (HOLL_4S)	BH-35-01	LEM	RADIAN (RAD)	21 FEB 93	

Depth	Graphic Log	Lithologic Description: Main Modifier	Predominant Lithology	Color	Munsell	Grain Size	Grading	Moisture	Plasticity	USCS Class (ASTM) [redacted]	[redacted] (VVL)	Blow Counts	Sample Interval	Recovery	Observations and Comments
21															
22															
23															
24		SILTY	CLAY	YELLOWISH BRN	10YR 5/4			M	HIGH	CH	STCL	3,3,7,5	25-27	2	
25															
26															
27															
28															
29															

F3721

DRILLING LOG

Project (PROJID)	Location (LOCID)	Inspector	Company (LOGCODE)	Date (LOGDATE)	Sheet 4 of 4
FOUR SITES (HOLL_4S)	BH-35-01	LEM	RADIAN (RAD)	21 FEB 93	

Depth	Graphic Log	Lithologic Description: Main Modifier	Predominant Lithology	Color	Munsell	Grain Size	Grading	Moisture	Plasticity	USCS Class (ASTM)	[redacted] (VVL)	Blow Counts	Sample Interval	Recovery	Observations and Comments
31		SILTY	SAND	BROWN	10YR 5/3	VF	P	S		SM	SDSL	10,13,10,9	30-32	2	IRON STAINING
		SILTY	CLAY	YELLOWISH BRN	10YR 5/6			S	HIGH	CH	STCL				TD = 32 FT.
32															
33															
34															
35															
36															
37															
38															
39															

F3721

DRILLING LOG

Project (PROJID)	Location (LOCID)	Inspector	Company (LOGCOOL)	Date (LOGDATE)	Sheet 1 of 4
FOUR SITES (HOLL_4S)	BH-35-02	LEM	RADIAN (RAD)	22 FEB 93	

Depth	Graphic Log	Lithologic Description: Main Modifier	Predominant Lithology	Color	Munsell	Grain Size	Grading	Moisture	Plasticity	USCS Class (ASTM)	[redacted] (VVL)	Blow Counts	Sample Interval	Recovery	Observations and Comments
		CLAYEY	SILT	PALE YELLOW	2.5Y 8/2			M	LOW	ML	STCL	4,5,6,7	0-2	1.8	SOME SAND DRAEGER TUBE FOR CHLOROFORM = 0
1															
2		SILTY	SAND	PALE YELLOW	2.5Y 7/4	F	P	D		SM	SDSL	17,20,18,15	2.5-4.5	2.0	
3															
		SILTY	SAND	LT. YELLOW BRN	10YR 6/4	VF	P	D		SM	SDSL				
4															
5												13,13,17,18	5-7	1.6	
6															
7		SANDY	SILT	PALE YELLOW	2.5Y 7/3	F	P	D		ML	SDSL	10,16,15,20	7.5-9.5	2.0	DRAEGER TUBE FOR CHLOROFORM = 0
8															
9															
			SILT	YELLOWISH BRN	10YR 5/4			D	LOW	ML	SILT				

F3722

DRILLING LOG

Project (PROJID)	Location (LOCID)	Inspector	Company (LOGCODE)	Date (LOGDATE)	Sheet 2 of 4
FOUR SITES (HOLL_4S)	BH-35-02	LEM	RADIAN (RAD)	22 FEB 93	

Depth	Graphic Log	Lithologic Description: Main Modifier	Predominant Lithology	Color	Munsell	Grain Size	Grading	Moisture	Plasticity	USCS Class (ASTM) [redacted]	[redacted] (VVL)	Blow Counts	Sample Interval	Recovery	Observations and Comments
												7,10,10,11	10-12	2.0	
		SANDY	SILT	PALE BROWN	10YR 6/3	M	P	D		ML	SDSL				
11															
		SANDY	CLAY	YELLOWISH BRN	10YR 5/4	F	P	D	LOW	CL	SDCL				
12															
13															
		SANDY	CLAY	STRONG BROWN	5YR 4/6	F	P	D	LOW	CL	SDCL				
14															GYPSUM CRYSTALS
15												8,16,20,21	15-17	2.0	
16															
17															
18															
19															

F3722

DRILLING LOG

Project (PROJID)	Location (LOCID)	Inspector	Company (LOGCODE)	Date (LOGDATE)	Sheet 3 of 4
FOUR SITES (HOLL_4S)	BH-35-02	LEM	RADIAN (RAD)	22 FEB 93	

Depth	Graphic Log	Main Modifier	Predominant Lithology	Color	Munsell	Grain Size	Grading	Moisture	Plasticity	USCS Class (ASTM)	[redacted] (VVL)	Blow Counts	Sample Interval	Recovery	Observations and Comments
												3,6,6,10	20-22	2.0	
21															MOIST AT 21.3 FT.
22															
23															
24															
25			SAND	V. PALE BRN	10YR 7/4	VF	P	S		SP	SD	6,5,5,5	25-27	2.0	WATER AT APPROX. 25 FT. ANGULAR CONTACT AT TOP OF SAND
26		CLAYEY	SAND	STRONG BROWN	7.5YR4/6	VF	P	S	HIGH	CH	SDCL				
27															
28															
29															

F3722

DRILLING LOG

Project (PROJID)	Location (LOCID)	Inspector	Company (LOGCODE)	Date (LOGDATE)	Sheet 4 of 4
FOUR SITES (HOLL_4S)	BH-35-02	LEM	RADIAN (RAD)	22 FEB 93	

Depth	Graphic Log	Lithologic Description: Main Modifier	Predominant Lithology	Color	Munsell	Grain Size	Grading	Moisture	Plasticity	USCS Class (ASTM) [redacted]	[redacted] (VVL)	Blow Counts	Sample Interval	Recovery	Observations and Comments
												4,3,3,5	30-32	0.0	
31															
32															TD = 32 FT.
33															
34															
35															
36															
37															
38															
39															

F3722

DRILLING LOG

Project (PROJID)	Location (LOCID)	Inspector	Company (LOGCODE)	Date (LOGDATE)	Sheet
FOUR SITES (HOLL_4S)	BH-35-03	LEM	RADIAN (RAD)	22 FEB 93	1 of 4

Depth	Graphic Log	Lithologic Description: Main Modifier	Predominant Lithology	Color	Munsell	Grain Size	Grading	Moisture	Plasticity	USCS Class (ASTM) [redacted]	[redacted] (VVL)	Blow Counts	Sample Interval	Recovery	Observations and Comments
		SANDY	SILT	V. PALE BRN	10YR 7/3	M	P	D		ML	SDSL	17,25,25,15	0-2	1.6	CALICHE
1															
2		SILTY	SAND	BROWN	7.5YR5/4	F	P	D		SM	SDSL	7,10,15,12	2.5-4.5	1.8	
3															
4												10,19,25,20	5-7	1.8	
5															
6															
7		SILTY	CLAY	BROWN	7.5YR5/4			D	HIGH	CH	STCL	9,16,17,22	7.5-9.5	2.0	GYPSUM CRYSTALS
8															
9															

F3723

DRILLING LOG

Project (PROJID)	Location (LOCID)	Inspector	Company (COMCODE)	Date (LOGDATE)	Sheet 2 of 4
FOUR SITES (HOLL_4S)	BH-35-03	LEM	RADIAN (RAD)	22 FEB 93	

Depth	Graphic Log	Lithologic Description: Main Modifier	Predominant Lithology	Color	Munsell	Grain Size	Grading	Moisture	Plasticity	USCS Class (ASTM)	[redacted] (VVL)	Blow Counts	Sample Interval	Recovery	Observations and Comments
		SILTY	SAND	YELLOWISH BRN	10YR 5/4	VF	P	D		SM	SDSL	15,17,15,20	10-12	2.0	
11		SILTY	CLAY	REDDISH BRN	5YR 4/4			M	HIGH	CH	STCL				GYPSUM CRYSTALS SMALL (.5 CM) SAND LENSES
12															
13															
14															
15												6,15,17,22	15-17	2.0	
16												6,15,17,22	15-17	2.0	
17															
18															
19															

F3723

DRILLING LOG

Project (PROJID)	Location (LOCID)	Inspector	Company (COMPANY)	Date (LOGDATE)	Sheet
FOUR SITES (HOLL_4S)	BH-35-03	LEM	RADIAN (RAD)	22 FEB 93	3 of 4

Depth	Graphic Log	Lithologic Description: Main Modifier	Predominant Lithology	Color	Munsell	Grain Size	Grading	Moisture	Plasticity	USCS Class (ASTM)	[redacted] (VVL)	Blow Counts	Sample Interval	Recovery	Observations and Comments
												11,18,16,11	20-22	2.0	
21		SILTY	SAND	DK. YELLOW BRN	10YR 4/6	VF	P	M		SM	SDSL				
22		SILTY	CLAY	REDDISH BRN	5YR 4/4			M	HIGH	CH	STCL				
23															
24		CLAYEY	SAND	DK. YELLOW BRN	10YR 4/6	VF	P	M		SC	SDCL				
25												7,10,8,9	25-27	2.0	
26															
27															
28															
29															

F3723

DRILLING LOG

Project (PROJID)	Location (LOCID)	Inspector	Company (LOGCODE)	Date (LOGDATE)	Sheet 4 of 4
FOUR SITES (HOLL_4S)	BH-35-03	LEM	RADIAN (RAD)	22 FEB 93	

Depth	Graphic Log	Lithologic Description: Main Modifier	Predominant Lithology	Color	Munsell	Grain Size	Grading	Moisture	Plasticity	USCS Class (ASTM)	[redacted] (VVL)	Blow Counts	Sample Interval	Recovery	Observations and Comments
			SAND	PALE YELLOW	2.5Y 7/4	VF	P	M		SP	SD	6,7,7,5	30-32	2	
31		CLAYEY	SAND	PALE OLIVE	5Y 6/3	VF	P	S		SC	SDCL				
32															TD = 32 FT.
33															
34															
35															
36															
37															
38															
39															

F3723

Appendix A-5-1

Portions of: *Draft Final Remedial Investigation (RI) Report, Investigation, Study and Recommendation for 29 Waste Sites, Holloman Air Force Base, NM,* Radian Corporation, June 1992

RADIAN CORPORATION

DCN 92-269-004-16-07
RCN 269-004-16-06

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REMEDIAL INVESTIGATION (RI) REPORT

INVESTIGATION, STUDY AND RECOMMENDATION FOR 29 WASTE SITES HOLLOMAN AIR FORCE BASE, NM

Volume I

DRAFT FINAL

Prepared for:

49 SG/CEV
Holloman Air Force Base, NM

Prepared by:

Radian Corporation
8501 North MoPac Blvd.
P.O. Box 201088
Austin, Texas 78720-1088

Under Contract No. DACW45-89-D-0515 with:

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

June 1992

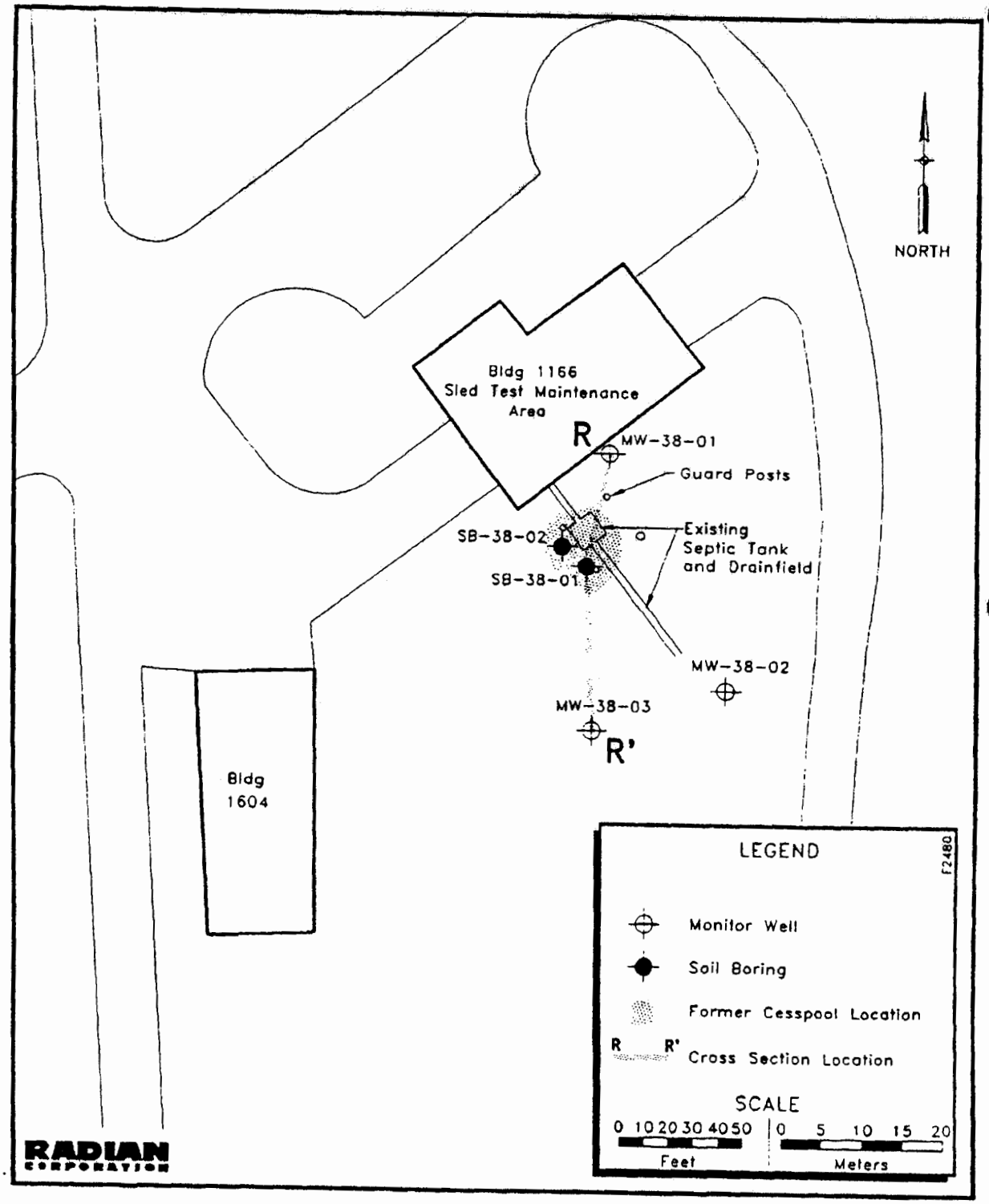


Figure 4-61. Soil Boring, Monitor Well, and Cross Section Locations for Site 38

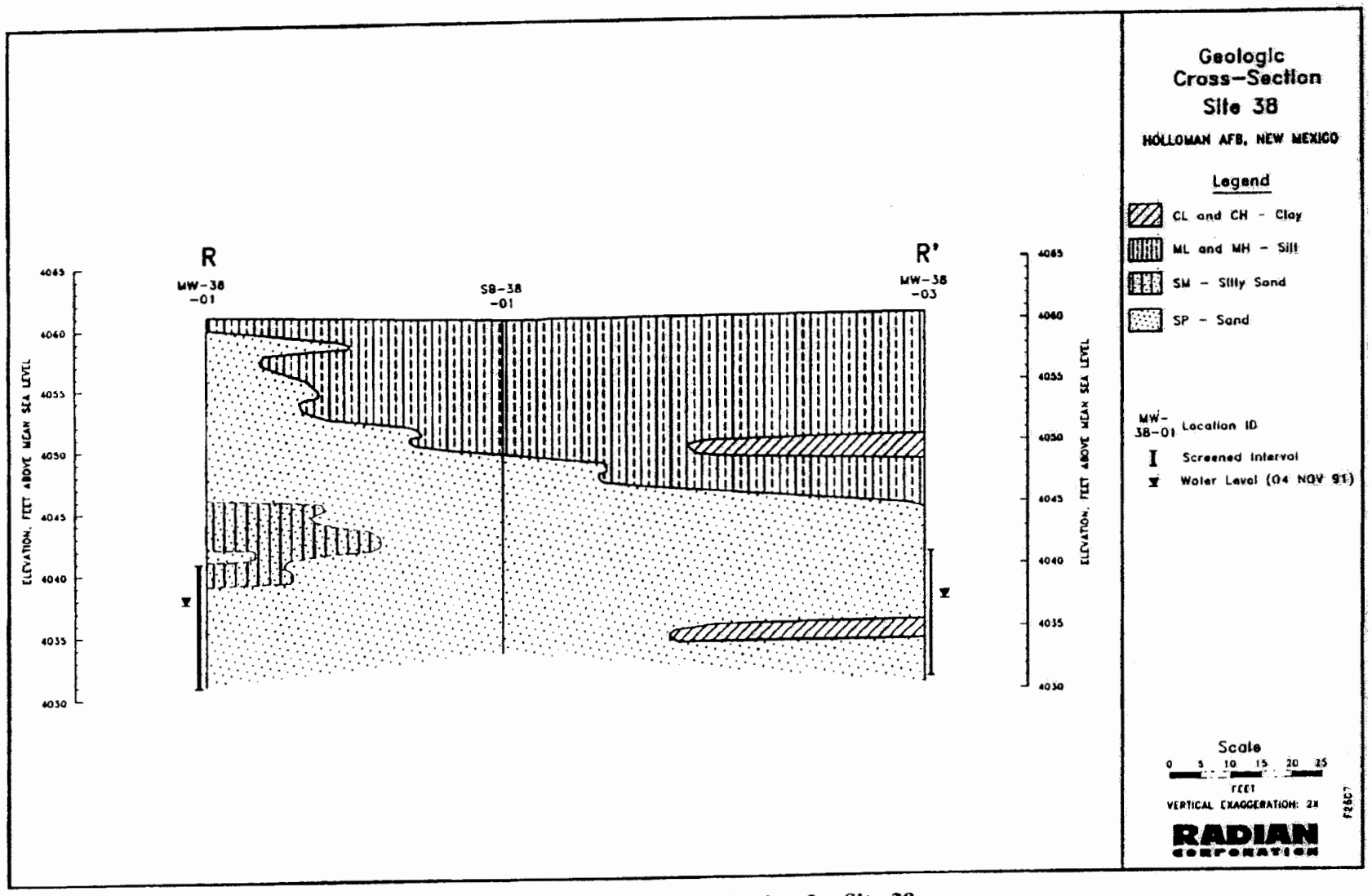


Figure 4-62. Geologic Cross Section for Site 38

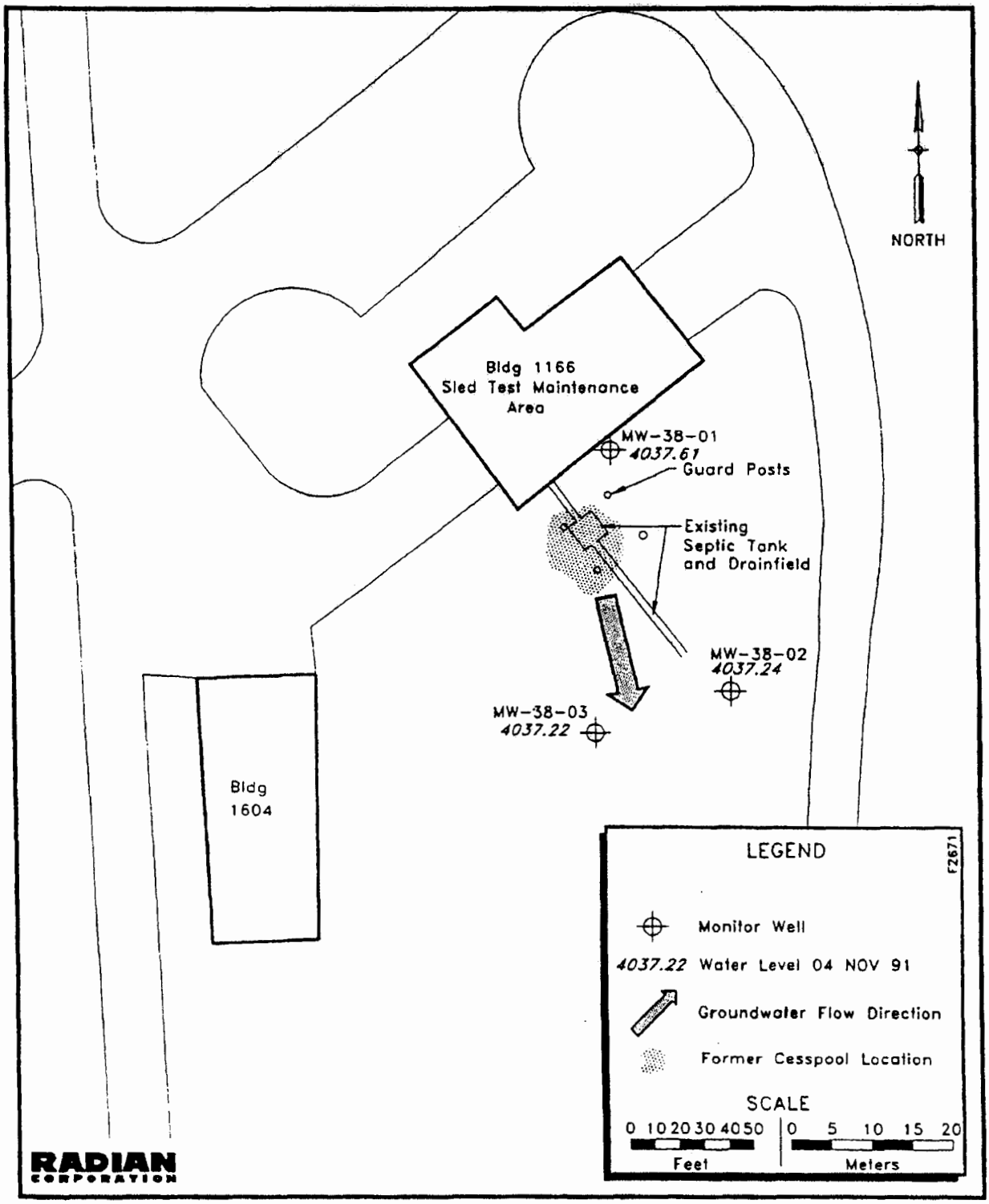


Figure 4-63. Monitor Well Locations and Groundwater Flow Direction for Site 38

Table 4-83

Concentrations of Inorganic and Organic Analytes in Site 38 Soil Samples

Location	[illegible]		[illegible]		[illegible]		[illegible]	
Sample ID	[illegible]		[illegible]		[illegible]		[illegible]	
Analyte	Result	(D.L.)	Result	(D.L.)	Result	(D.L.)	Result	(D.L.)
Inorganic results								
SW6010 - Metals (mg/kg)								
Chromium	6.7 @	(1.9)	4.1 @	(3.4)	5.7 @	(3.4)	5.6 @	(3.7)
Nickel	5.5 @	(3.8)	ND	(6.8)	ND	(6.9)	ND	(7.5)
Zinc	19	(3.8)	7.6 @	(6.8)	14 @	(6.9)	11 @	(7.5)
SW7060 - Arsenic (mg/kg)	1.6 @	(0.37)	0.56 @	(0.36)	1.1 @	(0.37)	0.73 @	(0.36)
SW7421 - Lead (mg/kg)	2.5	(0.28)	0.70 @	(0.27)	20	(1.1)	1.1 @	(0.27)
Organic results								
EPA 418.1 - TRPH (mg/kg)	24.4 @	(12.6)	29.1 @	(12.1)	1540	(250)	18.4 @	(12.6)
SW8240 - Volatile Organics (ug/kg)								
Methylene chloride	37 JB	(130)	78 JB	(120)	52 JB	(130)	240 B@	(130)
Toluene	7.7 J	(130)	7.2 J	(120)	6.2 J	(130)	8.9 J	(130)

NOTE: Table presents only constituents detected in soil at this site.
@ = Measured result is less than five times the detection limit.
ND = Not Detected, at the reported detection limit.
B = Analyte detected in laboratory blank analysis, no blank subtraction performed.
J = Detected below the detection limit.

Table 4-84

Concentrations of Inorganic Analytes in Site 38 Groundwater Samples

Laboratory Sample ID	MW38-01 38-01-01		MW38-02 38-02-01		MW38-03 38-03-01	
Analyses	Result	(DL)	Result	(DL)	Result	(DL)
EPA 160.1 - Total Dissolved Solids (mg/L)	15000	(10)	15000	(10)	5500	(10)
EPA 300.0 - Chloride (mg/L)	3700	(26)	3800	(26)	900	(2.6)
EPA 300.0 - Sulfate (mg/L)	4900	(5.0)	3900	(5.0)	1900	(5.0)
EPA 340.2 - Fluoride (mg/L)	1.5	(0.10)	1.4	(0.10)	2.1	(0.10)
EPA 353.1 - Nitrate-Nitrite (mg/L)	110	(4.4)	130	(4.4)	110	(4.4)
EPA 365.2 - Total Phosphorus (mg/L)	0.33	(0.020)	0.084 @	(0.020)	0.19	(0.020)
SW6010 - Metals (mg/L)						
Antimony	ND	(0.20)	0.14 @	(0.10)	ND	(0.10)
Copper	0.047 @	(0.040)	ND	(0.020)	0.059 @	(0.020)
Nickel	0.047 @	(0.040)	ND	(0.020)	ND	(0.020)
Zinc	0.047 @	(0.040)	ND	(0.020)	0.027 @	(0.020)
SW7421 - Lead (mg/L)	0.0078 @	(0.0060)	ND	(0.0060)	0.013 @	(0.0060)

NOTE: Table presents only constituents detected in groundwater at this site.
@ = Measured result is less than five times the detection limit.
ND = Not Detected, at the reported detection limit.

Table 4-85

Concentrations of Organic Analytes in Site 38 Groundwater Samples

Location Sample ID	MW-38-01 38-01-01		MW-38-02 38-02-01		MW-38-03 38-03-01	
Analyte	Result	(DL)	Result	(DL)	Result	(DL)
SW8240 - Volatile Organics (µg/L)						
Chloroform	1.3 J	(5.0)	2.0 J	(5.0)	ND	(5.0)
Methylene chloride	30	(5.0)	49	(5.0)	18 @	(5.0)
Trichloroethene	3.1 J	(5.0)	2.8 J	(5.0)	ND	(5.0)

NOTE: Table presents only constituents detected in groundwater at this site.
J = Detected below the detection limit.
ND = Not Detected, at the reported detection limit.
@ = Measured result is less than five times the detection limit.

Table 4-86

Groundwater Analytes Detected Above Risk-Based Action Levels at Site 38

Analyte	Location ID	Result		Action Level
Groundwater Results (mg/L)				
Antimony	MW-38-02	0.14	@	0.01
Fluoride	MW-38-03	2.1		2
Methylene chloride[a]	MW-38-01	0.03		0.005
Methylene chloride[a]	MW-38-02	0.049		0.005
Methylene chloride[a]	MW-38-03	0.018	@	0.005
Trichloroethene	MW-38-01	0.0031	J	0.003

Note: Result units were changed to match action level units for this table.

@ = Measured result is less than five times the detection limit.
[a] Methylene chloride was determined to be a laboratory contaminant in a QA/QC review and is, therefore, not considered to be above the action level in samples from the site.
J = Detected below the detection limit.

DRILLING LOG

HOLE NO. SB-38-01

F2413

1. COMPANY NAME	RADIAN CORPORATION
2. DRILLING SUBCONTRACTOR	SOUTHWEST ENG INC
SHEET 1 OF 2 SHEETS	
3. PROJECT	HOLLOMAN AFB RI/FS FOR 29 SITES
4. LOCATION	38
5. NAME OF DRILLER	ART VALTIERRA
6. MANUFACTURER'S DESIGNATION OF DRILL	HOLLOW-STEM AUGER
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT	BOREHOLE DIA.: 7.5"
8. HOLE LOCATION	686043.76(Y), 532166.32(X)
9. SURFACE ELEVATION	4060.48
10. DATE STARTED	24 SEP 91
11. DATE COMPLETED	24 SEP 91
12. OVERBURDEN THICKNESS	
15. DEPTH GROUNDWATER ENCOUNTERED	22.0 ft bgl
13. DEPTH DRILLED INTO ROCK	
16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED	
14. TOTAL DEPTH OF HOLE	27 ft.
17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY)	

18. GEOTECHNICAL SAMPLES	DISTURBED	UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES

20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY %

22. DEPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR
			GROUT	HTH

a	DEPTH b	DESCRIPTION OF MATERIALS c	FIELD SCREENING RESULTS d	GEOTECH SAMPLE OR CORE BOX NO. e	ANALYTICAL SAMPLE NO. f	BLOW COUNTS g	REMARKS/RECOVERY h
		SILT: greyish-orange (5YR 7/4), low plasticity, dry, 0-.3 ft gravel fill. (ML)	HS=0.3ppm		91JULH038-001	5,6,8,9	1.0/2.0 ft composite 0-10 ft on 2.5' intervals
	1						
	2						
		SILT: light brown (5YR 5/6), dry, low plasticity, trace fine sand. (ML)	HS=0.6ppm			6,9,6,5	1.9/2.0 ft
	3						
	4						
	5	SILT, as above: moist, no sand. (ML)	HS=1.3ppm			3,14,8,7	1.7/2.0 ft VOAs from interval 5-7 ft
		SILT: very pale orange (10YR 8/2), dry, low plasticity, caliche. (ML)					
	6						
		CLAYEY SILT: light brown (5YR 5/6), moist, medium plasticity, gypsum. (ML)					
	7						
		CLAYEY SILT, as above.	HS=0.3ppm			8,12,10,9	
	8						
	9						

PROJECT HOLLOMAN AFB RI/FS FOR 29 SITES HOLE NO. SB-38-01

DRILLING LOG

HOLE NO. SB-38-01

PROJECT HOLLOMAN AFB RI/FS

INSPECTOR HTH

SHEET 2 OF 2 SHEETS

a	DEPTH b	DESCRIPTION OF MATERIALS c	FIELD SCREENING RESULTS d	GEOTECH SAMPLE OR CORE BOX NO. e	ANALYTICAL SAMPLE NO. f	BLOW COUNTS g	REMARKS/RECOVERY h
		CLAYEY SILT, as above	HS=0.0ppm		91JULH038-002	4,10,30,40	2.0/2.0 ft Composite of 10 20 ft on 5.0 ft intervals
	11	SAND: very pale orange (10YR 8/2), very fine grained, clorly graded, dry. (SP)					
	12						
	13						
	14						
	15	SAND, as above.	HS=0.0ppm			43,50	0.5/2.0 ft not enough recovery for work
	16						
	17						
	18						
	19						
	20	SAND, as above: have rust color staining.	HS=0.0ppm			35,50	VOA from 20-22 ft interval
	21						
	22						water at 22.0 ft bgl
	23						
	24						
	25	SAND: greyish-orange (10YR 7/4), fine to very fine, poorly graded, wet. (SP)				35,50	1.8/2.0 ft
	26						
	27						TD= 27.0 ft

PROJECT HOLLOMAN AFB RI/FS FOR 29 SITES

HOLE NO. SB-38-01

F2413

DRILLING LOG

HOLE NO. SB-38-02

F2414

1. COMPANY NAME	RADIAN CORPORATION
2. DRILLING SUBCONTRACTOR	SOUTHWEST ENG INC
SHEET 1 OF 2 SHEETS	
3. PROJECT	HOLLOMAN AFB RI/FS FOR 29 SITES
4. LOCATION	38
5. NAME OF DRILLER	ART VALTIERRA
6. MANUFACTURER'S DESIGNATION OF DRILL	HOLLOW-STEM AUGER
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT	BOREHOLE DIA.: 7.5"
8. HOLE LOCATION	686052.24(Y), 532156.26(X)
9. SURFACE ELEVATION	4060.73
10. DATE STARTED	24 SEP 91
11. DATE COMPLETED	24 SEP 91
12. OVERBURDEN THICKNESS	
15. DEPTH GROUNDWATER ENCOUNTERED	22.5 ft bgl
13. DEPTH DRILLED INTO ROCK	
16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED	
14. TOTAL DEPTH OF HOLE	25 ft.
17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY)	

18. GEOTECHNICAL SAMPLES	DISTURBED	UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES

20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY %

22. DEPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR
			GROUT	HTH

a	DEPTH b	DESCRIPTION OF MATERIALS c	FIELD SCREENING RESULTS d	GEOTECH SAMPLE OR CORE BOX NO. e	ANALYTICAL SAMPLE NO. f	BLOW COUNTS g	REMARKS/RECOVERY h
		SILT: greyish-orange (10YR 7/4), dry, low plasticity (gravel fill from 0-0.3'), stain on surface above boring. (ML)	HS=25.5ppm SC=5.4ppm		91JULH038 -003	6,6,10,9	1.2/2.0 ft chemical odor
	1						
	2						
	3	SILT: moderate yellowish-brown (10YR 5/4), low plasticity, dry, gypsum layers. (ML)	HS=81.3ppm			4,4,3,4	1.8/2.0 ft VOA sample interval 2.5-4.5 ft
	4						
	5	SILT: very pale orange (10YR 8/2), low plasticity, dry. (ML)	HS=5.7ppm			11,10,7,8	1.7/2.0 ft
	6	SILT: light brown (5YR 5/6), low plasticity, dry, gypsum mottling, some clay. (ML)					
	7						
	8	SILT, as above: clay content increases with depth. (ML)	HS=2.7ppm			4,7,7,9	
	9	CLAYEY SILT, as above: medium plasticity. (ML)					

DRILLING LOG

HOLE NO. SB-38-02

PROJECT HOLLOMAN AFB RI/FS

INSPECTOR HTH

SHEET 2 OF 2 SHEETS

a	DEPTH b	DESCRIPTION OF MATERIALS c	FIELD SCREENING RESULTS d	GEOTECH SAMPLE OR CORE BOX NO. e	ANALYTICAL SAMPLE NO. f	BLOW COUNTS g	REMARKS/RECOVERY h
		SILTY CLAY: moderate brown (5YR 4/4), moderate plasticity, moist, gypsum mottling. (CL)	HS=0.3ppm		91JULH038-004	24,6,24,50	1.8/2.0 ft composite 10-20' on 5 ft intervals
	11	SAND: very pale orange (10YR 8/2), very fine grained, poorly graded, dry. (SP)					
	12						
	13						
	14						
	15	SAND, as above: pale yellowish-orange (10YR 8/6).	HS=0.3ppm			29,50	0.5/2.0 ft VOA sample interval 15-17 ft
	16						
	17						
	18						
	19						
	20	SAND, as above.	HS=0.0ppm			50	0.4/2.0 ft no VOA collected because of little recovery
	21						
	22						▽ water at 22.5 ft bgl
	23						
	24						
	25	SAND: light brown (5YR 6/4), fine to very fine grained, poorly graded, wet. (SP)				37,50	
	26						
	27						TD= 27.0 ft

PROJECT HOLLOMAN AFB RI/FS FOR 29 SITES HOLE NO. SB-38-02

F2414

DRILLING LOG

HOLE NO. MW-38-01

1. COMPANY NAME	RADIAN CORPORATION
2. DRILLING SUBCONTRACTOR	SOUTHWEST ENG INC
SHEET 1 OF 3 SHEETS	
3. PROJECT	HOLLOMAN AFB RI/FS FOR 29 SITES
4. LOCATION	38
5. NAME OF DRILLER	ART VALTIERRA
6. MANUFACTURER'S DESIGNATION OF DRILL	HOLLOW-STEM AUGER
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT	BOREHOLE DIA.: 7.5"
8. HOLE LOCATION	686092.55(Y), 532175.89(X)
9. SURFACE ELEVATION	4061.03
10. DATE STARTED	24 SEP 91
11. DATE COMPLETED	24 SEP 91
12. OVERBURDEN THICKNESS	
15. DEPTH GROUNDWATER ENCOUNTERED	22 ft bgl
13. DEPTH DRILLED INTO ROCK	
16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED	04 NOV 91 25.24 ft bmp
14. TOTAL DEPTH OF HOLE	30 ft.
17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY)	

18. GEOTECHNICAL SAMPLES	DISTURBED	UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES
		X	

20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY %

22. DEPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR
		X		ACD

a	DEPTH b	DESCRIPTION OF MATERIALS c	FIELD SCREENING RESULTS d	GEOTECH SAMPLE OR CORE BOX NO. e	ANALYTICAL SAMPLE NO. f	BLOW COUNTS g	REMARKS/RECOVERY h
		SANDY SILT: brown (10YR 5/4), organic with gravels, fill (?). (ML)					3.0/5.0 ft
	1	SAND: tan-brown (10YR 7/4) very fine, moist, crumbly, clean, poorly graded, homogeneous. (SP)					
	2						
		changes to brown (5YR 6/4) with white mottles.					
	3						
	4						
	5	tan zone (~1'), minor caliche.					3.0/5.0 ft
	6	changes to brown (5YR 6/4), minor caliche.					
	7						
		changes to SAND: fine to medium, clean					
	8						
	9						

DRILLING LOG

HOLE NO. MW-38-01

PROJECT HOLLOMAN AFB RI/FS

INSPECTOR ACD

SHEET 2 OF 3 SHEETS

a	DEPTH b	DESCRIPTION OF MATERIALS c	FIELD SCREENING RESULTS d	GEOTECH SAMPLE OR CORE BOX NO. e	ANALYTICAL SAMPLE NO. f	BLOW COUNTS g	REMARKS/RECOVERY h
							3.0/5.0 ft
	11						
		small (1"), brown (5YR 4/4), hard silt/ very fine sand zone.					
	12						
	13	some tan zones, more of a tan-pink (5YR 8/4) color.					
	14						
	15	SAND: brown (5YR 6/4), very fine, caliche zones interbedded with SILT: brown (5YR 5/6), gypsum crystals present, no loose sand, all caliche, very hard. (SM)					4.5/5.0 ft
	16						
	17						
	18						
	19	SAND: yellow-green (5YR 7/6), to grey-yellow (5Y 8/4) laminae, fine to very fine, black streaks, moist, loose, crumbly. (SP)					
	20	SAND and SILT: interbedded, tan to brown to red brown, predominantly sand, some caliche, sand is very fine to medium, some orange to yellow staining at 20 -21 ft. (SM)					3.5/5.0 ft
	21						
	22	SAND: brown (5YR 6/4), fine to medium, clean, wet, subrounded. (SP)					
	23						-water at 22.74 ft
	24						
	25						
	26						
	27			MW-038-01-27.5-30.0			

PROJECT HOLLOMAN AFB RI/FS FOR 29 SITES HOLE NO. MW-38-01

DRILLING LOG

HOLE NO. MW-38-01

F2395

PROJECT HOLLOMAN AFB RI/FS

INSPECTOR ACD

SHEET 3 OF 3 SHEETS

a	DEPTH b	DESCRIPTION OF MATERIALS c	FIELD SCREENING RESULTS d	GEOTECH SAMPLE OR CORE BOX NO. e	ANALYTICAL SAMPLE NO. f	BLOW COUNTS g	REMARKS/RECOVERY h
	29						
	30						TD=30.0 ft
	31						
	32						
	33						
	34						
	35						
	36						
	37						
	38						
	39						
	40						
	41						
	42						
	43						
	44						
	45						

DRILLING LOG

HOLE NO. MW-38-02

1. COMPANY NAME	RADIAN CORPORATION
2. DRILLING SUBCONTRACTOR	SOUTHWEST ENG INC
SHEET	1 OF 3 SHEETS
3. PROJECT	HOLLOMAN AFB RI/FS FOR 29 SITES
4. LOCATION	38
5. NAME OF DRILLER	ART VALTIERRA
6. MANUFACTURER'S DESIGNATION OF DRILL	HOLLOW-STEM AUGER
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT	BOREHOLE DIA.: 7.5"
8. HOLE LOCATION	685992.12(Y), 532222.78(X)
9. SURFACE ELEVATION	4061.19
10. DATE STARTED	24 SEP 91
11. DATE COMPLETED	24 SEP 91
12. OVERBURDEN THICKNESS	
15. DEPTH GROUNDWATER ENCOUNTERED	23 ft bgl
13. DEPTH DRILLED INTO ROCK	
16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED	04 NOV 91 26.32 ft bmp
14. TOTAL DEPTH OF HOLE	30 ft.
17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY)	

18. GEOTECHNICAL SAMPLES	DISTURBED	UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES
		X	

20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY %

22. DEPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR
		X		ACD

a	DEPTH b	DESCRIPTION OF MATERIALS c	FIELD SCREENING RESULTS d	GEOTECH SAMPLE OR CORE BOX NO. e	ANALYTICAL SAMPLE NO. f	BLOW COUNTS g	REMARKS/RECOVERY h
		SILTY SAND: yellow-orange (10YR 6/5), very fine, some ribbons, firm, moist, crumbly, soft. (SM)					3.5/5.0 ft may be a sandy silt (borderline)
	1						
	2						
		changes to light brown (5YR 6/4), with white mottles					
	3						
	4						
	5						4.0/5.0 ft
		some gypsum crystals; grades to					
	6						
	7	grades to CLAYEY SILT: brown (5YR 5/6), gypsum cystals, high plasticity, stiff. (MH)					
	8	SANDY, CLAYEY SILT: brown (5YR 4/4), medium plasticity, crumbly, moist, soft. (ML)					
	9						

DRILLING LOG

HOLE NO. MW-38-02

PROJECT HOLLOMAN AFB RI/FS

INSPECTOR ACD

SHEET 2 OF 3 SHEETS

a	DEPTH b	DESCRIPTION OF MATERIALS c	FIELD SCREENING RESULTS d	GEOTECH SAMPLE OR CORE BOX NO. e	ANALYTICAL SAMPLE NO. f	BLOW COUNTS g	REMARKS/RECOVERY h
	11	CLAYEY SILT, and clay: gypsum crystals, brown and grey/olive. (MH)					
	12	SAND: tan (10YR 8/2), clean, moist, fine to medium grained. (SP)					
	13						
	14						
	15	SAND: tan (10YR 8/2) to brown (5YR 5/4), very fine to medium zones, caliche dominant, some brown zones, some silty zones, mainly a clean, poorly graded sand caliche. (SP)					
	16						
	17						
	18						
	19						
	20	SANDY SILT: brown (5YR 5/6), low plasticity. (ML)					
	21	SAND: tan/olive (10YR 8/2), caliche, fine, clean. (SP)					
	22	SAND: brown (5YR 4/6 and tan (10YR 8/2), interbedded, medium grained, moist, clean. (SP)					
	23	SAND: olive (5Y 6/4), clean, fine to very fine, wet, poorly graded. (SP)					looks "stressed"
	24						▽ —water at 23.82 ft
	25	SAND: very fine, tan and brown, saturated. (SP)					
	26						
	27			MW-038-02-27.5-30.0			

PROJECT HOLLOMAN AFB RI/FS FOR 29 SITES

HOLE NO. MW-38-02

DRILLING LOG

HOLE NO. MW-38-02

PROJECT HOLLOMAN AFB RI/FS

INSPECTOR ACD

SHEET 3 OF 3 SHEETS

a	DEPTH b	DESCRIPTION OF MATERIALS c	FIELD SCREENING RESULTS d	GEOTECH SAMPLE OR CORE BOX NO. e	ANALYTICAL SAMPLE NO. f	BLOW COUNTS g	REMARKS/RECOVERY h
	29						
	30						TD= 30.0 ft
	31						
	32						
	33						
	34						
	35						
	36						
	37						
	38						
	39						
	40						
	41						
	42						
	43						
	44						
	45						

PROJECT HOLLOMAN AFB RI/FS FOR 29 SITES

HOLE NO. MW-38-02

72396

DRILLING LOG

HOLE NO. MW-38-03

1. COMPANY NAME	RADIAN CORPORATION
2. DRILLING SUBCONTRACTOR	SOUTHWEST ENG INC
SHEET 1 OF 3 SHEETS	
3. PROJECT	HOLLOMAN AFB RI/FS FOR 29 SITES
4. LOCATION	38
5. NAME OF DRILLER	ART VALTIERRA
6. MANUFACTURER'S DESIGNATION OF DRILL	HOLLOW-STEM AUGER
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT	BOREHOLE DIA.: 7.5"
8. HOLE LOCATION	685974.75(Y), 532168.57(X)
9. SURFACE ELEVATION	4060.72
10. DATE STARTED	24 SEP 91
11. DATE COMPLETED	24 SEP 91
12. OVERBURDEN THICKNESS	
15. DEPTH GROUNDWATER ENCOUNTERED	23.08 ft bgl
13. DEPTH DRILLED INTO ROCK	
16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED	04 NOV 91 25.88 ft bmp
14. TOTAL DEPTH OF HOLE	30 ft.
17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY)	

18. GEOTECHNICAL SAMPLES	DISTURBED	UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES

20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY %

22. DEPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR
		X		HTH

a	DEPTH b	DESCRIPTION OF MATERIALS c	FIELD SCREENING RESULTS d	GEOTECH SAMPLE OR CORE BOX NO. e	ANALYTICAL SAMPLE NO. f	BLOW COUNTS g	REMARKS/RECOVERY h
	1						
	2						
	3						
	4						
	5	CLAYEY SILT: pale yellowish-orange (10YR 8/6), medium plasticity, dry, some caliche. (ML)				9,10,9,7	1.6/2.0 ft
	6						
	7						
	8						
	9						

PROJECT HOLLOMAN AFB RI/FS FOR 29 SITES HOLE NO. MW-38-03

DRILLING LOG

HOLE NO. MW-38-03

PROJECT HOLLOMAN AFB RI/FS

INSPECTOR HTH

SHEET 2 OF 3 SHEETS

a	DEPTH b	DESCRIPTION OF MATERIALS c	FIELD SCREENING RESULTS d	GEOTECH SAMPLE OR CORE BOX NO. e	ANALYTICAL SAMPLE NO. f	BLOW COUNTS g	REMARKS/RECOVERY h
	11	CLAY: light brown (5YR 5/6), medium plasticity, dry, hard, gypsum mottling, increasing silt content at 11-12 ft. (CL)				4,8,11,14	2.0/2.0 ft
	12	SILT: light brown (5YR 5/6), low plasticity, dry, 11.5-12.0 ft no clay all silt. (ML)					
	13						
	14						
	15	SAND: yellowish-grey (5Y 7/2), very fine grained, almost silty, poorly graded, dry, some calliche. (SP)				24,41,42, 50	1.8/2.0 ft
	16						
	17						
	18						
	19						
	20	SAND: as above, fine to very fine grained, dry. (SP)				50	0.5/2.0 ft
	21						
	22						
	23						water at 23.08 ft bgl
	24						
	25	SANDY CLAY : yellowish-grey (5Y 7/2), medium plasticity, wet, hard. (CL)				4,22,36,50	
	26	SAND: yellowish grey (5Y 7/2), medium to very fine grained, moderately sorted, wet, trace clay near 25.5 ft, some silt below 25.5 ft. (SP)					
	27						

PROJECT HOLLOMAN AFB RI/FS FOR 29 SITES

HOLE NO. MW-38-03

DRILLING LOG

HOLE NO. MW-38-03

F2415

PROJECT HOLLOMAN AFB RI/FS

INSPECTOR HTH

SHEET 3 OF 3 SHEETS

a	DEPTH b	DESCRIPTION OF MATERIALS c	FIELD SCREENING RESULTS d	GEOTECH SAMPLE OR CORE BOX NO. e	ANALYTICAL SAMPLE NO. f	BLOW COUNTS g	REMARKS/RECOVERY h
	29						
	30						TD= 30.0 ft
	31						
	32						
	33						
	34						
	35						
	36						
	37						
	38						
	39						
	40						
	41						
	42						
	43						
	44						
	45						

PROJECT HOLLOMAN AFB RI/FS FOR 29 SITES

HOLE NO. MW-38-03

ELEVATION GROUND WATER			PROJECT HOLLOMAN AFB RI/FS
DATE INSTALLED 24 SEPT 91	STARTED	COMPLETED	LOCATION (Coordinates or Station) 38
ELEVATION TOP OF CASING 4062.85			SIGNATURE OF INSPECTOR/INSTALLER ACD
DRILLING METHOD HOLLOW STEM AUGER			WELL NO. (as shown on drawing: title and file number) MW-38-01

MONITORING WELL CONSTRUCTION DIAGRAM

(ALL MEASUREMENTS FROM GROUND SURFACE)

PROTECTIVE CASING

TYPE OF PROTECTIVE CASING: Steel Lockbox

TOP OF WELL

PROTECTIVE POSTS

CASING DIAMETER: 2 in.

TYPE OF PIPE JOINTS: Flush Threaded

TYPE OF BLANK CASING: PVC

BACKFILL/GROUT MIX ETC. Type I Portland Cement

TOP OF SEAL

TYPE OF SEAL: Bentonite Pellets

TOP OF FILTERPACK

TOP OF SCREEN

FILTER PACK

BOTTOM OF WELL

BOTTOM OF BORING

BORING DIAMETER

LENGTH OF SOLID PIPE: 22 ft.

WELL SCREEN LENGTH: 9.5 ft.

STICK-UP: 2.5 ft.

GROUND SURFACE

CONCRETE PAD MIN. 4.0' THICKNESS

	14.0 ft. bgl
	17.0 ft. bgl
	19.5 ft. bgl
	29.5 ft. bgl
	30.0 ft. bgl
	7.5 in.

SCREEN INFORMATION

SCREEN DIA.: 2 in.

SLOT WIDTH: 0.010 in.

SCHEDULE: 40

MATERIAL: ☒ PVC ☐ STAINLESS STEEL ☐ OTHER (DESCRIBE)

FILTERPACK MATERIAL

TYPE: 16-40 Colorado Silica Sand

BACKFILL METHOD: Tremie through auger

WELL DEVELOPMENT

METHOD: See Well Development Record

TIME SPENT DEVELOPING:

VOLUME OF WATER REMOVED:

VOLUME OF WATER ADDED:

DESCRIPTION OF PREDEVELOPMENT WATER:

DESCRIPTION OF POST DEVELOPMENT WATER:

WATER LEVEL SUMMARY

WATER LEVEL MEASUREMENTS

DATE/TIME/LEVEL 4 NOV 91/1525/25.24 ft. bmp

DEPTH FROM TOP CASING AFTER DEVELOPMENT:

D1738G

ELEVATION GROUND WATER			PROJECT HOLLOMAN AFB RI/FS
DATE INSTALLED 24 SEPT 91	STARTED	COMPLETED	LOCATION (Coordinates or Station) 38
ELEVATION TOP OF CASING 4063.56			SIGNATURE OF INSPECTOR/INSTALLER ACD
DRILLING METHOD HOLLOW STEM AUGER			WELL NO. (as shown on drawing: title and file number) MW-38-02

MONITORING WELL CONSTRUCTION DIAGRAM

(ALL MEASUREMENTS FROM GROUND SURFACE)

PROTECTIVE CASING

TYPE OF PROTECTIVE CASING: Steel Lockbox

TOP OF WELL

PROTECTIVE POSTS

CASING DIAMETER: 2 in.

TYPE OF PIPE JOINTS: Flush Threaded

TYPE OF BLANK CASING: PVC

BACKFILL/GROUT MIX ETC. Type I Portland Cement

TOP OF SEAL

TYPE OF SEAL: Bentonite Pellets

TOP OF FILTERPACK

TOP OF SCREEN

FILTER PACK

BOTTOM OF WELL

BOTTOM OF BORING

BORING DIAMETER

23.0 ft. LENGTH OF SOLID PIPE

9.5 ft. WELL SCREEN LENGTH

STICK-UP: 2.5 ft.

GROUND SURFACE

CONCRETE PAD MIN. 4.0 THICKNESS

SCREEN INFORMATION

SCREEN DIA.: 2 in.

SLOT WIDTH: 0.010 in.

SCHEDULE: 40

MATERIAL: ☒ PVC ☐ STAINLESS STEEL ☐ OTHER (DESCRIBE)

15.5 ft. bgl

18.5 ft. bgl

20.5 ft. bgl

FILTERPACK MATERIAL

TYPE: 16-40 Colorado Silica Sand

BACKFILL METHOD: Tremie through auger

30.0 ft. bgl

30.0 ft. bgl

7.5 in.

WELL DEVELOPMENT

METHOD: See Well Development Record

TIME SPENT DEVELOPING:

VOLUME OF WATER REMOVED:

VOLUME OF WATER ADDED:

DESCRIPTION OF PREDEVELOPMENT WATER:

DESCRIPTION OF POST DEVELOPMENT WATER:

WATER LEVEL SUMMARY

WATER LEVEL MEASUREMENTS

DATE/TIME/LEVEL 4 NOV 91/1527/26.32 ft. bmp

DEPTH FROM TOP CASING AFTER DEVELOPMENT:

D1738H

ELEVATION GROUND WATER			PROJECT HOLLOMAN AFB RI/FS
DATE INSTALLED 24 SEPT 91	STARTED 1500	COMPLETED 1700	LOCATION (Coordinates or Station) 38
ELEVATION TOP OF CASING 4063.10			SIGNATURE OF INSPECTOR/INSTALLER HTH
DRILLING METHOD HOLLOW STEM AUGER			WELL NO. (as shown on drawing: title and file number) MW-38-03

MONITORING WELL CONSTRUCTION DIAGRAM

(ALL MEASUREMENTS FROM GROUND SURFACE)

PROTECTIVE CASING

TYPE OF PROTECTIVE CASING: Steel Lockbox

TOP OF WELL

PROTECTIVE POSTS

CASING DIAMETER: 2 in.

TYPE OF PIPE JOINTS: Flush Threaded

TYPE OF BLANK CASING: PVC

BACKFILL/GROUT MIX ETC. Type I Portland Cement

TOP OF SEAL

TYPE OF SEAL: 1/4" Bentonite Pellets

TOP OF FILTERPACK

TOP OF SCREEN

FILTER PACK

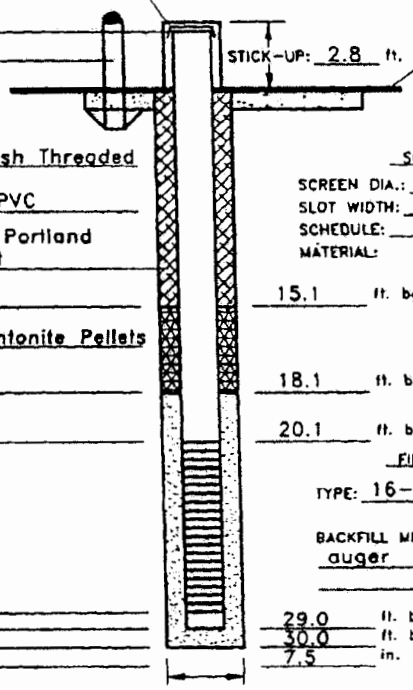
BOTTOM OF WELL

BOTTOM OF BORING

BORING DIAMETER

LENGTH OF SOLID PIPE: 21.9 ft.

WELL SCREEN LENGTH: 9.5 ft.



STICK-UP: 2.8 ft.

GROUND SURFACE

CONCRETE PAD MIN. 4.0" THICKNESS

SCREEN INFORMATION

SCREEN DIA.: 2 in.

SLOT WIDTH: 0.010 in.

SCHEDULE: 40

MATERIAL: ☒ PVC ☐ STAINLESS STEEL ☐ OTHER (DESCRIBE)

15.1 ft. bgl

18.1 ft. bgl

20.1 ft. bgl

FILTERPACK MATERIAL

TYPE: 16-40 Colorado Silica Sand

BACKFILL METHOD: Pour through auger

29.0 ft. bgl

30.0 ft. bgl

7.5 in.

WELL DEVELOPMENT

METHOD: See Well Development Record

TIME SPENT DEVELOPING:

VOLUME OF WATER REMOVED:

VOLUME OF WATER ADDED:

DESCRIPTION OF PREDEVELOPMENT WATER:

DESCRIPTION OF POST DEVELOPMENT WATER:

WATER LEVEL SUMMARY

WATER LEVEL MEASUREMENTS

DATE/TIME/LEVEL 20 OCT 91/0930/25.87 ft. bmp

4 NOV 91/1530/25.88 ft. bmp

DEPTH FROM TOP CASING AFTER DEVELOPMENT:

01738N

Appendix A-6-1

Portions of: *Installation Restoration Program Phase II – Confirmation/Quantification Stage 1, Report (April 1984 to March 1985) for Holloman Air Force Base, New Mexico 88330,* Dames & Moore, March 6, 1987

INSTALLATION RESTORATION PROGRAM
PHASE II - CONFIRMATION/QUANTIFICATION
STAGE 1

REPORT (APRIL 1984 TO MARCH 1985)

FOR

HOLLOMAN AIR FORCE BASE
NEW MEXICO 88330

HEADQUARTERS TACTICAL AIR COMMAND
COMMAND SURGEON'S OFFICE (HQ TAC/SGPB)
BIOENVIRONMENTAL ENGINEERING DIVISION
LANGLEY AIR FORCE BASE, VIRGINIA 23665-5001

MARCH 6, 1987

PREPARED BY

DAMES & MOORE
1550 NORTHWEST HIGHWAY
PARK RIDGE, ILLINOIS 60068

USAF CONTRACT NO. F33615-83-D-4002, DELIVERY ORDER NO. 0025

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USAFOEHL TECHNICAL PROGRAM MANAGER

LT. COL. EDWARD BARNES
USAFOEHL/TS

USAF OCCUPATIONAL & ENVIRONMENTAL HEALTH LABORATORY (USAFOEHL)
TECHNICAL SERVICES DIVISION (TS)
BROOKS AIR FORCE BASE, TEXAS 78235-5501

TABLE 1

CHEMICAL SAMPLING EVENTS
HOLLOMAN AFB, NEW MEXICO
PHASE II, STAGE 1

SITE	OIL & GREASE, TOC[a] AND TOX	PHENOLICS	PESTICIDES[b]	TRACE METALS	C^{14} AND TRITIUM
1	3W	3W	3W	3W[c]	—
50	1W, 5S	1W, 5S	1W	—	—
51	1W, 6S	1W, 6S	—	—	—
13	—	—	—	1W[d], 6S[e]	—
18	—	—	—	1W[f], 6S[g]	—
32	8S	—	—	—	8S
31	1W, 9S	1W, 9S	—	1W[h], 9S[i]	—

Note: W = water sample, S = soil sample.

[a]Soils not analyzed for TOC.

[b]Aldrin, DDT isomers, dieldrin, endrin, heptachlor, heptachlor epoxide, lindane, methoxychlor, diazinon, malathion, parathion.

[c]Arsenic, chromium, cadmium, lead, nickel, silver.

[d]Arsenic.

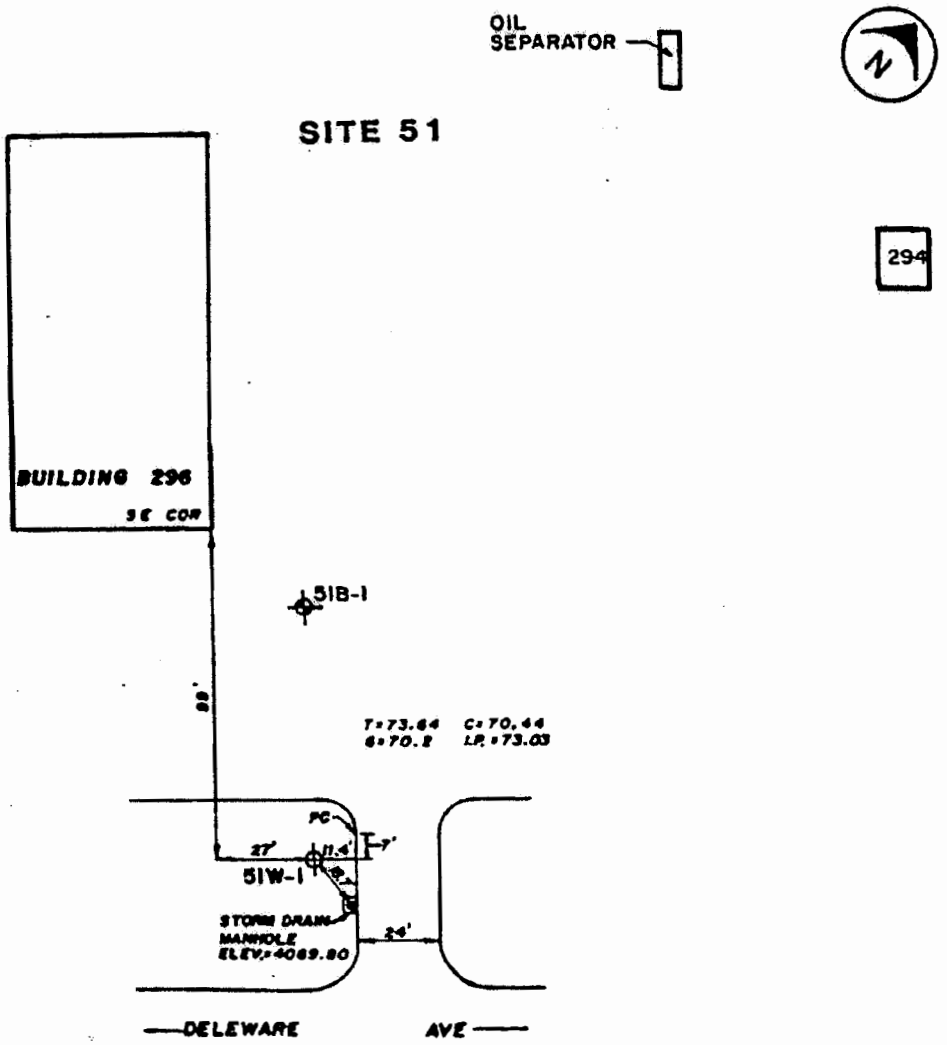
[e]Total arsenic by EP toxicity extraction.

[f]Total chromium and hexavalent chromium.

[g]Total chromium and hexavalent chromium by EP toxicity extraction.

[h]Total lead.

[i]Total lead by EP toxicity extraction.



EXPLANATION:

BORING LOCATION AND NUMBER

MONITORING WELL LOCATION AND NUMBER

DRAWING REFERENCE:
TITLED: SURVEY PLAT
BY: BURKE/COLLINS/ASSOCIATES PC
ENGINEERS-SURVEYORS
ALAMOGORDO, NEW MEXICO
DRAWING NO.: 84372
DATE: 10-18-84

Scale in Feet
0 50 100

SITES 51

Dames & Moore

Figure 8

TABLE 2

WELL CONSTRUCTION DETAILS

WELL NUMBER	DEPTH (ft)	WATER TABLE ELEVATION (10/02/84) (ft)	SCREENED INTERVAL (ft)	GROUND ELEVATION (ft)
1W1	58	4084.79	4062.2 - 4087.2	4120.2
1W2	40	4079.45	4059.2 - 4084.2	4099.2
1W3	34	4077.22	4057.9 - 4082.9	4091.9
13W1	20	4071.94	4058.6 - 4073.6	4078.6
18W1	20	4069.84	4054.8 - 4064.8	4074.8
31W1	38	4080.34	4063.2 - 4083.2	4101.2
50W1	19	4064.56	4051.1 - 4066.1	4070.1
51W1	19	4064.90	4051.2 - 4066.2	4070.2

TABLE 4

SUMMARY OF CONSTITUENTS ABOVE DETECTION IN WATER SAMPLES

PARAMETER	STANDARD USEPA[a]	STANDARD NEW MEXICO[b]	UNIT	DETECTION LIMIT	WELL NUMBER 1W1	1W2	1W3	51W1	13W1	18W1	31W1	50W1
Arsenic	0.05	0.1	mg/L	0.01	d	d	d	--	0.01	--	--	--
Cadmium	0.01	0.01	mg/L	0.01	0.09	0.21	0.24	--	--	--	--	--
Nickel	--	0.2[c]	mg/L	0.1	0.2	0.4	0.5	--	--	--	--	--
Lead	0.05	0.05	mg/L	0.01	d	0.03	0.05	--	--	--	d	--
Silver	0.05	0.05	mg/L	0.01	0.10	0.18	0.21	--	--	--	--	--
Chromium (hexavalent)	--	--	mg/L	0.004	--	--	--	--	--	0.007	--	--
Oil and grease	--	--	µg/L	600.	4,200.	3,400.	5,300.	85,000	--	--	15,000	140,000
TOC	--	--	µg/L	1000.	14,000.	24,000.	7,000.	68,000	--	--	170,000	95,000
TOX	--	--	µg/L	10.	140,000.	200,000.	220,000.	27,000	--	--	17,000	120
Phenolics	--	5.0	µg/L	10.	d	d	20.	290	--	--	d	d

[a]Safe Drinking Water Act (42 USCA §300f et seq.).

[b]New Mexico Water Quality Control Commission Regulations (does not necessarily apply to discharges to water with an existing TDS of greater than 10,000 ppm).

[c]Standard for irrigation use.

[d]Denotes value less than the limit of detection.

TABLE 5

SUMMARY OF CONSTITUENTS ABOVE DETECTION LIMITS IN SOIL SAMPLES
(CORRECTED FOR PERCENT MOISTURE)

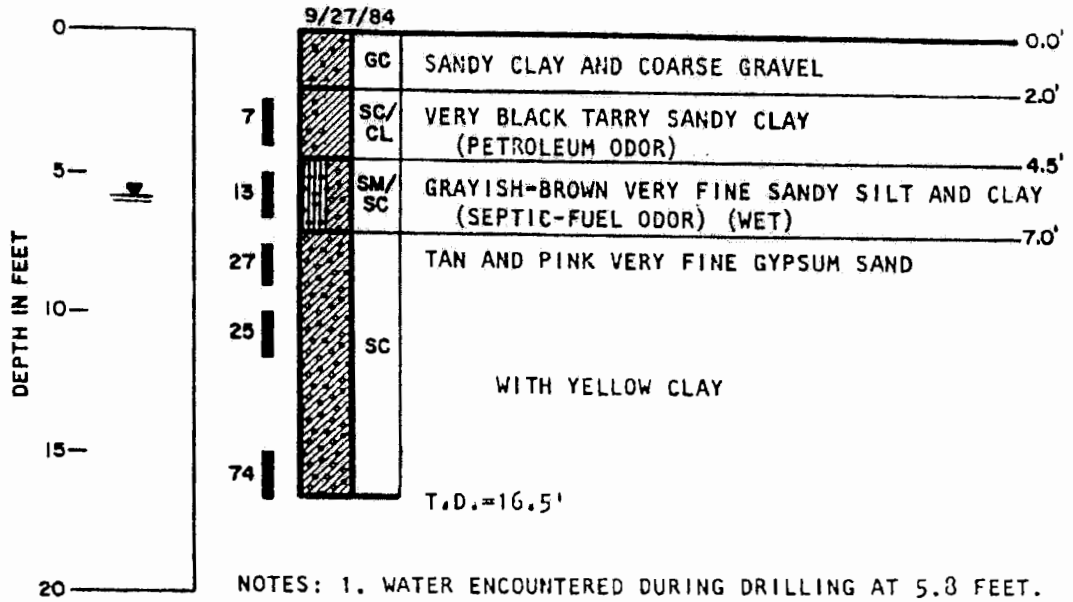
BORING/WELL NO. AND DEPTH	PARAMETER					
	CARBON-14 (pCi/g)	ARSENIC[a] (mg/L)	LEAD[a] (mg/L)	OIL AND GREASE (mg/kg)	TOX (mg/kg)	PHENOLICS (mg/kg)
Standard[b]	—	5.0	5.0	—	—	—
Detection Limit	—	0.01	0.01	7	5.0	1
13B1, 0-1'	—	0.04	—	—	—	—
31B1, 5-6.5'	—	—	c	c	8.2	c
31B1, 7.5-9'	—	—	c	40	c	c
31B2, 2.5-4'	—	—	c	c	7.7	c
31B2, 5-6.5'	—	—	c	25	7.5	c
31B2, 7.5-9'	—	—	c	32	7.4	c
31W1, 2.5-4'	—	—	c	c	8.1	1
31W1, 5-6.5'	—	—	c	44	42.5	c
31W1, 7.5-9'	—	—	c	c	7.1	c
51B1, 5-6.5'	—	—	—	39	7.0	c
51B1, 7.5-9'	—	—	—	c	30.3	c
51B1, 10-11.5'	—	—	—	c	9.0	c
51W1, 5-6.5'	—	—	—	c	50.0	c
51W1, 10-11.5'	—	—	—	c	6.4	c
32B1, 10-11.5'	240±194	—	—	c	c	—
32B2, 7.5-9'	c	—	—	16	c	—
32B2, 10-11.5'	c	—	—	c	24.7	—
32B3, 10-11.5'	c	—	—	c	7.7	—
32B4, 7.5-9'	—	—	—	9	c	—
32B4, 10-11.5'	c	—	—	15	8.0	—
50B1, 5-6.5'	—	—	—	1192	c	c
50B1, 7.5-9'	—	—	—	4265	c	c
50W1, 5-6.5'	—	—	—	160	c	17
50W1, 7.5-9'	—	—	—	3700	c	c
50W1, 10-11.5'	—	—	—	1143	c	c

[a]Samples have been extracted for EP toxicity according to Method 1310 published in USEPA Publication No. SW-846.

[b]Federal Resource Conservation and Recovery Act of 1982 and New Mexico Hazardous Waste Management Regulations are nearly identical.

[c]Denotes value less than the limit of detection.

HOLLOMAN AFB
BORING 51-B1



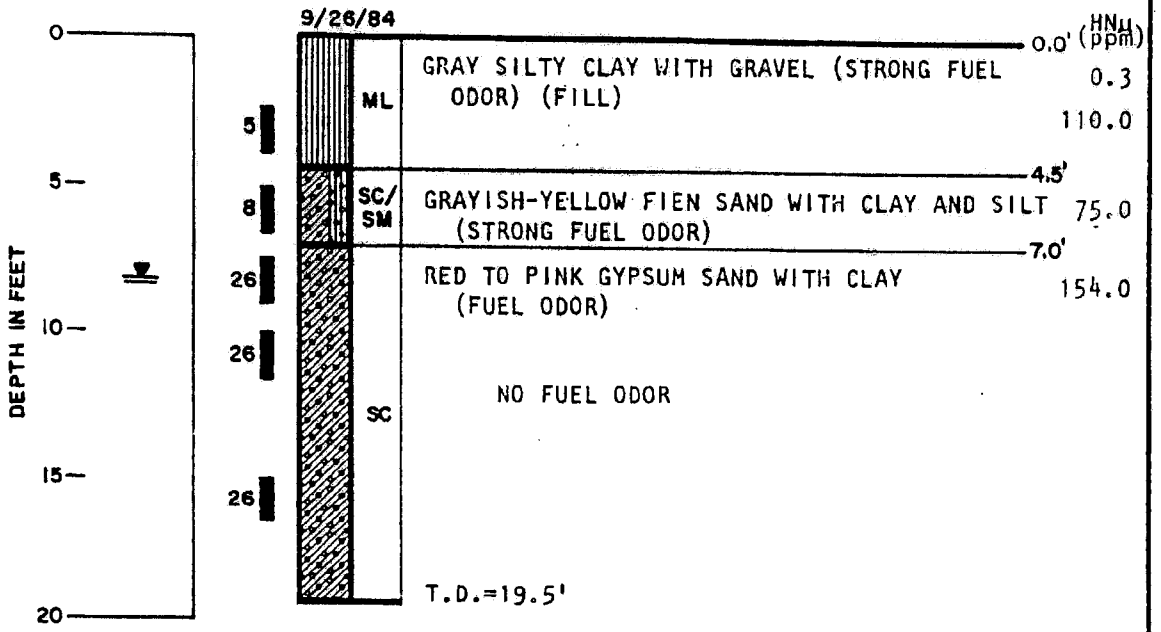
NOTES: 1. WATER ENCOUNTERED DURING DRILLING AT 5.8 FEET.

2. HNμ READINGS WERE NOT RECORDED DUE TO EQUIPMENT MALFUNCTION.

LOG OF BORING

Dames & Moore

HOLLOMAN AFB
BORING 51-W1



NOTES: 1. STATIC WATER LEVEL MEASURED 10/2/84.

LOG OF BORING

Dames & Moore

PLATE C-9

PIEZOMETER DETAIL INFORMATION SHEET

GROUND SURFACE ELEVATION 4070.2

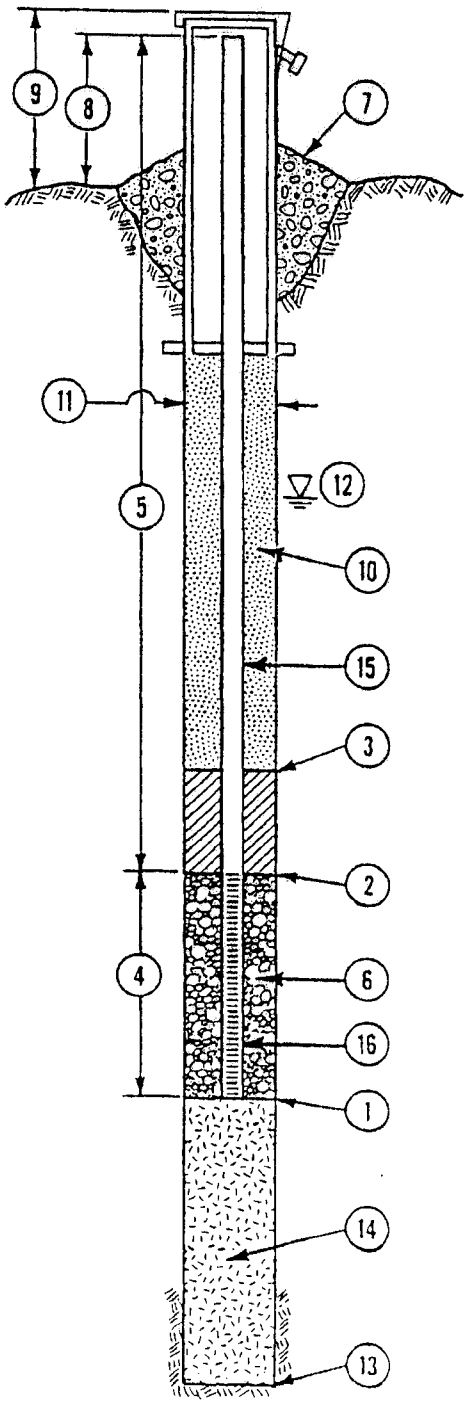
TOP OF WELL CASING ELEVATION 4073.03

JOB NUMBER 01016-210-07

BORING NUMBER 51-W1

DATE 9/26/84

LOCATION Holloman AFB



1. DEPTH TO BOTTOM OF WELL POINT OR SLOTTED PIPE 19.5 FEET.*
2. DEPTH TO BOTTOM OF SEAL (IF INSTALLED) 3.5 FEET.*
3. DEPTH TO TOP OF SEAL (IF INSTALLED) 2.0 FEET.*
4. LENGTH OF WELL SCREEN 15 FEET. SLOT SIZE 0.010.
5. TOTAL LENGTH OF PIPE 22 FEET AT 2 INCH DIAMETER.
6. TYPE OF PACK AROUND WELL POINT OR SLOTTED PIPE pea gravel/sand.
7. CONCRETE CAP. (YES) NO (CIRCLE ONE)
8. HEIGHT OF WELL CASING ABOVE GROUND 2.8 FEET.
9. PROTECTIVE CASING? (YES) NO (CIRCLE ONE) HEIGHT ABOVE GROUND ____ FEET. LOCKING CAP? (YES) NO (CIRCLE ONE)
10. TYPE OF UPPER BACKFILL concrete.
11. BOREHOLE DIAMETER 7.25 INCHES.
12. DEPTH TO GROUND WATER 8.13 FEET.**
13. TOTAL DEPTH OF BOREHOLE 19.5 FEET.*
14. TYPE OF LOWER BACKFILL pea gravel.
15. PIPE MATERIAL Sch. 40 screw joint
16. SCREEN MATERIAL Sch 40 Machine cut

*(DEPTH FROM GROUND SURFACE)

**(DEPTH FROM TOP OF PROTECTIVE CASING)

PIEZOMETER INSTALLATION DETAILS

Dames & Moore

PLATE D-5

Appendix A-6-2

Portions of: *Final Installation Restoration Program Remediation Investigation Report, Holloman Air Force Base, New Mexico,* Walk, Haydel & Associates, Inc., December 1989

INSTALLATION RESTORATION PROGRAM
REMEDIAL INVESTIGATION

FINAL

REMEDIAL INVESTIGATION REPORT
HOLLOMAN AIR FORCE BASE, NEW MEXICO

VOLUME I

CONTRACT NUMBER DACA45-86-C-0043
MODIFICATION NUMBERS P00007, P00014
WALK, HAYDEL & ASSOCIATES JOB NUMBER 87-3781

DECEMBER, 1989

UNDER CONTRACT WITH:

OMAHA DISTRICT, CORPS OF ENGINEERS
215 NORTH 17TH STREET
OMAHA, NEBRASKA 68102-4978

FOR:

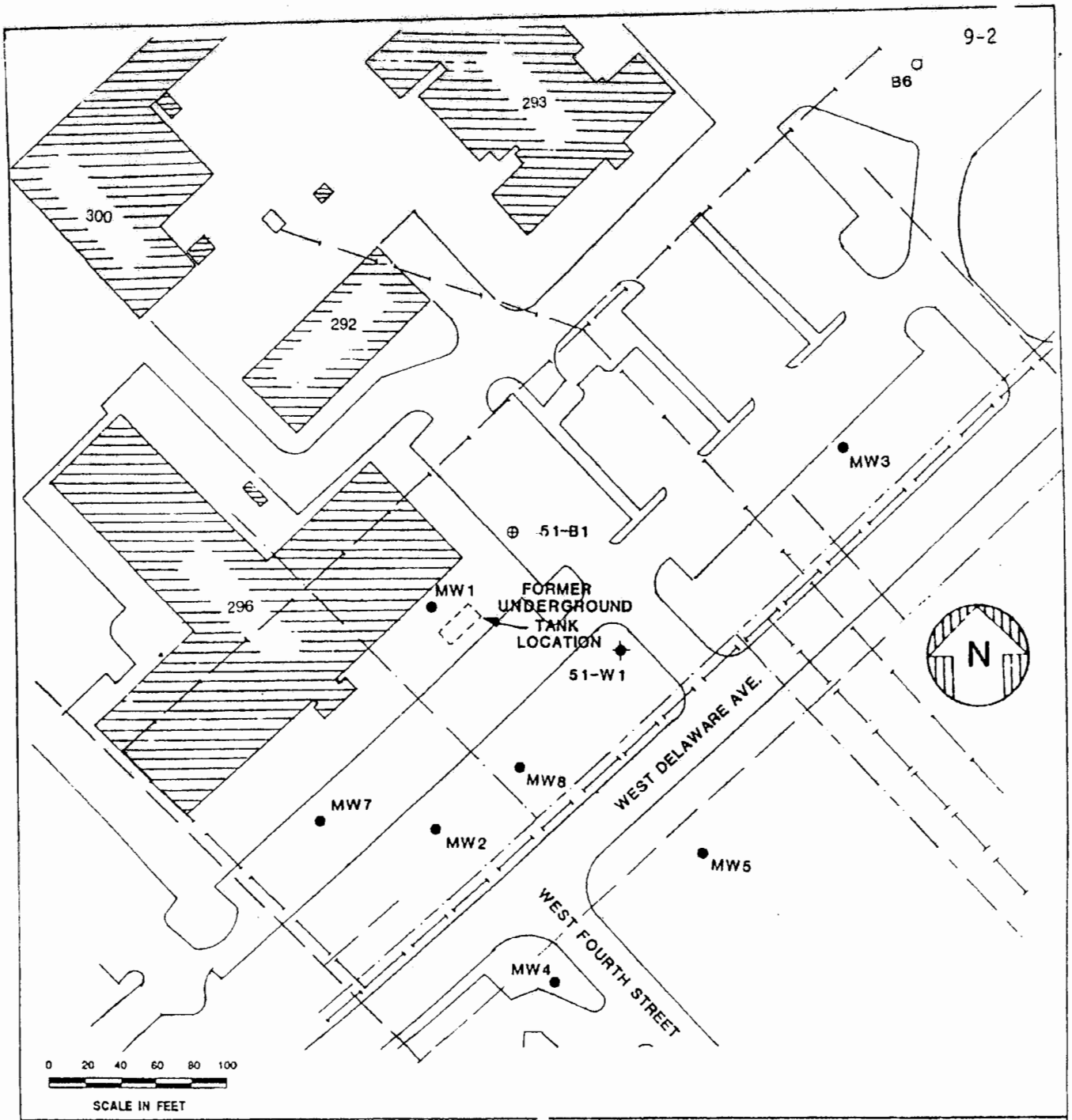
HEADQUARTERS, TACTICAL AIR COMMAND
HQ, TAC/DEEV
LANGLEY AIR FORCE BASE, VIRGINIA 23665-5542

PREPARED BY:

WALK, HAYDEL & ASSOCIATES, INC.

ENGINEERS

NEW ORLEANS MOBILE LITTLE ROCK BATON ROUGE



LEGEND

- MONITORING WELL
- SOIL BORING
- PHASE II SOIL BORING
- PHASE II MONITORING WELL
- SEWAGE/DRAINAGE LINE
- WATER LINE
- GAS LINE
- STORM DRAIN
- UNDERGROUND TANK

FIGURE 9-1

SITE 51

OLD AGE REFUELING STATION

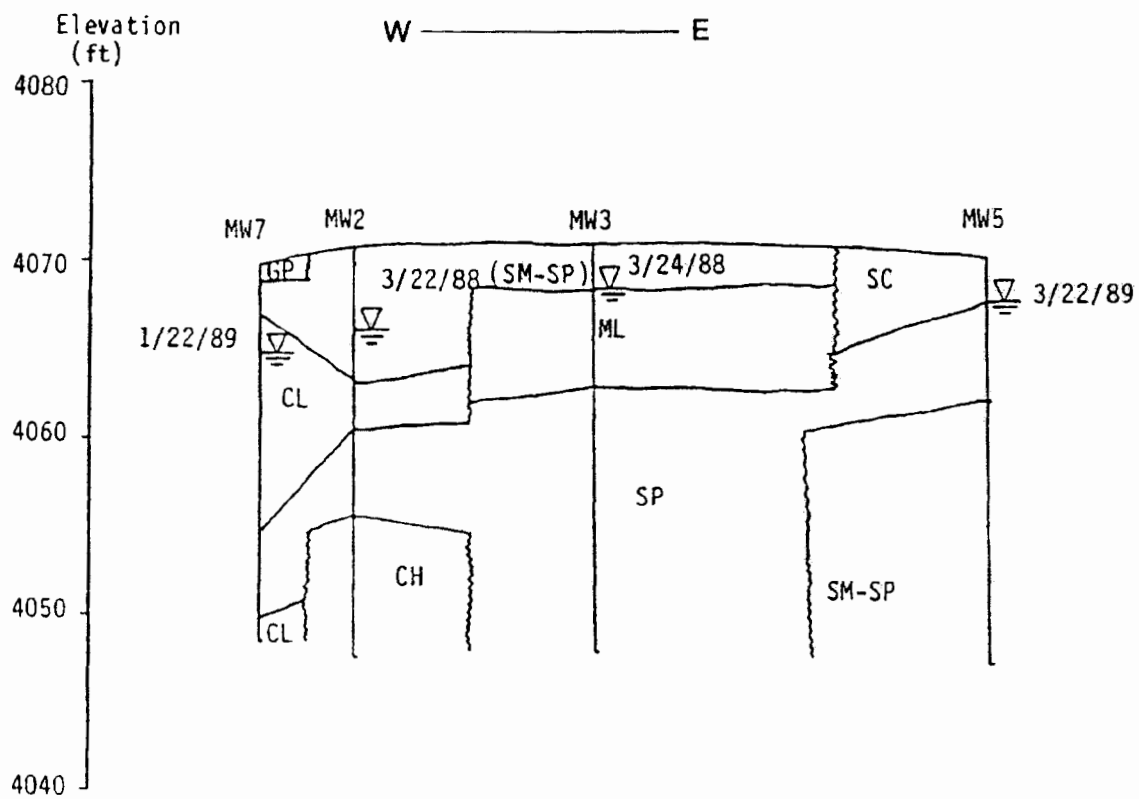
CONTRACT NO. DACA45-86-C-0043

REMEDIAL INVESTIGATION

HOLLOMAN AFB, NEW MEXICO

WH&A 1012 (REV.3/83)

WALK, HAYDEL & ASSOCIATES, INC.
ENGINEERS
NEW ORLEANS—MOBILE—BATON ROUGE



HORIZONTAL SCALE: 1" = 100'

LEGEND

WATER LEVEL DURING DRILLING ON DATE INDICATED

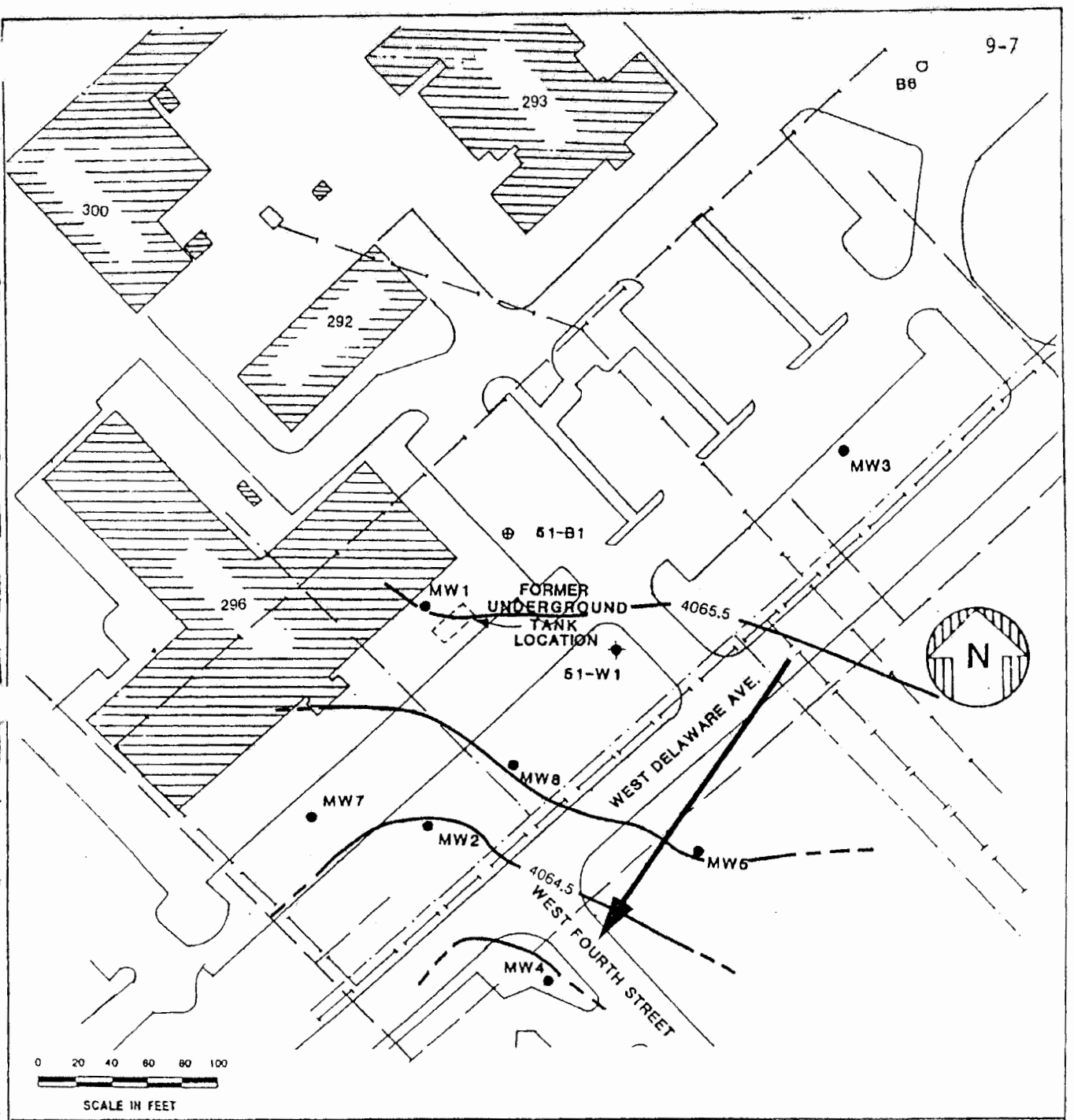
FIGURE 9-2

SITE 51
GENERALIZED SOIL PROFILE

CONTRACT NO. DACA45-86-C-0046

REMEDIAL INVESTIGATION
HOLLOMAN AFB, NEW MEXICO

WHBA 1012 (REV.3/83)
WALK, HAYDEL & ASSOCIATES, INC.
ENGINEERS
NEW ORLEANS—MOBILE—BATON ROUGE



LEGEND

- MONITORING WELL
- SOIL BORING
- PHASE II SOIL BORING
- PHASE II MONITORING WELL
- SEWAGE/DRAINAGE LINE
- WATER LINE
- GAS LINE
- STORM DRAIN
- UNDERGROUND TANK
- GROUNDWATER CONTOUR
- GROUNDWATER FLOW DIRECTION

FIGURE 9-3

SITE 51

GROUNDWATER CONTOUR MAP

CONTRACT NO. DACA45-88-C-0043

REMEDIAL INVESTIGATION

HOLLOMAN AFB, NEW MEXICO

TABLE 9-1

SITE 51 - SOIL

VOLATILE ORGANICS (ug/kg)

	Depth (ft)	Boring B1	B2	B3	B4	B5	B7	B8
	0				-	-		
Benzene	2.5	-	14			-		(540)
Ethylbenzene		-	70			-		(1115)
Toluene		-	2			-		(845)
Total Xylenes		-	-			-		(1470)
Benzene	5	47*	3100*				(-)	(9)
Chlorobenzene			7500					(-)
Ethylbenzene		27	62300					(28)
Styrene			2010					(-)
Toluene			22800					(10)
Total Xylenes			-					(14)
1,1,2,2-Tetrachloroethane			19400					(-)
Benzene	7.5			6	-		(-)	
1,1-Dichloroethane				6	-		(-)	
1,1-Dichloroethene				4	-		(-)	
1,1,1-Trichloroethane				4	-		(-)	
Benzene	10		-	7				
Ethylbenzene			-	2				
1,1-Dichloroethane			-	25				
1,1-Dichloroethene			-	10				
1,1,1-Trichloroethane			-	10				
Total Xylenes			-	1				
Benzene	15			7	-	-	(-)	
Ethylbenzene				4	-	-	(-)	
1,1-Dichloroethene				3	-	-	(-)	
Toluene				6	-	-	(-)	
Total Xylenes				1	-	-	(-)	
	20							(-)

- Not detected
( ) Stage II data
* Outside QC limits due to out-of-range surrogate recoveries

TABLE 9-2
SITE 51 - SOIL
BNA/TIC

	Depth (ft)	Boring B1	B2	B3	B4	B5	B7	B8
BNA or BN Extractables (ug/kg)								
	0				-	-**		
	2.5	-	-			-		(-)*
2-Methylnaphthalene	5	-	5,200				(-)*	
Naphthalene		-	26,000				(-)*	
	7.5	-		-	-		(-)*	
	10		-	-				
	15			-	-	-*	(-)*	
	20							(-)
Tentatively Identified Compounds (ug/kg)								
Pentane	2.5						(-)	(46)
Cyclohexane							(-)	(818)
Methyl-cyclopentane							(-)	(335)
Trans-1,3-Dimethyl-cyclopentane							(-)	(180)
Methylcyclohexane							(-)	(2000)
1,1-Oxybis (hexane)							(-)	(142)
Trans 1,2-Dimethyl-cyclohexane							(-)	(71)
1,3,5-Cyclo-heptatriene							(-)	(832)
Trans 1,3-Dimethyl-cyclohexane							(-)	(286)
1,1-Dimethyl-cyclohexane							(-)	(495)

- Not detected
* Acid extractables not reported due to out-of-range surrogate recoveries.
** Elevated detection limit (x200)
( ) Stage II data

TABLE 9-3

SITE 51 - SOIL

TRPH/LEAD (mg/kg)

	Depth (ft)	Boring B1	B2	B3	B4	B5	B7	B8
TRPH								
	0				32	663		
	2.5	-	35			-		(42)
	5	-	1265				(20)	(41)
	7.5	-		-	87		(32)	
	10		-	-				
	15			-	-	-	(24)	
	20							(20)
LEAD								
	0				6	6		
	2.5	3	5			-		
	5	1	1					
	7.5		1	-	1			
	10		1	-				
	15			1	1	1		

\- Not detected
( ) Stage II data

TABLE 9-4

SITE 51 - GROUNDWATER

ORGANICS (ug/L)

	Monitoring Well							
	W1	MW1	(MW1)	MW2	(MW2)	(MW2FP)	MW3	(MW3)
Volatiles								
Benzene	(16)	-	(-)	6	(220)	(300000)	-	(40)
Chlorobenzene	(-)	-	(-)	-	(-)	(650000)	-	(-)
Chloroform	(-)	-	(59)	-	(-)	(-)	-	(-)
1,1 Dichloroethane	(23)	59	(-)	3	(-)	(-)	-	(740)
1,1-Dichloroethene	(-)	-	(13)	-	(-)	(-)	-	(310)
Ethylbenzene	(-)	-	(-)	-	(450)	(4800000)	-	(-)
2-Hexanone	(-)	-	(-)	-	(-)	(650000)	-	(-)
Tetrachloroethene	(-)	-	(-)	-	(-)	(-)	-	(160)
Toluene	(-)	-	(-)	4	(280)	(700000)	-	(-)
Total Xylenes	(-)	-	(-)	34	(720)	(5250000)	-	(-)
1,1,1-Trichloroethane	(-)	-	(-)	-	(-)	(-)	-	(90)
Trichloroethene	(-)	15	(-)	3	(-)	(-)	-	(60)
Acid/Base/Neutral Extractables								
Bis(2-ethylhexyl) phthalate	-	-	(-)	-	-		21	

WHA A 1012 (REV.3/83)

WALK, HAYDEL & ASSOCIATES, INC.
ENGINEERS
NEW ORLEANS-MOBILE-BATON ROUGE

TABLE 9-4 (continued)

SITE 51 - GROUNDWATER

ORGANICS (ug/L)

	Monitoring Well					
	MW4	(MW4)	MW5	(MW5)	MW7	MW8
Volatiles						
1,1-Dichloroethane	-	(20)	-	-	(-)	(10)
1,1-Dichloroethene	-	(7)	-	-		
Tetrachloroethene	-	(24)	11	20	(-)	(-)
Trichloroethene	-	(6)	3	-	(8)	(-)
Acid/Base/Neutral Extractables						
Bis(2-ethylhexyl)phthalate	-		-		(-)	(18)*
1,2-Dichlorobenzene	-		-		(12)	

- Not detected
* Corps of Engineers lab data
FP Floating product
( ) Stage II data

WH&A 1012 (REV.3/83)
WALK, HAYDEL & ASSOCIATES, INC.
ENGINEERS
NEW ORLEANS-MOBILE-BATON ROUGE

TABLE 9-5

SITE 51 - GROUNDWATER

TRPH/LEAD

	Monitoring Well			
	W1	MW1	MW2	MW2(FP)
TRPH (mg/L)	-	-	-	-
	(1)	(-)	(3)	(560000)
LEAD (ug/L)	9	-	-	

	Monitoring Well				
	MW3	MW4	MW5	MW7	MW8
TRPH (mg/L)	-	-	-		
	(-)	(-)	(-)	(-)	(-)
LEAD (ug/L)	27	20	12		

\- Not detected
( ) Stage II data

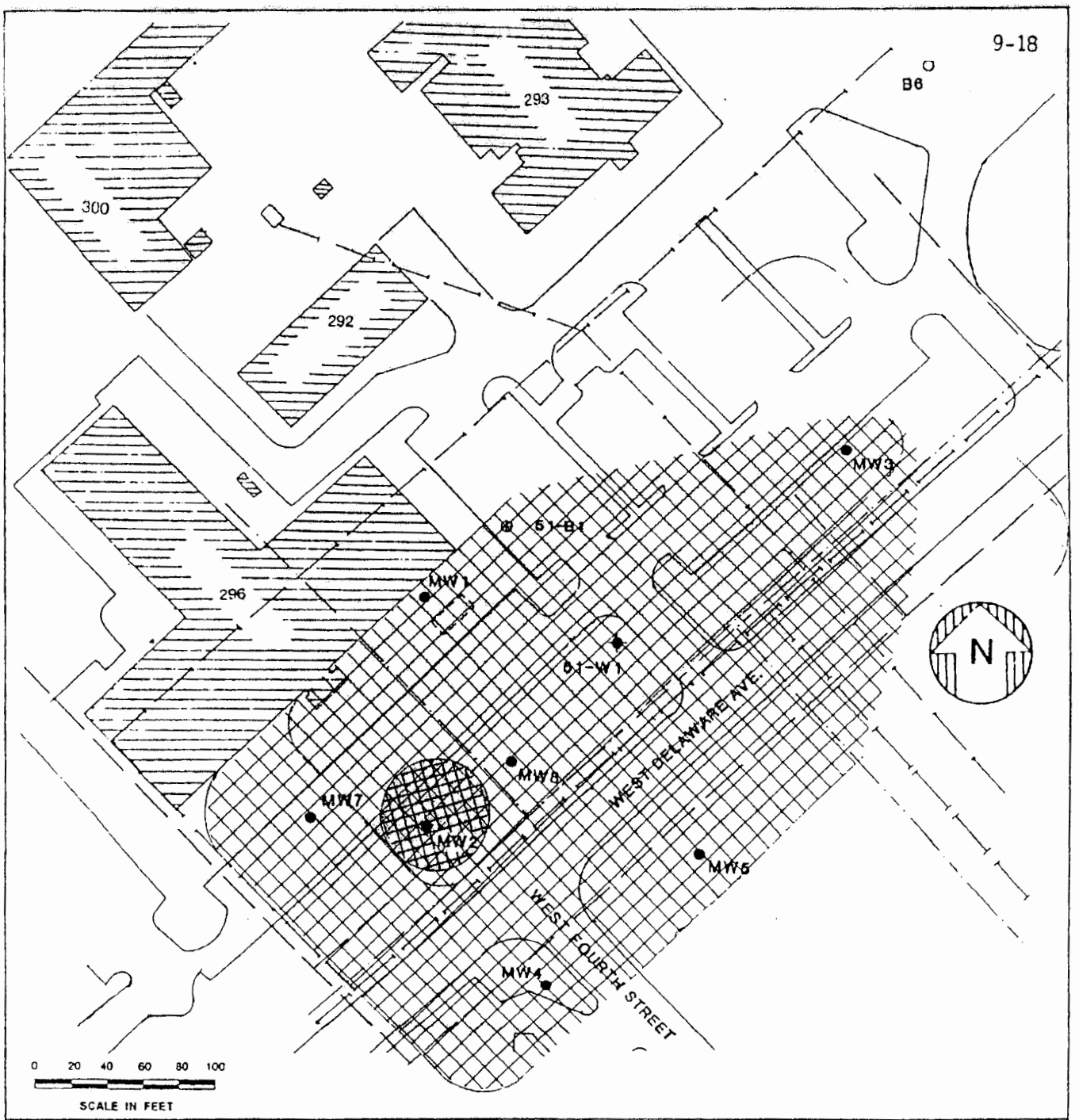
TABLE 9-6

SITE 51 - GROUNDWATER

TENTATIVELY IDENTIFIED COMPOUNDS (ug/L)

Tentatively Identified Compounds	Monitoring Well MW2(FP)
Methylcyclohexane	(2399000)
Trans-1,2-Dimethyl-cyclohexane	(655000)
1,1-Dimethylcyclopentane	(503000)
Trans 1,3-Dimethyl-cyclopentane	(1443000)
1,1,3-Trimethyl-cyclopentane	(2709000)
Cis-1,3-Dimethyl-cyclohexane	(2043000)
1,1,3-Trimethyl-cyclohexane	(3255000)
3,5,5 Trimethyl-1-Hexane	(2158000)
Ethylcyclohexane	(4770000)

( ) Stage II data
FP Floating product



LEGEND

- MONITORING WELL
- SOIL BORING
- PHASE II SOIL BORING
- PHASE II MONITORING WELL
- SEWAGE/DRAINAGE LINE
- WATER LINE
- GAS LINE
- STORM DRAIN
- UNDERGROUND TANK
- SOIL CONTAMINATION
- GROUNDWATER CONTAMINATION
- FLOATING PRODUCT

FIGURE 9-4

SITE 51

AREA OF KNOWN CONTAMINATION

CONTRACT NO. DACA45-86-C-0043

REMEDIAL INVESTIGATION

HOLLOMAN AFB, NEW MEXICO

WH&A 1012 (REV.3/83)

WALK, HAYDEL & ASSOCIATES, INC.
ENGINEERS
NEW ORLEANS—MOBILE—BATON ROUGE

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INSTALLATION RESTORATION PROGRAM
REMEDIAL INVESTIGATION

FINAL

REMEDIAL INVESTIGATION REPORT
HOLLOMAN AIR FORCE BASE, NEW MEXICO

VOLUME V

CONTRACT NUMBER DACA45-86-C-0043
MODIFICATION NUMBERS P00007, P00014
WALK, HAYDEL & ASSOCIATES JOB NUMBER 87-3781

DECEMBER, 1989

UNDER CONTRACT WITH:

OMAHA DISTRICT, CORPS OF ENGINEERS
215 NORTH 17TH STREET
OMAHA, NEBRASKA 68102-4978

FOR:

HEADQUARTERS, TACTICAL AIR COMMAND
HQ, TAC/DEEV
LANGLEY AIR FORCE BASE, VIRGINIA 23665-5542

PREPARED BY:

WALK, HAYDEL & ASSOCIATES, INC.
ENGINEERS
NEW ORLEANS MOBILE LITTLE ROCK BATON ROUGE

PROFESSIONAL SERVICE INDUSTRIES, INC.

BORING NO. S51-MW1 PROJECT NO. 342-65219H PROJECT NAME Holloman Air Force Base

DATE/TIME START 3/27/88 7:30 DATE/TIME END 3/27/88 9:45 DRILL CREW Mitchell*, Caho, Flair *Engineer

DRILLING METHOD: AUGER 0 FT TO 23 FT, ROTARY - FT TO - FT DRILL RIG CME 55

AUGER/BIT SIZE(S) & INTERVAL(S) 3¼ I.D./All SURFACE COVER Gravel

TOC ELEV. 4071.54 BORING COORDINATES N 670404 E 551029 WATER DURING DRILLING 4.5'

WATER AT COMPLETION 4.5' DELAYED WATER LEVEL Monitor well installed in boring

DATE GROUTED N/A MATERIAL(S) & QUANTITY N/A

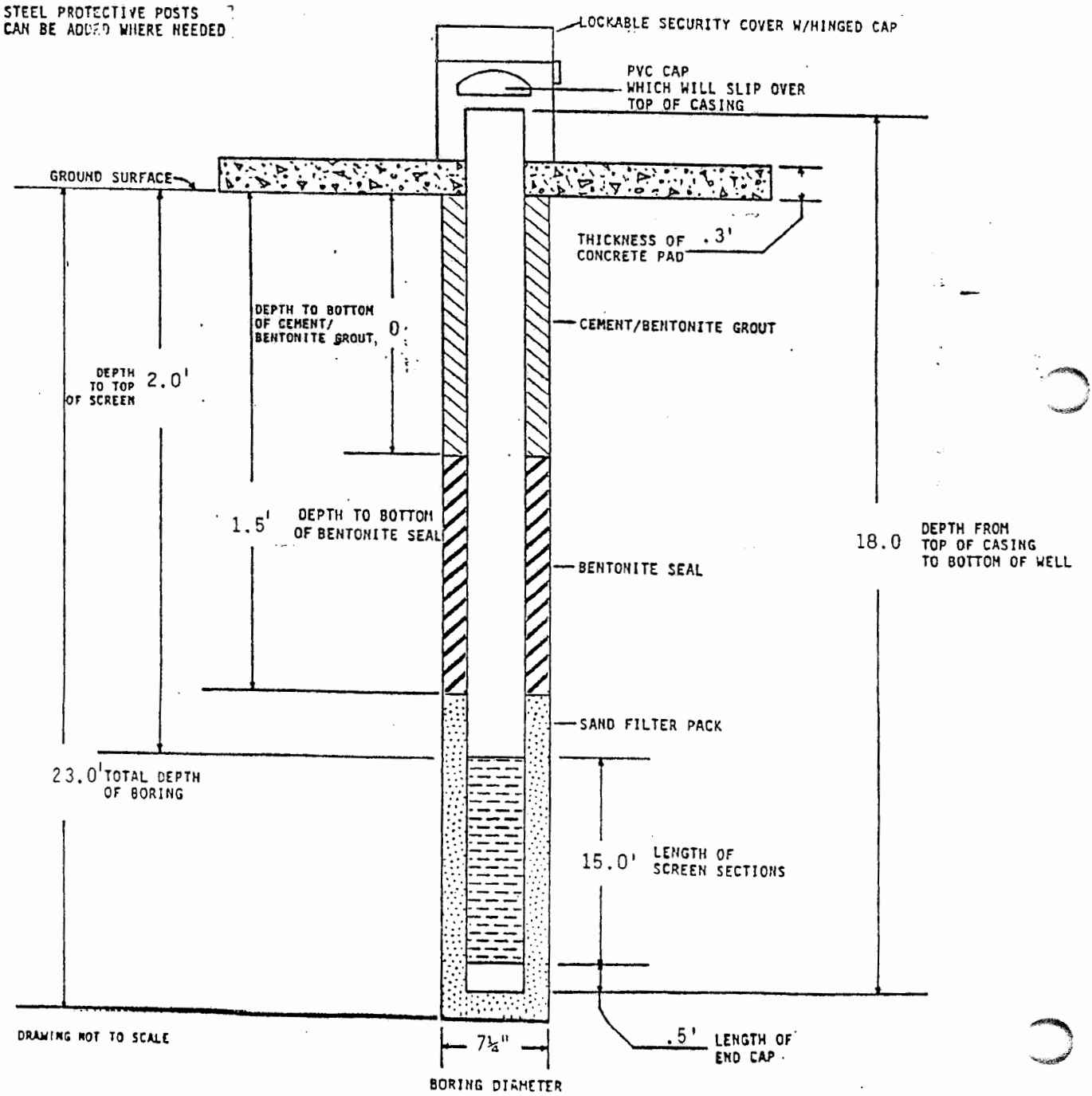
DEPTH FT.	SAMPLE TYPE & INTERVAL	MOISTURE	SOIL DESCRIPTION & VISUAL CLASSIFICATION	SPT	* PID (ppm)	HAND PENETROMETER (tsf)	OTHER
	SS	M	Red-brown silty SAND (SM)	4-5-8	0.6		Nonplastic
							Mc = 19%
	SS	M/W	Light gray SAND w/gypsum crystals (SP)	2-3-8	11.0		
5							
	SS	W		5-4-4	30.0		
			Red-brown, tan mottled sandy silty CLAY w/gypsum crystals (CL)				
	SS	W		8-13-18	3.7		
10							
	SS	M/W		8-25-34	3.0		LL=32, PI=14
							Mc=25
15							
	SS	W	Brown SAND w/ Trace Silt (SP)	20-75-5/¾"	1.0		
20							
			Total Depth of Boring = 23.0 feet				
25			LL=Liquid Limit				
			PI=Plasticity Index				
			Mc= Moisture Content				

SOIL SAMPLE KEY
SS - SPLIT SPOON
ST - SHELBY TUBE
PB - PITCHER BARREL
RC - ROCK CORE
TC - TRIO CORE

MOISTURE KEY
D - DRY (VERY LITTLE MOISTURE)
M - MOIST (SOME MOISTURE)
W - WET (SATURATED)

PROJECT Holloman Air Force Base MONITOR WELL I.D. NO. H-STE-51-MW1

Monitor Well Data Sheet



DEVELOPMENT DATA

PROJECT: Holloman Air Force Base

PROJECT NO.: 342-65219 SITE NO.: 51 MONITOR WELL NO.: MW1

WELL DIA./MATERIAL: 2" PVC FLUSH MOUNT: ____ ABOVE GRADE: X

TOP OF CASING TO BOTTOM OF WELL: 18.0' FT.

WATER LEVEL BEFORE DEVELOPMENT: 5.9 FT. DATE 4/10/88 TIME 8:40

WATER LEVEL AFTER DEVELOPMENT: 7.8 FT. DATE 4/10/88 TIME 12:55

DATE DEVELOPED: 4/10/88 TIME INTERVAL: 4 hrs.

VALUES OF PARAMETERS AFTER CONSTANT LEVEL OBTAINED:

pH: 8.43 TEMPERATURE: 26.2 °C

CONDUCTIVITY: 3.36 m/cm Ω TURBIDITY: 14.0 NTU

VOLUME OF WATER REMOVED DURING DEVELOPMENT: 215 GAL.

APPROXIMATE RATE OF WATER REMOVAL: 54 GAL/HR

EQUIPMENT USED DURING DEVELOPMENT:

SURGE BLOCK X PVC HAND PUMP ____ PVC BAILER ____

STAINLESS BAILER ____ RIG PUMP X AIR LIFT ____

SUBMERSIBLE PUMP ____ OTHER: ____

PHOTO OF WATER? YES X NO ____

RISING HEAD TEST DATA **

DEPTH TO WATER AFTER DRAWDOWN: ____ FT. TIME: ____

DEPTH TO WATER DURING RECOVERY: ____ FT. TIME: ____

DEPTH TO WATER DURING RECOVERY: ____ FT. TIME: ____

EQUIPMENT USED TO PERFORM TEST: ____

PERSONNEL: Monroe/Flair/Heitman

Well passed plumbness test with 1 7/8" OD pipe 4/10/88

* ALL WATER LEVEL MEASUREMENTS FROM TOP OF CASING

** REFER TO IN-SITU PERMEABILTY REPORT.

PROFESSIONAL SERVICE INDUSTRIES, INC.

BORING NO. S51-MW2 PROJECT NO. 342-65219H PROJECT NAME Holloman Air Force Base

DATE/TIME START 3/22/88 10:00 DATE/TIME END 3/22/88 12:15 DRILL CREW Mitchell,* Caho, Flair
*Engineer

DRILLING METHOD: AUGER 0 FT TO 23 FT, ROTARY - FT TO - FT DRILL RIG CME 55

AUGER/BIT SIZE(S) & INTERVAL(S) 3¼ I.D./All SURFACE COVER Gravel

TOC ELEV. 4070.79 BORING COORDINATES N 670280 E 551021 WATER DURING DRILLING 4.5'

WATER AT COMPLETION 4.5' DELAYED WATER LEVEL Monitor well installed in boring

DATE GROUTED N/A MATERIAL(S) & QUANTITY N/A

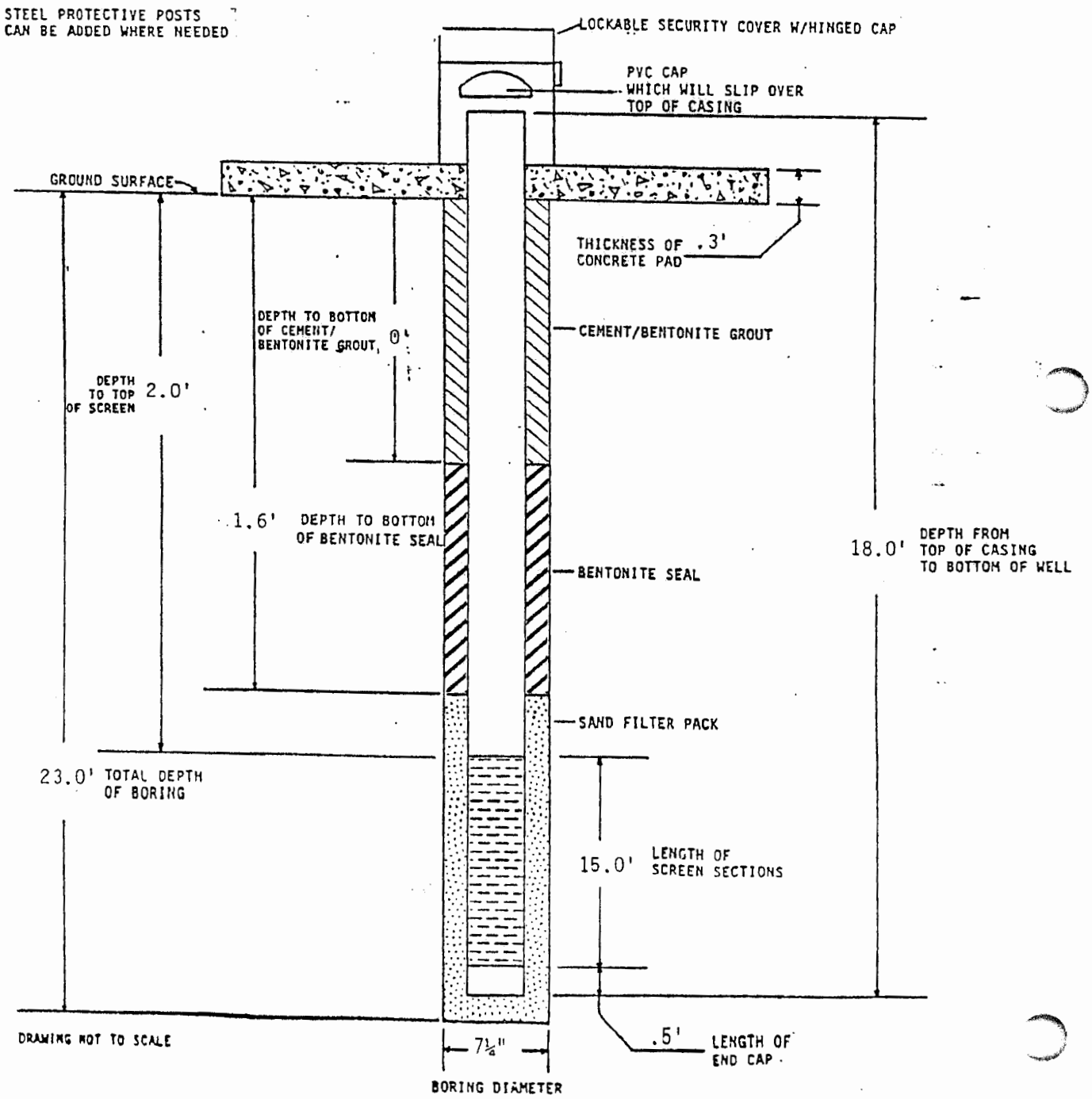
DEPTH FT.	SAMPLE TYPE & INTERVAL	MOISTURE	SOIL DESCRIPTION & VISUAL CLASSIFICATION	SPT	PID (ppm)	HAND PENETROMETER (tsf)	OTHER
	SS	M	Brown SAND w/gravel & clay seams & Trace silt (SM-SP)	10-13-8	3.0*		
							LL=27, PI=6
	SS	M/W		2-3-8	17.0		Mc=20
5							
	SS	W		2-2-1	24.0		
				11-26-34	17.0		
	SS	M/W	Red-brown sandy silty CLAY w/ gypsum crystals (CL)				
10							
	SS	W	Light tan SAND w/gypsum crystals (SP)	9-16-24	20.0		
15							
	SS	M/W	Red-brown silty CLAY w/gypsum crystal seams (CH)	10-21-30	4.2		LL=51, PI=26 Mc=27
20							
			Total Depth of Boring = 23.0 feet				
25							

SOIL SAMPLE KEY
SS - SPLIT SPOON
ST - SHELBY TUBE
PB - PITCHER BARREL
RC - ROCK CORE
TC - TWO CONE

MOISTURE KEY
D - DRY (VERY LITTLE MOISTURE)
M - MOIST (SOME MOISTURE)
W - WET (SATURATED)

PROJECT Holloman Air Force Base MONITOR WELL I.D. NO. H-STE-51-MW2

Monitor Well Data Sheet



DEVELOPMENT DATA

PROJECT: Holloman Air Force Base

PROJECT NO.: 342-65219 SITE NO.: 51 MONITOR WELL NO.: MW2

WELL DIA./MATERIAL: 2"PVC FLUSH MOUNT: ____ ABOVE GRADE: X

TOP OF CASING TO BOTTOM OF WELL: 18.0 FT.

WATER LEVEL BEFORE DEVELOPMENT: 5.9 FT. DATE 4/4/88 TIME 3:10

WATER LEVEL AFTER DEVELOPMENT: 8.6 FT. DATE 4/5/88 TIME 6:00

DATE DEVELOPED: 4/4/88 TIME INTERVAL: 4 hrs.

VALUES OF PARAMETERS AFTER CONSTANT LEVEL OBTAINED:

pH: 7.62 TEMPERATURE: 21.2 °C

CONDUCTIVITY: 5.55 m/cm Ω TURBIDITY: 42 NTU

VOLUME OF WATER REMOVED DURING DEVELOPMENT: 189 GAL.

APPROXIMATE RATE OF WATER REMOVAL: 47 GAL/HR

EQUIPMENT USED DURING DEVELOPMENT:

SURGE BLOCK X PVC HAND PUMP ____ PVC BAILER ____

STAINLESS BAILER ____ RIG PUMP X AIR LIFT ____

SUBMERSIBLE PUMP ____ OTHER: 1/2 hp centrifugal pump (4/5/88)

PHOTO OF WATER? YES X NO ____

RISING HEAD TEST DATA **

DEPTH TO WATER AFTER DRAWDOWN: ____ FT. TIME: ____

DEPTH TO WATER DURING RECOVERY: ____ FT. TIME: ____

DEPTH TO WATER DURING RECOVERY: ____ FT. TIME: ____

EQUIPMENT USED TO PERFORM TEST: ____

PERSONNEL: Monroe/Flair/Heitman

Well passed plumbness test using 1 7/8" OD pipe 4/4/88

* ALL WATER LEVEL MEASUREMENTS FROM TOP OF CASING

** REFER TO IN-SITU PERMEABILITY REPORT.

PROFESSIONAL SERVICE INDUSTRIES, INC.

BORING NO. S51-MW3 PROJECT NO. 342-65219H PROJECT NAME Holloman Air Force Base

DATE/TIME START 3/24/88 7:45 DATE/TIME END 3/24/88 9:00 DRILL CREW Mitchell*, Caho, Flair (* Engineer)

DRILLING METHOD: AUGER 0 FT TO 23 FT, ROTARY - FT TO - FT DRILL RIG CME 55

AUGER/BIT SIZE(S) & INTERVAL(S) 3¼ I.D./All SURFACE COVER Gravel

TOC ELEV. 4071.03 BORING COORDINATES N 670484 E 551242 WATER DURING DRILLING 2.5'

WATER AT COMPLETION 2/5' DELAYED WATER LEVEL Monitor well installed in boring

DATE GROUTED N/A MATERIAL(S) & QUANTITY N/A

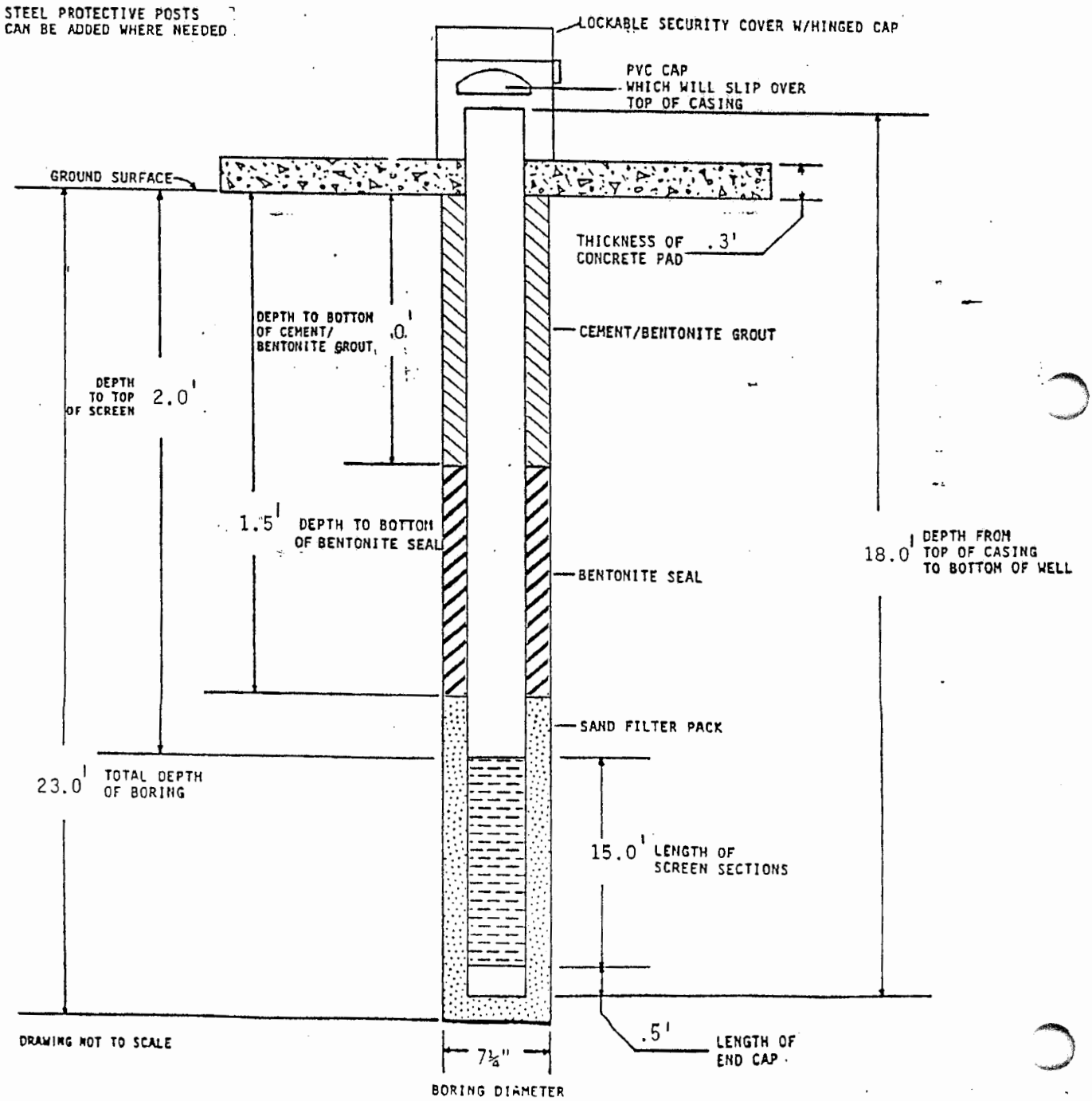
DEPTH FT.	SAMPLE TYPE & INTERVAL	MOISTURE	SOIL DESCRIPTION & VISUAL CLASSIFICATION	SPT	PID (ppm)	HAND PENETROMETER (tsf)	OTHER
	SS	M	Brown silty SAND w/gypsum crystals (SM-SP)	4-7-16	0.9		
	SS	W	Tan clayey sandy SILT (ML)	7-5-7	0.4		
5	SS	W		12-15-13	0.9		LL=37, PI=7 Mc=30
	SS	W	Red-brown silty SAND (SM)	6-14-16	3.0		
10	SS	M/W	Light tan SAND w/gypsum crystals (SP)	9-12-14	2.2		LL=30, PI=7 Mc=28
15	SS	M/W		10-12-40	2.8		
			Tan SAND w/gypsum crystals (SP)				
20							
			Total Depth of Boring = 23.0 feet				
25							

SOIL SAMPLE KEY
SS - SPLIT SPOON
ST - SHELBY TUBE
PS - PITCHER BARREL
RC - ROCK CORE
TC - TWO CORE

MOISTURE KEY
D - DRY (VERY LITTLE MOISTURE)
M - MOIST (SOME MOISTURE)
W - WET (SATURATED)

PROJECT Holloman Air Force Base MONITOR WELL I.D. NO. H-STE-51-MW3

Monitor Well Data Sheet



DEVELOPMENT DATA

PROJECT: Holloman Air Force Base

PROJECT NO.: 342-65219 SITE NO.: 51 MONITOR WELL NO.: MW3

WELL DIA./MATERIAL: 2" PVC FLUSH MOUNT: ____ ABOVE GRADE: X

TOP OF CASING TO BOTTOM OF WELL: 18.0 FT.

WATER LEVEL BEFORE DEVELOPMENT: 5.1 FT. DATE 4/4/88 TIME 2:55

WATER LEVEL AFTER DEVELOPMENT: 6.0 FT. DATE 4/5/88 TIME 6:30

DATE DEVELOPED: 4/4/88 TIME INTERVAL: 4 3/4 hrs

VALUES OF PARAMETERS AFTER CONSTANT LEVEL OBTAINED:

pH: 8.46 TEMPERATURE: 21.1 °C

CONDUCTIVITY: 1415 m/cmΩ TURBIDITY: 28 NTU

VOLUME OF WATER REMOVED DURING DEVELOPMENT: 636 GAL.

APPROXIMATE RATE OF WATER REMOVAL: 134 GAL/HR

EQUIPMENT USED DURING DEVELOPMENT:

SURGE BLOCK X PVC HAND PUMP ____ PVC BAILER ____

STAINLESS BAILER ____ RIG PUMP X AIR LIFT ____

SUBMERSIBLE PUMP ____ OTHER: 1/2 hp. centrifugal pump (4/4/88)

PHOTO OF WATER? YES ____ NO X

RISING HEAD TEST DATA **

DEPTH TO WATER AFTER DRAWDOWN: ____ FT. TIME: ____

DEPTH TO WATER DURING RECOVERY: ____ FT. TIME: ____

DEPTH TO WATER DURING RECOVERY: ____ FT. TIME: ____

EQUIPMENT USED TO PERFORM TEST: ____

PERSONNEL: Monroe/Flair/Heitman

Well passed plubness test using 1 7/8" OD pipe 4/4/88

* ALL WATER LEVEL MEASUREMENTS FROM TOP OF CASING

** REFER TO IN-SITU PERMEABILITY REPORT.

PROFESSIONAL SERVICE INDUSTRIES, INC.

BORING NO. S51-MW4 PROJECT NO. 342-65219H PROJECT NAME Holloman Air Force Base

DATE/TIME START 3/22/88 8:00 DATE/TIME END 3/22/88 8:45 DRILL CREW Mitchell*, Caho, Flair (*Engineer)

DRILLING METHOD: AUGER 0 FT TO 23 FT, ROTARY - FT TO - FT DRILL RIG CME 55

AUGER/BIT SIZE(S) & INTERVAL(S) 3¼ I.D./All SURFACE COVER Gravel

TOC ELEV. 4070.83 BORING COORDINATES N 670196 E 551088 WATER DURING DRILLING 2.5'

WATER AT COMPLETION 2.5' DELAYED WATER LEVEL Monitor well installed in boring

DATE GROUTED N/A MATERIAL(S) & QUANTITY N/A

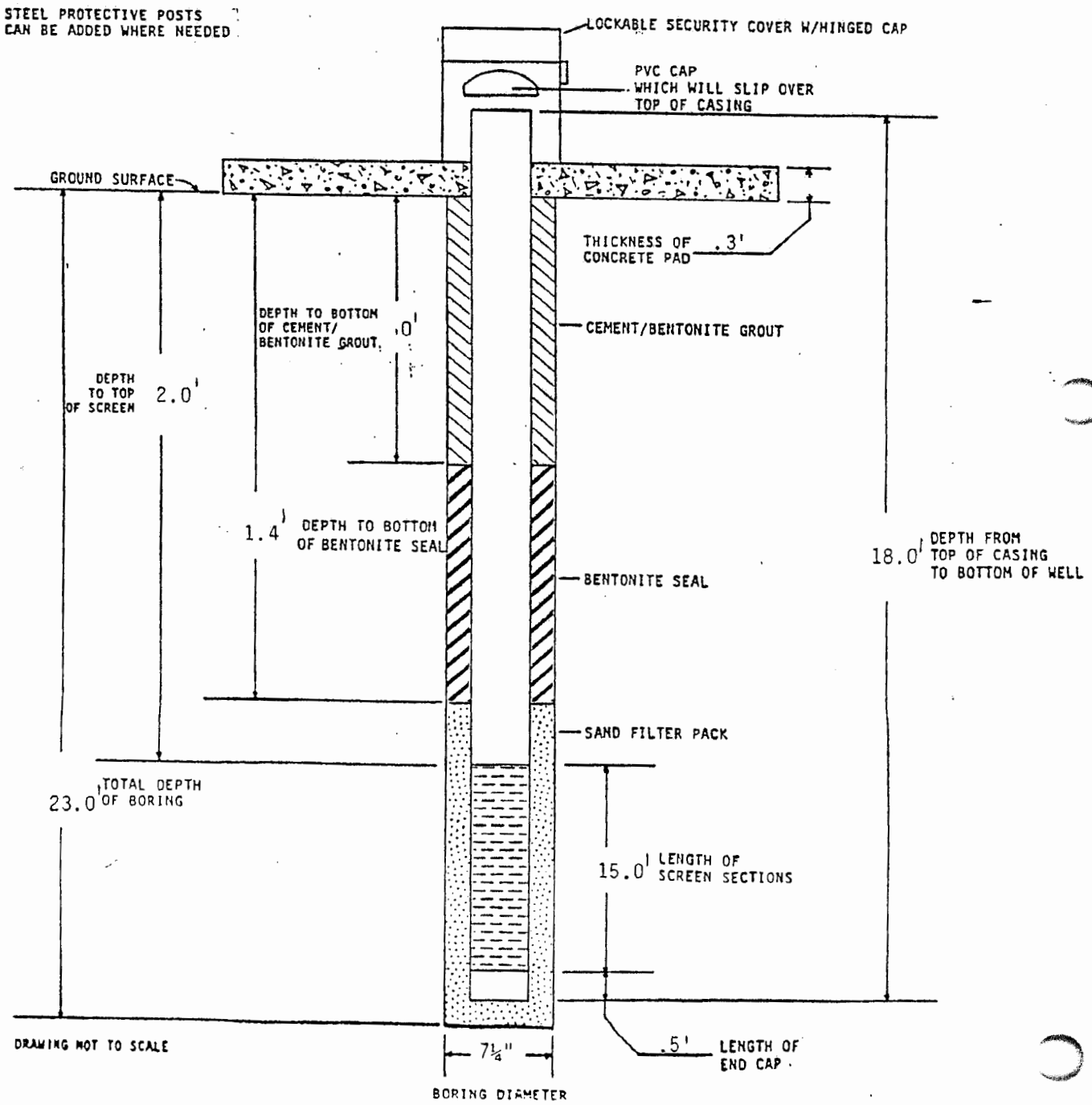
DEPTH FT.	SAMPLE TYPE & INTERVAL	MOISTURE	SOIL DESCRIPTION & VISUAL CLASSIFICATION	SPT	PID (ppm)	HAND PENETROMETER (tsf)	OTHER
	SS	M	Brown SAND (SM-SP)	3-4-11	0.5*		*Background=0
							LL=25,PI=3
	SS	W		5-4-4	0.4		Mc=20
5							
	SS	W		3-4-6	0.4		
	SS	W		7-13-19	0.4		
10			Red-brown sandy silty CLAY w/ gypsum crystals (CL)				
	SS	M		10-19-26	0.4		LL=29,PI=8
							Mc=18
15							
	SS	M	Brown, gray silty SAND w/gypsum crystals (SM)	11-29-34	0.4		
20							
			Total Depth of Boring = 23.0'				
25							

SOIL SAMPLE KEY
SS - SPLIT SPOON
ST - SHELBY TUBE
PB - PITCHER BARREL
RC - ROCK CORE
TZ - TWO CONE

MOISTURE KEY
D - DRY (VERY LITTLE MOISTURE)
M - MOIST (SOME MOISTURE)
W - WET (SATURATED)

PROJECT Holloman Air Force Base MONITOR WELL I.D. NO. H-STE-51-MW4

Monitor Well Data Sheet



DEVELOPMENT DATA

PROJECT: Holloman Air Force Base

PROJECT NO.: 342-65219 SITE NO.: 51 MONITOR WELL NO.: MW4

WELL DIA./MATERIAL: 2" PVC FLUSH MOUNT: ____ ABOVE GRADE: X

TOP OF CASING TO BOTTOM OF WELL: 18.0 FT.

WATER LEVEL BEFORE DEVELOPMENT: 6.1 FT. DATE 4/4/88 TIME 9:00

WATER LEVEL AFTER DEVELOPMENT: 6.7 FT. DATE 4/4/88 TIME 2:05

DATE DEVELOPED: 4/4/88 TIME INTERVAL: 4 hrs.

VALUES OF PARAMETERS AFTER CONSTANT LEVEL OBTAINED:

pH: 7.88 TEMPERATURE: 23.4 °C

CONDUCTIVITY: < 20 m/cm ℧ TURBIDITY: 9.0 NTU

VOLUME OF WATER REMOVED DURING DEVELOPMENT: 527 GAL.

APPROXIMATE RATE OF WATER REMOVAL: 126 GAL/HR

EQUIPMENT USED DURING DEVELOPMENT:

SURGE BLOCK X PVC HAND PUMP ____ PVC BAILER ____

STAINLESS BAILER ____ RIG PUMP X AIR LIFT ____

SUBMERSIBLE PUMP ____ OTHER: ____

PHOTO OF WATER? YES X NO ____

RISING HEAD TEST DATA **

DEPTH TO WATER AFTER DRAWDOWN: ____ FT. TIME: ____

DEPTH TO WATER DURING RECOVERY: ____ FT. TIME: ____

DEPTH TO WATER DURING RECOVERY: ____ FT. TIME: ____

EQUIPMENT USED TO PERFORM TEST: ____

PERSONNEL: Monroe/Flair/Heitman

Well passed plumbness test using 1 7/8" OD pipe 4/4/88

* ALL WATER LEVEL MEASUREMENTS FROM TOP OF CASING

** REFER TO IN-SITU PERMEABILITY REPORT.

PROFESSIONAL SERVICE INDUSTRIES, INC.

BORING NO. S51-MW5 PROJECT NO. 342-65219H PROJECT NAME Holloman Air Force Base

DATE/TIME START 3/22/88 1:00 DATE/TIME END 3/22/88 2:30 DRILL CREW Mitchell*, Caho, Flair
* Engineer

DRILLING METHOD: AUGER 0 FT TO 23 FT, ROTARY - FT TO - FT DRILL RIG CME 55

AUGER/BIT SIZE(S) & INTERVAL(S) 3¼ I.D./All SURFACE COVER Gravel

TOC ELEV. 4070.19 BORING COORDINATES N 670265 E 551165 WATER DURING DRILLING 2.5'

WATER AT COMPLETION 3.0' DELAYED WATER LEVEL Monitor well installed in boring

DATE GROUTED N/A MATERIAL(S) & QUANTITY N/A

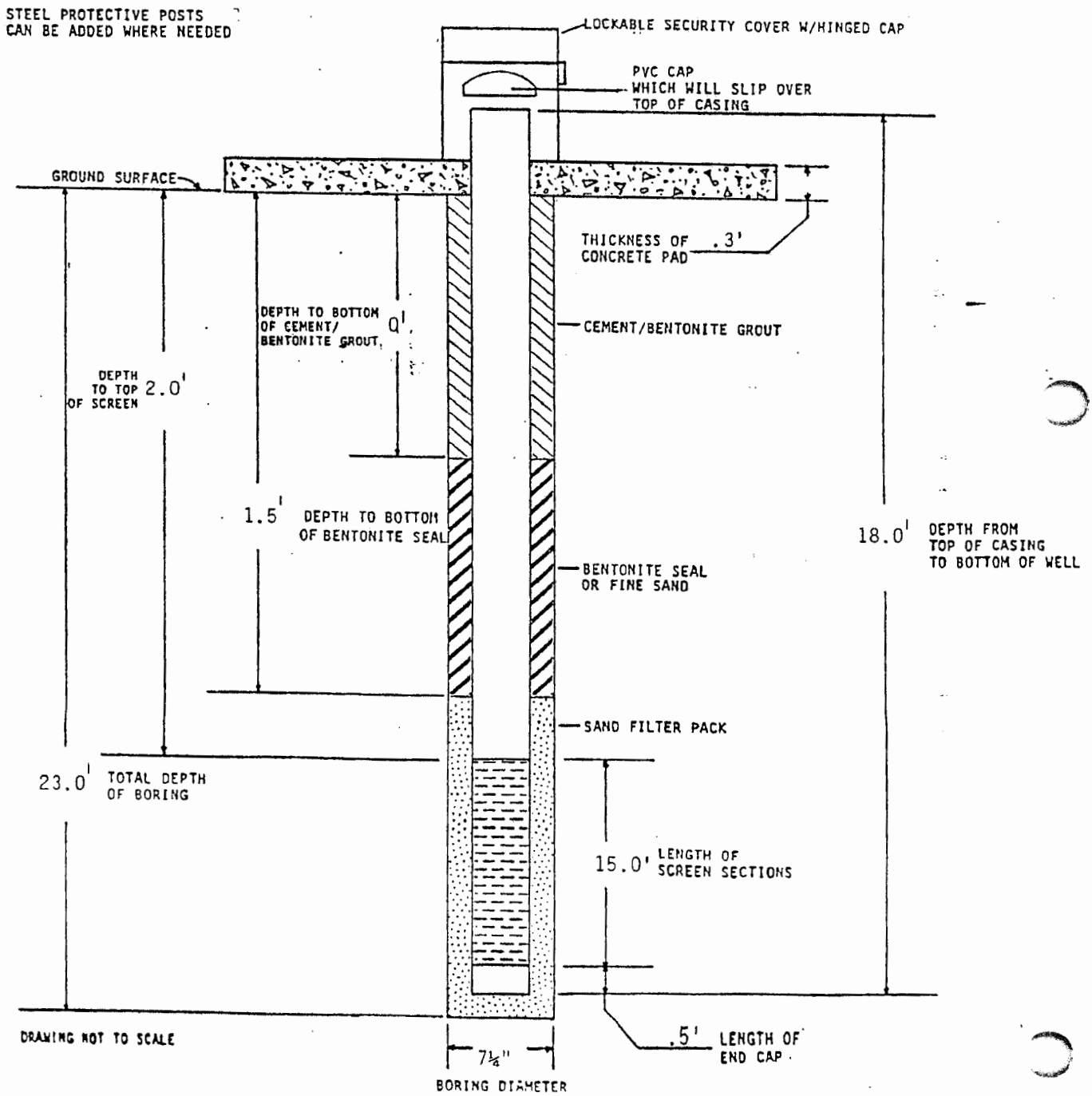
DEPTH FT.	SAMPLE TYPE & INTERVAL	MOISTURE	SOIL DESCRIPTION & VISUAL CLASSIFICATION	SPT	PID (ppm)	HAND PENETROMETER (tsf)	OTHER
	SS	M	Brown silty clayey SAND (SC)	11-6-2	4.0*		*Background=0.0
							LL=26, PI=12
							Mc=12
	SS	W	Light tan SAND (SP)	3-3-3	1.6		
5							
	SS	W	Brown SAND (SP)	2-2-3	0.8		
	SS	M/W	Tan sandy SILT w/ gypsum crystals (SM-SP)	8-11-20	0.4		
10							
	SS	M/W		8-15-18	0.3		
15							
	SS	M/W	Brown, gray SAND (SM-SP)	17-36-46	3.8		Nonplastic
							Mc=23
20							
			Total Depth of Boring = 23.0 feet				
25							

SOIL SAMPLE KEY
SS - SPLIT SPOON
ST - SHELBY TUBE
PB - PITCHER BARREL
RC - ROCK CORE
TC - TWO CONE

MOISTURE KEY
D - DRY (VERY LITTLE MOISTURE)
M - MOIST (SOME MOISTURE)
W - WET (SATURATED)

PROJECT Holloman Air Force Base MONITOR WELL I.D. NO. H-STE-51-MW5

Monitor Well Data Sheet



PROFESSIONAL SERVICE INDUSTRIES, INC.

BORING NO. S51-B6 PROJECT NO. 342-65219H PROJECT NAME Holloman Air Force Base

DATE/TIME START 3/27/88 11:00 DATE/TIME END 3/27/88 12:00 DRILL CREW Mitchell, Caho, Flair

DRILLING METHOD: AUGER 0 FT TO 11.5 FT, ROTARY - FT TO - FT DRILL RIG CME 55

AUGER/BIT SIZE(S) & INTERVAL(S) 3¼ I.D./All SURFACE COVER Gravel

G.S. ELEV. - BORING COORDINATES - WATER DURING DRILLING 4.5'

WATER AT COMPLETION 4.5' DELAYED WATER LEVEL Dry prior to grouting

DATE GROUTED 3/28/88 MATERIAL(S) & QUANTITY 1 bag sacrete

DEPTH FT.	SAMPLE TYPE & INTERVAL	MOISTURE	SOIL DESCRIPTION & VISUAL CLASSIFICATION	SPT	PID (ppm)	HAND PENETROMETER (tsf)	OTHER
	SS	M	Light tan sandy SILT w/gypsum crystals (ML)	7-10-14	3.4		
	SS	M/W	Red-brown silty SAND (SM)	2-WH-WH	0.8	-	
5	SS	W	Gray silty SAND (SM)	WH-1-5	5.7		
	SS	M	Red-brown sandy SILT w/gypsum crystals (ML)	8-21-40	6.5		
10	SS	M/W	Light tan clayey sandy SILT w/ gypsum crystals & iron stains (ML)	8-17-26	3.8		
			Total Depth of Boring = 11.5 feet				
15							
20							
25							

SOIL SAMPLE KEY
SS - SPLIT SPOON
ST - SHELBY TUBE
PB - PITCHER BARREL
RC - ROCK CORE
TC - TRIO CONE

MOISTURE KEY
D - DRY (VERY LITTLE MOISTURE)
M - MOIST (SOME MOISTURE)
W - WET (SATURATED)

PROFESSIONAL SERVICE INDUSTRIES, INC.

BORING NO. S-51-MW7 PROJECT NO. 342-65219H PROJECT NAME Holloman Air Force Base

DATE/TIME START 1/22/89 7:30 DATE/TIME END 1/22/89 10:00 DRILL CREW Flair, Monroe*, Arthur *Geologist

DRILLING METHOD: AUGER 0 FT TO 21.5 FT, ROTARY - FT TO - FT DRILL RIG CME55

AUGER/BIT SIZE(S) & INTERVAL(S) 3¼" I.D./ ALL SURFACE COVER Asphalt

T.O.C ELEV. 4069.87 BORING COORDINATES N 670286 E 550961 WATER DURING DRILLING 5'

WATER AT COMPLETION 6' DELAYED WATER LEVEL Water @ 5.0' below TOC 1/29/89 @ 11:15 am Monitor Well Installed in Boring

DATE GROUTED N/A MATERIAL(S) & QUANTITY See Monitor Well Materials List

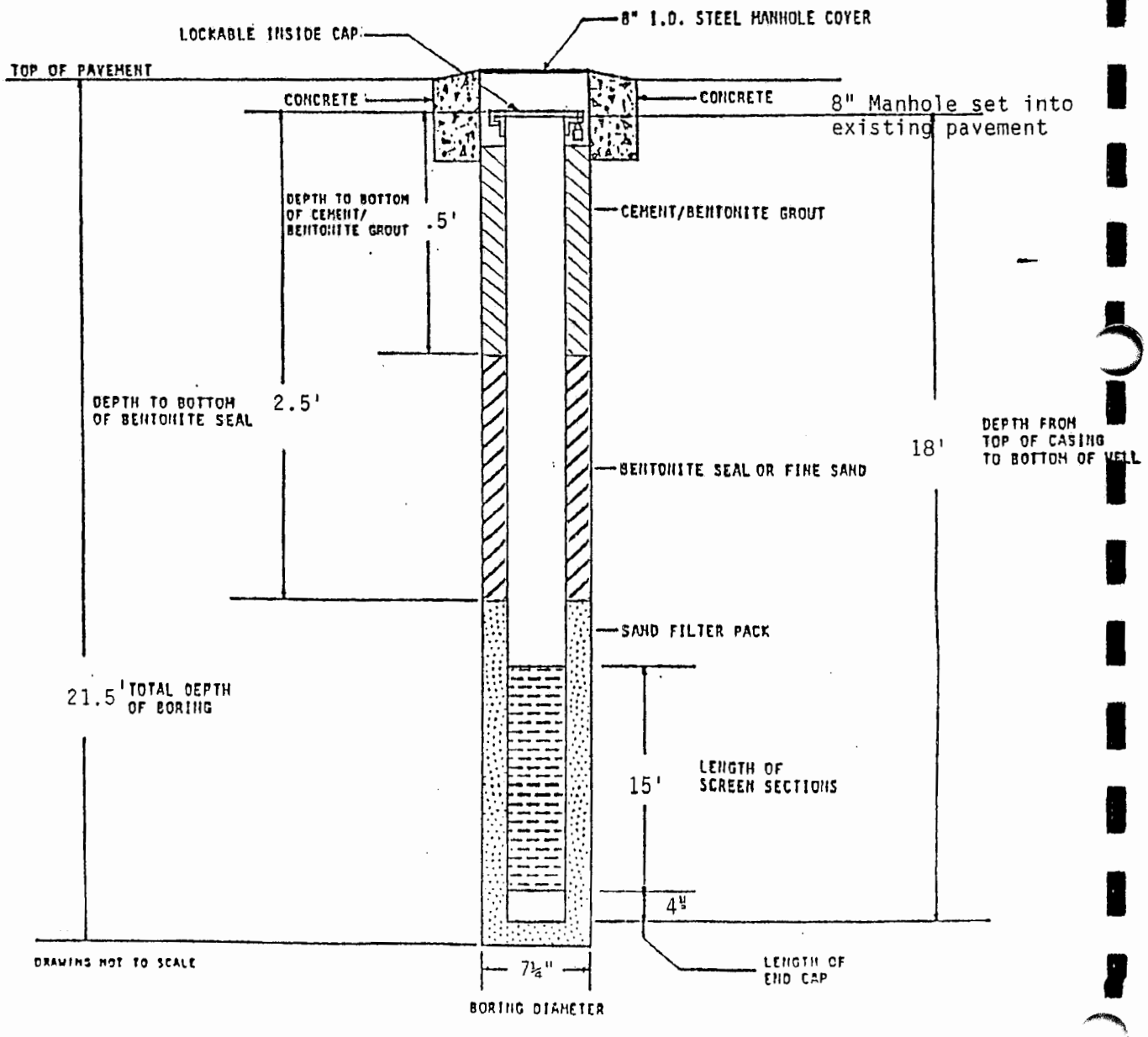
DEPTH FT.	SAMPLE TYPE & INTERVAL	MOISTURE	SOIL DESCRIPTION & VISUAL CLASSIFICATION	SPT	PID (ppm)	HAND PENETROMETER (tsf)	OTHER
	SS	M	Brown sandy GRAVEL (GP)		-		
			Brown clayey silty SAND (SM)	17/17/15			LL=31 PI=3
							Mc=10%
	SS	M/W	Brown sandy silty CLAY (CL)	5/7/17	1		
5			Brown silty sandy CLAY w/gypsum deposits (CL)				
	SS	W		4/5/9	1		Mc=29%
	SS	M		9/15/22	-		LL=40 PI=8
10							Mc=12%
	SS	M	Brown and gray sandy CLAY w/gypsum deposits (CL)	7/14/28	1.0		Mc=16%
15							
	SS	W	Brown silty SAND (SM)	14/29/30	-		Non plastic
							Mc=10%
20							
	SS	M	Brown sandy silty CLAY w/gypsum(CL)	21/44/35=4'	-		Mc=12%
			Boring terminated at 21.5 feet				
25							

SOIL SAMPLE KEY
- SPLIT SPOON
T - SHELBY TUBE
PB - PITCHER BARREL
RC - ROCK CORE
TC - THIN CORE

MOISTURE KEY
D - DRY (VERY LITTLE MOISTURE)
M - MOIST (SOME MOISTURE)
W - WET (SATURATED)

PROJECT Holloman Air Force Base MONITOR WELL I.D. NO. H-51-MW7

Monitor Well Data Sheet



DEVELOPMENT DATA

PROJECT: Holloman Air Force Base

PROJECT NO.: 342-65219H SITE NO.: H-51 MONITOR WELL NO.: MW7

WELL DIA./MATERIAL: 2" PVC FLUSH MOUNT: X ABOVE GRADE: ____

TOP OF CASING TO BOTTOM OF WELL: 18 ? FT.

WATER LEVEL BEFORE DEVELOPMENT: 5 FT. DATE 1/29/89 TIME 11:15

WATER LEVEL AFTER DEVELOPMENT: 12 FT. DATE 1/29/89 TIME 3:50

DATE DEVELOPED: 1/29/89 TIME INTERVAL: 4¼

VALUES OF PARAMETERS AFTER CONSTANT LEVEL OBTAINED:

pH: 7.50 TEMPERATURE: 25.7 °C

CONDUCTIVITY: 3200 m/cm Ω TURBIDITY: 28 NTU

VOLUME OF WATER REMOVED DURING DEVELOPMENT: 46 GAL.

APPROXIMATE RATE OF WATER REMOVAL: .18 GAL/MIN.

EQUIPMENT USED DURING DEVELOPMENT:

SURGE BLOCK X PVC HAND PUMP ____ PVC BAILER ____

STAINLESS BAILER ____ RIG PUMP ____ AIR LIFT ____

SUBMERSIBLE PUMP ____ OTHER: Gould Centrifugal Pump

PHOTO OF WATER? YES X NO ____

RISING HEAD TEST DATA

DEPTH TO WATER AFTER DRAWDOWN: * FT. TIME: *

DEPTH TO WATER DURING RECOVERY: * FT. TIME: *

DEPTH TO WATER DURING RECOVERY: * FT. TIME: *

EQUIPMENT USED TO PERFORM TEST: Environmental Data Logger (Hermit)

PERSONNEL: Flair/Monroe/Arthur

* Data obtained using Environmental Data Logger; results provided in Insitu Permeability Report.

ALL WATER LEVEL MEASUREMENTS FROM TOP OF CASING

** Conductivity measured on 25% solution by volume.

PROFESSIONAL SERVICE INDUSTRIES, INC.

BORING NO. S-51-MW8 PROJECT NO. 342-65219H PROJECT NAME Holloman Air Force Base

DATE/TIME START 1/20/89 1:15 DATE/TIME END 1/20/89 2:30 DRILL CREW Flair, Monroe*, Arthur *Geologist

DRILLING METHOD: AUGER 0 FT TO 21.5 FT, ROTARY - FT TO - FT DRILL RIG CME55

AUGER/BIT SIZE(S) & INTERVAL(S) 3¼" I.D./ ALL SURFACE COVER Gravel

T.O.C. ELEV. 4070.69 BORING COORDINATES N 670317 E 551069 WATER DURING DRILLING 5'

WATER AT COMPLETION 6' DELAYED WATER LEVEL Water @ 5.5' below TOC on 1/29/89 @ 12:55 am Monitor Well Installed in Boring

DATE GROUTED N/A MATERIAL(S) & QUANTITY See Monitor Well Materials List

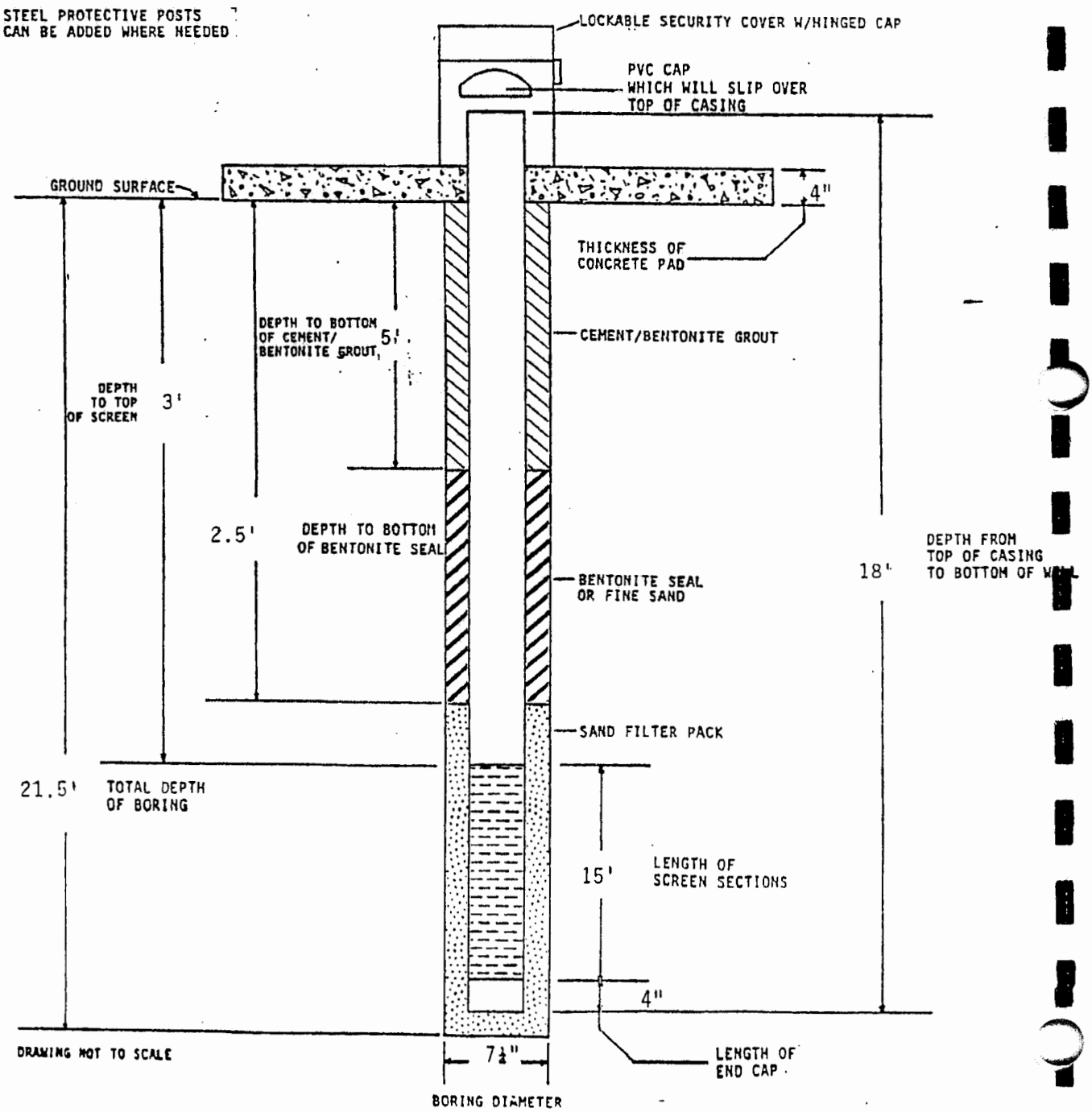
DEPTH FT.	SAMPLE TYPE & INTERVAL	MOISTURE	SOIL DESCRIPTION & VISUAL CLASSIFICATION	SPT	PID (ppm)	HAND PENETROMETER (tsf)	OTHER
	SS	M	Brown silty sandy GRAVEL (GM)	8/31/14	3.5		
			Brown clayey silty SAND (SM)				
	SS	M	Gray silty clayey SAND (SC)	9/21/14	150		
5	SS	W/M		12/31/38	175		50 ppm from bore hole
			Tan silty clayey SAND (SC)				
	SS	M	Brown sandy CLAY w/gypsum deposits (CL)	13/36/29	–		
10	SS	M		8/17/27	–		
15	SS	M	Gray sandy CLAY w/gypsum deposits (CL)	14/21/27	-		
20	SS	M	Tan sandy CLAY w/gypsum deposits (CL)	50/50=3"	-		
			Boring terminated at 21.5 feet				
25							

SOIL SAMPLE KEY
- SPLIT SPOON
T - SHELBY TUBE
PB - PITCHER BARREL
RC - ROCK CORE

MOISTURE KEY
D - DRY (VERY LITTLE MOISTURE)
M - MOIST (SOME MOISTURE)
W - WET (SATURATED)

PROJECT Holloman Air Force Base MONITOR WELL I.D. NO. 51-MW8

Monitor Well Data Sheet



MONITOR WELL MATERIAL LIST

PROJECT: Holloman Air Force Base DATE: 1/22/89

PROJECT NO.: 342-65219H SITE NO.: H-51 MONITOR WELL NO.: MW8

MONITOR WELL DIA.: 2 (in) SCREEN OPENING: .010 (in)

SCREEN: SLOTTED X WIRE WOUND ____

BRAND OF PIPE & SCREEN: Monoflex

STARTING AT WELL BOTTOM AND GOING UP

END PLUG LENGTH	4"	PVC X	STAINLESS ____
SCREEN LENGTH	10'	PVC X	STAINLESS ____
SCREEN LENGTH	5'	PVC X	STAINLESS ____
SCREEN LENGTH	____	PVC ____	STAINLESS ____
RISER LENGTH	5'	PVC X	STAINLESS ____
RISER LENGTH	____	PVC ____	STAINLESS ____
RISER LENGTH	____	PVC ____	STAINLESS ____
RISER LENGTH	____	PVC ____	STAINLESS ____
RISER LENGTH	____	PVC ____	STAINLESS ____
CAP: SLIP X THREADED ____		PVC X	STAINLESS ____

DOES WELL CAP LOCK? YES X NO ____

COVER: FLUSH MOUNT ____ ABOVE GRADE X

PADLOCK NO. 2004

SACKS SAND 4 PAILS BENTONITE 1

SACKS CEMENT 1 SACKS BENTONITE 1/4

SACKS VOLCLAY N/A SACKS SACRETE 5

CONCRETE PAD SIZE 3 feet x 3 feet x 4 inches

NO. CENTRALIZERS 1 LOCATION 8 feet from bottom of screen

OTHER Installed 3 protective posts

DEVELOPMENT DATA

PROJECT: Holloman Air Force Base

PROJECT NO.: 342-65219H SITE NO.: H-51 MONITOR WELL NO.: MW-8

WELL DIA./MATERIAL: 2"/PVC FLUSH MOUNT: ____ ABOVE GRADE: X

TOP OF CASING TO BOTTOM OF WELL: 18 FT.

WATER LEVEL BEFORE DEVELOPMENT: 5.5 FT. DATE 1/29/89 TIME 12:55

WATER LEVEL AFTER DEVELOPMENT: 10 FT. DATE 1/29/89 TIME 5:05

DATE DEVELOPED: 1/29/89 TIME INTERVAL: 4 hours

VALUES OF PARAMETERS AFTER CONSTANT LEVEL OBTAINED:

pH: 7.23 TEMPERATURE: 24.6 °C

CONDUCTIVITY: 8860 NAT m/cm Ω TURBIDITY: 100+ NTU

VOLUME OF WATER REMOVED DURING DEVELOPMENT: 60 GAL.

APPROXIMATE RATE OF WATER REMOVAL: 0.25 GAL/MIN.

EQUIPMENT USED DURING DEVELOPMENT:

SURGE BLOCK ____ PVC HAND PUMP ____ PVC BAILER ____

STAINLESS BAILER ____ RIG PUMP ____ AIR LIFT ____

SUBMERSIBLE PUMP ____ OTHER: Homelite Centrifugal Pump

PHOTO OF WATER? YES X NO ____

RISING HEAD TEST DATA

DEPTH TO WATER AFTER DRAWDOWN: * FT. TIME: *

DEPTH TO WATER DURING RECOVERY: * FT. TIME: *

DEPTH TO WATER DURING RECOVERY: * FT. TIME: *

EQUIPMENT USED TO PERFORM TEST: Environmental Data Logger (Hermit)

PERSONNEL: Flair/Monroe/Arthur

*Data obtained with Environmental Data Logger; results provided in In-Situ Permeability Report.

ALL WATER LEVEL MEASUREMENTS FROM TOP OF CASING

Appendix A-6-3

Portions of: *Closing Report, Holloman Air Force Base, Alamagordo, New Mexico,* IT Corporation, 1991

HOLLOMAN AIR FORCE BASE
ALAMAGORDO, NEW MEXICO
CLOSING REPORT

CONTRACT NUMBER

DACW45-90-D9002
CONTROL NO. ENGER910020025

PREPARED BY:

IT CORPORATION
336 WEST ANAHEIM STREET
WILMINGTON, CALIFORNIA 90744

6.0 PRELIMINARY SITE INVESTIGATION

6.1 Site 51

A backhoe was dispatched to Site 51 on September 26, 1991, to excavate a 6 foot by 6 foot hole, 15 feet deep, southeast of an existing monitoring well (see Figure 3). Samples were taken and sent to the **IT** Laboratory in Cerritos, California for testing (see Appendix E).

6.2 Holding Cell Construction

IT's project management discussed phase safety plans and tailgate safety procedures. On September 27, 1991, **IT** started the construction of a holding cell to contain the highly contaminated soil to be generated from the various locations, as outlined in the work plan.

7.0 SITE 51

7.1 Excavation

Excavation started at Site 51 after a tailgate safety meeting and phase safety plan review on September 28, 1991 (Figure 3). Approximately 400 cubic yards of soil was removed, and 2000 gallons of groundwater was pumped in the base clarifying system. During the proposal stages, the USACE had received permission from the base to pump all the liquids from the excavation into the base clarifier system. This was revoked September 28, 1991. During the excavation, the project Health and Safety Engineer recorded high readings using the HNU instrument which indicate hydrocarbon vapors. The excavation of this site was completed on approximately October 4, 1991. The Quality Control Daily Reports indicate 3,320 cubic yards of contaminated soil was removed and stockpiled. Approximately 10,000 gallons of waste water was removed and disposed of at local recyclers.

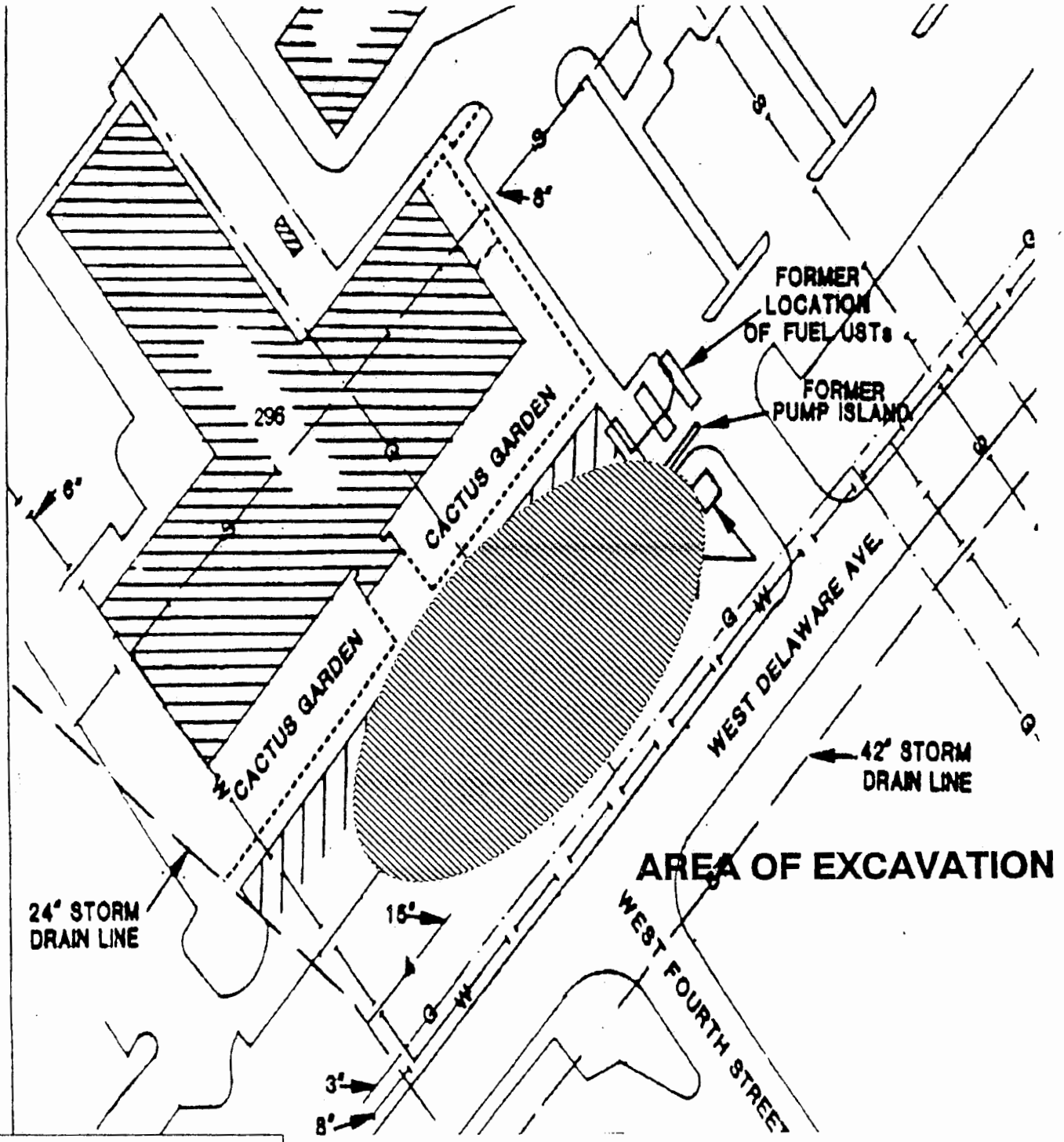
7.2 Backfill

The backfill of Site 45 began on October 10, 1992. The backfill soil was removed from the base spoil pit and transported to Site 45. The backfill of the site was complete on approximately October 16, 1991.

7.3 Landscape

The landscape of Site 45 began on October 10, 1991. Three trees were planted and decorative gravel replaced.

SITE 51



PREPARED BY:
DAVID ERB
NOT TO SCALE

IT CORPORATION

FIGURE #3

Appendix A-6-4

Portions of: *Technical Memorandum, Installation Restoration Program Sites SS-12, SD-27, and OT-45,* Foster Wheeler Environmental Corporation and Radian International, LLC, June 1996

DCN 96-670-008-16

TECHNICAL MEMORANDUM

INSTALLATION RESTORATION SITES SS-12, SD-27, AND OT-45

Prepared for:

49 CES/CEV
Holloman Air Force Base, NM

and

HQ ACC/CEVR
Langley Air Force Base, VA

Prepared by:

Foster Wheeler Environmental Corporation
143 Union Blvd., Suite 1010
Lakewood, Colorado 80203
303/988-2202

Radian International LLC
8501 North Mopac Blvd.
Austin, Texas 78720
512/454-4797

Under Contract No. DACW45-94-D-0003, DO No. 02, WAD 03 with:

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

June 1996

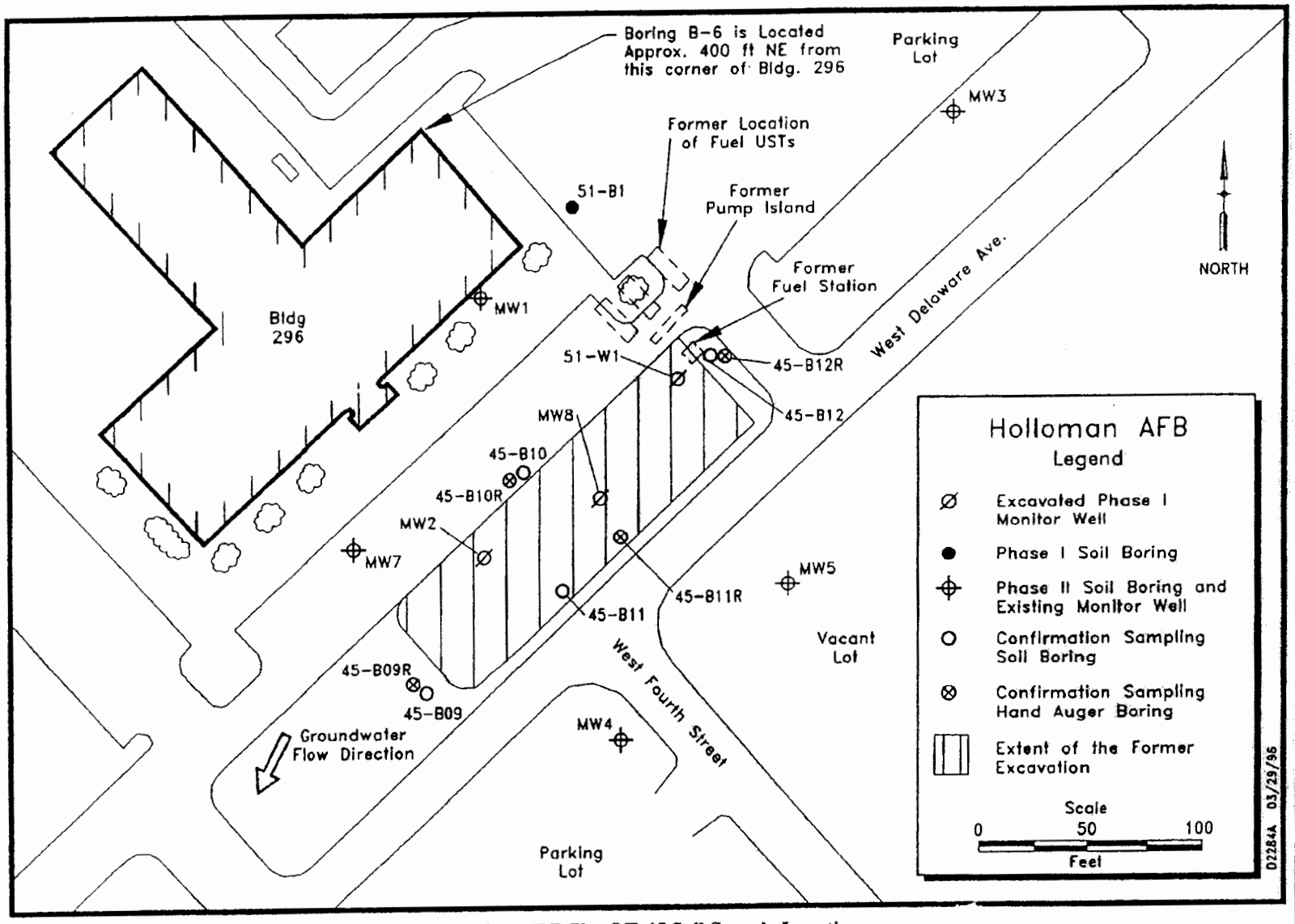


Figure 3-2. IRP Site OT-45 Soil Sample Locations

Table 3-1
Summary of Analytical Results for IRP Site OT-45

Location ID		45-B09	45-B09R	45-B09	45-B09R	45-B10	45-B10R	45-B10	45-B10R
Beginning Depth-End Depth (ft)		1-2.5	1-2.5	3-4.25	3-4.25	1-2.5	1-2.5	3-4.5	3-4.5
SW8015ME (mg/kg)	Diesel Range Organics	6.0 QR	1.1 QRJ (5.4)	ND	2.4 QRJ (5.7)	150 QR	270 QR (4.9)	310 QR	49 QR (5.1)
SW8015MP (mg/kg)	Gasoline Range Organics	1.2 QR	0.39 QJ (0.68)	0.84 QR	0.42 QJ (0.71)	1.5 QR	0.56 QJ (0.61)	750 QR	4.2 Q (0.64)
	Benzene	NA	ND (0.034)	NA	ND (0.035)	NA	ND (0.03)	NA	ND (0.032)
	Ethylbenzene	NA	ND (0.034)	NA	ND (0.035)	NA	0.025 J (0.03)	NA	0.029 J (0.032)
	Toluene	NA	ND (0.034)	NA	ND (0.035)	NA	0.00023 J (0.03)	NA	ND (0.032)
	Total xylenes	NA	ND (0.034)	NA	ND (0.035)	NA	ND (0.03)	NA	ND (0.032)

Location ID		45-B11	45-B11R	45-B11	45-B11R	45-B12	45-B12R	45-B12	45-B12R
Beginning Depth-End Depth (ft)		1-2.5	1-2.5	3-4.25	3-4.25	1-2.5	1-2.5	3-4.5	3-4.5
SW8015ME (mg/kg)	Diesel Range Organics	330 QR (18)	220 QR (4.6)	290 QR (21)	42 QR (4.8)	1200 R (59)	200 QR (5.4)	530 QR (57)	63 QR (5.8)
SW8015MP (mg/kg)	Gasoline Range Organics	1.1 Q (0.58)	0.34 QJ (0.58)	0.80 Q (0.67)	1.1 Q (0.6)	1900 Q (37)	170 M (3.4)	3400 Q (14)	250 M (3.6)
	Benzene	NA	ND (0.029)	NA	ND (0.03)	NA	ND (0.17)	NA	0.23 (0.18)
	Ethylbenzene	NA	ND (0.029)	NA	0.021 J (0.03)	NA	2.0 (0.17)	NA	7.2 (0.18)
	Toluene	NA	ND (0.029)	NA	ND (0.03)	NA	ND (0.17)	NA	ND (0.18)
	Total xylenes	NA	ND (0.029)	NA	ND (0.03)	NA	1.3 (0.17)	NA	3.3 (0.18)

( ) = Detection limit.
J = Estimated concentration; analyte measured below the detection limit.
M = This sample has GC/FID characteristics similar to weathered gasoline.
NA = Not analyzed.
ND = Not detected. No instrument response for analyte or result less than zero.
Q = This sample has GC/FID characteristics for which reliable identification of a product could not be achieved.
R = The diesel range organics are defined further in Table 3-2 of the *Sampling and Quality Control Summary Report (A-E SQCSR) Table 1 Phase II RFI* (Radian and FWEC, 1995).

DRILLING LOG

HOLE NO.	45-B09
1. COMPANY NAME	Radian Corporation
2. DRILLING SUBCONTRACTOR	Geo-Test, Inc.
SHEET 1 OF 1 SHEETS	
3. PROJECT	Holloman AFB Table I Phase II RFI
4. LOCATION	IRP Site 45
5. NAME OF DRILLER	Victor Maldonado
6. MANUFACTURERS DESIGNATION OF DRILL	CME - 55
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT	2" x 2" ID Stainless Steel Split Spoon; 7.25" OD Hollow Stem Auger
8. HOLE LOCATION	Easting=550993.24; Northing=670225.69
9. SURFACE ELEVATION	4071.73 ft. MSL
10. DATE STARTED	11-16-94
11. DATE COMPLETED	11-16-94
12. OVERBURDEN THICKNESS	NA
15. DEPTH GROUNDWATER ENCOUNTERED	4.5 ft
13. DEPTH DRILLED INTO ROCK	NA
18. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED	NA
14. TOTAL DEPTH OF HOLE	7 ft
17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY)	None
18. RISK ASSESSMENT SAMPLES	No
SAMPLE ID (S) / DEPTH	
19. TOTAL NUMBER OF CORE BOXES	NA
20. NUMBER OF SAMPLES FOR CHEMICAL ANALYSIS	2
SW8020	
SW8080	
SW8240	
SW8270	
SW8015ME	2
SW8015MP	2
Metals	
EPA 418.1	
SOP-428	
SOP-427	
21. TOTAL CORE REC.	NA
22. DISPOSITION OF HOLE	Vertical
BACKFILL	Grout
MONITORING WELL	
OTHER (SPECIFY)	
23. SIGNATURE OF INSPECTOR	Carolyn Cooper

ELEV. a	DEPTH b	GRAPHIC LOG c	DESCRIPTION OF MATERIALS d	SPLIT SPOON (ppm) e	HEAD-SPACE (ppm) f	BLOW CNTS g	% REC-OVERY h	ANALYTICAL SAMPLE NO. i
			SILT; Clayey, with trace gravel, very fine to fine-grained, brown (10YR4/3) and very pale brown (10YR8/3), wet, loose, with roots, backfill material, mottled appearance, (ML) (STCL).					
4069.8	2			0	0	3 7 6	80	94-45-B09-01R 930 01/31/95
			SAND; Silty, poorly graded, very fine-grained, pale yellow (2.5Y7/4), moist, medium density, with cemented layers and nodules, sparse ferrous staining; (SM) (SDSL).					
4067.8	4		water at 4.5 ft.	0	0	5 5 9	50	94-45-B09-02R 1000 01/31/95
			SAND; Silty, poorly graded, very fine-grained, pale yellow (2.5Y7/4), wet, medium density, with nodules, sparse ferrous staining, (SM) (SDSL).					
4065.8	6			0	0	8 15 22	60	
			Total Depth = 7 ft.					
4063.8	8							

PROJECT: Holloman AFB Table I Phase II RFI | HOLE NO.: 45-B09

DRILLING LOG

HOLE NO.	45-B10
SHEET 1 OF 1 SHEETS	
1. COMPANY NAME	Radian Corporation
2. DRILLING SUBCONTRACTOR	Geo-Test, Inc.
3. PROJECT	Holloman AFB Table I Phase II RFI
4. LOCATION	IRP Site 45
5. NAME OF DRILLER	Victor Maldonado
6. MANUFACTURERS DESIGNATION OF DRILL	CME - 55
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT	2" x 2" ID Stainless Steel Split Spoon; 7.25" OD Hollow Stem Auger
8. HOLE LOCATION	Easting=551039.17; Northing=670325.73
9. SURFACE ELEVATION	4072.48 ft. MSL
10. DATE STARTED	11-16-94
11. DATE COMPLETED	11-16-94
12. OVERBURDEN THICKNESS	NA
13. DEPTH DRILLED INTO ROCK	NA
14. TOTAL DEPTH OF HOLE	5.5 ft
15. DEPTH GROUNDWATER ENCOUNTERED	4.5 ft
16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED	NA
17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY)	None
18. RISK ASSESSMENT SAMPLES	No
SAMPLE ID (S)	
DEPTH	
19. TOTAL NUMBER OF CORE BOXES	NA
20. NUMBER OF SAMPLES FOR CHEMICAL ANALYSIS	2
SW8020	
SW8080	
SW8240	
SW8270	
SW8015ME	2
SW8015MP	2
Metals	
EPA 418.1	
SOP-426	
SOP-427	
21. TOTAL CORE REC.	NA
22. DISPOSITION OF HOLE	Vertical
BACKFILL	Grout
MONITORING WELL	
OTHER (SPECIFY)	
23. SIGNATURE OF INSPECTOR	Carolyn Cooper

ELEV. a	DEPTH b	GRAPHIC LOG c	DESCRIPTION OF MATERIALS d	SPLIT SPOON (ppm) e	HEAD-SPACE (ppm) f	BLOW CNTS g	% REC-OVERY h	ANALYTICAL SAMPLE NO. i
			Asphalt					
			Gravel with silty sand. Fill material.					
								94-45-B10-01R 1545 01/31/95
4070.4	2		SAND; Silty, with gravel, poorly graded, very fine-grained, brown (10YR5/3), dry, loose, (SM) (SDSL).	0	0.6	5 2 5	30	
								94-45-B10-02R 1600 01/31/95
4068.4	4		SAND; Silty, poorly graded, very fine-grained, pale red (2.5YR7/4), moist, low to medium density, with cemented layers; water at 4.5 ft, (SM) (SDSL).	110	136	3 5 3	50	
			SAND; Silty, poorly graded, very fine-grained, light gray (10YR7/2), wet, low to medium density, with cemented layers; ft, (SM) (SDSL).					
			Total Depth = 5.5 ft.					
4066.4	6							
4064.4	8							

PROJECT: Holloman AFB Table I Phase II RFI HOLE NO.: 45-B10

DRILLING LOG

HOLE NO.	45-B11
1. COMPANY NAME	Radian Corporation
2. DRILLING SUBCONTRACTOR	Geo-Test, Inc.
SHEET	1 OF 1 SHEETS
3. PROJECT	Holloman AFB Table I Phase II RFI
4. LOCATION	IRP Site 45
5. NAME OF DRILLER	Victor Maldonado
6. MANUFACTURERS DESIGNATION OF DRILL	CME - 55
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT	2' x 2" ID Stainless Steel Split Spoon; 7.25" OD Hollow Stem Auger
8. HOLE LOCATION	Easting=551057.60; Northing=670271.28
9. SURFACE ELEVATION	4071.54 ft. MSL
10. DATE STARTED	11-16-94
11. DATE COMPLETED	11-16-94
12. OVERBURDEN THICKNESS	NA
15. DEPTH GROUNDWATER ENCOUNTERED	3.5 ft
13. DEPTH DRILLED INTO ROCK	NA
16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED	NA
14. TOTAL DEPTH OF HOLE	5 ft
17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY)	None
18. RISK ASSESSMENT SAMPLES	No
SAMPLE ID (S)	
DEPTH	
19. TOTAL NUMBER OF CORE BOXES	NA

20. NUMBER OF SAMPLES FOR CHEMICAL ANALYSIS											21. TOTAL CORE REC.
2	SW8020		SW8080		SW8240		SW8270		SW8015HE	2	NA
	SW8015MP	2	Metals		EPA 418.1		SOP-426		SOP-427		

22. DISPOSITION OF HOLE	BACKFILL	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR
Vertical	Grout			Carolyn Cooper

ELEV. a	DEPTH b	GRAPHIC LOG c	DESCRIPTION OF MATERIALS d	SPLIT SPOON (ppm) e	HEAD-SPACE (ppm) f	BLOW CNTS g	% REC-OVERY h	ANALYTICAL SAMPLE NO. i
			Gravel; Fill material.					
			SILT; Lean, with gravel, very fine-grained, brown (10YR4/3) and very pale brown (10YR8/3), moist, medium density, with roots, backfill material., (ML) (STCL).					
4069.6	2			0	0	5 6 5	80	94-45-B11-01R 1415 01/31/95
			Fibrous material (some kind of liner) with clayey silt, gray, NSI, moist, soft.					
4067.6	4		SAND; Silty, poorly graded, very fine-grained, pale yellow (2.5Y8/3), wet, loose, (SM) (SOSL).	0	0	2 3 3	100	94-45-B11-02R 1515 01/31/95
			Total Depth = 5 ft.					
4065.6	6							
4063.6	8							

PROJECT: Holloman AFB Table I Phase II RFI

HOLE NO.: 45-B11

DRILLING LOG

HOLE NO.	45-B12
1. COMPANY NAME	Radian Corporation
2. DRILLING SUBCONTRACTOR	Geo-Test, Inc.
SHEET 1 OF 1 SHEETS	
3. PROJECT	Holloman AFB Table I Phase II RFI
4. LOCATION	IRP Site 45
5. NAME OF DRILLER	Victor Maldonado
6. MANUFACTURERS DESIGNATION OF DRILL	CME - 55
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT	2' x 2" ID Stainless Steel Split Spoon; 7.25" OD Hollow Stem Auger
8. HOLE LOCATION	Easting=551128.19; Northing=670379.23
9. SURFACE ELEVATION	4071.62 ft. MSL
10. DATE STARTED	11-16-94
11. DATE COMPLETED	11-16-94
12. OVERBURDEN THICKNESS	NA
15. DEPTH GROUNDWATER ENCOUNTERED	5 ft
13. DEPTH DRILLED INTO ROCK	NA
16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED	NA
14. TOTAL DEPTH OF HOLE	9 ft
17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY)	None
18. RISK ASSESSMENT SAMPLES	No
SAMPLE ID (S) / DEPTH	
19. TOTAL NUMBER OF CORE BOXES	NA

20. NUMBER OF SAMPLES FOR CHEMICAL ANALYSIS											21. TOTAL CORE REC.
4	SW8020		SW8080		SW8240		SW8270		SW8015ME	4	NA
	SW8015MP	4	Metals		EPA 418.1		SOP-426		SOP-427		

22. DISPOSITION OF HOLE	BACKFILL	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR
Vertical	Grout			Carolyn Cooper

ELEV. a	DEPTH b	GRAPHIC LOG c	DESCRIPTION OF MATERIALS d	SPLIT SPOON (ppm) e	HEAD-SPACE (ppm) f	BLOW CNTS g	% REC-OVERY h	ANALYTICAL SAMPLE NO. i
			Gravel					
			SILT; Lean, with gravel, very fine-grained, brown (10YR4/3) and very pale brown (10YR8/3), moist, soft, backfill material, (ML) (STCL).					
4069.6	2		SILT; Lean, with trace gravel, light gray (2.5Y7/1), moist, soft, non-plastic, mottled appearance; water at 5 ft, (ML) (STCL).	106	293	5 5 5	85	94-45-B12-01R 94-45-B12-21R 1200 01/31/95
4067.6	4			168	275	4 5 50	90	94-45-B12-02R 94-45-B12-22R 1245 01/31/95
4065.6	6		SILT; Lean, with trace gravel, light gray (2.5Y7/1), wet, soft, non-plastic, mottled appearance; water ends at 6.5 ft. (ML) (STCL).	82	26	25 40 50	100	
4063.6	8		SAND; Silty, poorly graded, very fine-grained, reddish yellow (7.5YR6/6), moist, very dense, (SM) (SDSL).	0	2			
			Total Depth = 9 ft.					

PROJECT: Holloman AFB Table I Phase II RFI HOLE NO.: 45-B12

Appendix A-7-1

Portions of: *Draft Final Site Investigation Report Waste Sites SS-06, SD-15, AOC-RR, and AOC-BBMS, Holloman Air Force Base, New Mexico,* Ebasco Services Inc. and Groundwater Technology, October 1995

DRAFT FINAL
SITE INVESTIGATION REPORT
WASTE SITES SS-06, SD-15, AOC-RR, AND AOC-BBMS
HOLLOMAN AIR FORCE BASE, NEW MEXICO

Prepared for:

49 CES/CEVR
Holloman Air Force Base, NM

and

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Under Contract No. DACW-45-94-D-0003

Delivery Order 1, Work Authorization Directives 3, 5, 9

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

October 1995

HAFB-03\SI-TEXT.RPT

TABLE 2-1
SOIL VAPOR SURVEY RESULTS AT SS-06
POL FUEL LINE SPILL
HOLLOMAN AFB, NM
MARCH 1995

Sample No.	Benzene (ug/l)	Toluene (ug/l)	Ethylbenzene (ug/l)	Xylenes (ug/l)	Total BTEX (ug/l)	TPH (ug/l)
SS-06-SG-1	0.14	1.20	0.15	0.56	2.05	<20
SS-06-SG-2	0.10	1.00	0.15	0.56	1.81	<20
SS-06-SG-3	0.08	0.89	0.15	0.59	1.71	<20
SS-06-SG-4	0.08	0.84	0.14	0.56	1.62	<20
SS-06-SG-5	0.10	0.82	0.15	0.60	1.67	<20
SS-06-SG-6	0.09	0.77	0.15	0.59	1.60	<20
SS-06-SG-7	0.06	0.69	0.15	0.58	1.48	<20
SS-06-SG-8	0.07	0.54	0.12	0.48	1.21	<20
SS-06-SG-9	<0.05	0.57	0.14	0.55	1.26	<20
SS-06-SG-10	<0.05	0.52	0.13	0.51	1.16	<20
SS-06-SG-10-DUP	<0.05	0.53	0.13	0.52	1.18	<20
SS-06-SG-11	<0.05	0.50	0.11	0.39	1.00	<20
SS-06-SG-12	0.11	0.36	0.13	0.32	0.92	<20
SS-06-SG-13	<0.05	0.38	0.10	0.37	0.85	<20
SS-06-SG-14	<0.05	0.29	0.07	0.26	0.62	<20

TABLE 2-1 (continued)
SOIL GAS SURVEY RESULTS AT SS-06
POL FUEL LINE SPILL
HOLLOMAN AFB, NM
MARCH 1995

Sample No.	Benzene (ug/l)	Toluene (ug/l)	Ethylbenzene (ug/l)	Xylenes (ug/l)	Total BTEX (ug/l)	TPH (ug/l)
SS-06-SG-15	0.06	0.27	0.10	0.29	0.72	<20
SS-06-SG-16	<0.05	0.30	0.09	0.33	0.72	<20
SS-06-SG-17	<0.05	<0.05	0.06	0.22	0.28	<20
SS-06-SG-18	<0.05	0.10	<0.05	0.17	0.27	<20
SS-06-SG-19	<0.05	0.09	<0.05	0.16	0.25	<20
SS-06-SG-19DUP	<0.05	0.08	<0.05	0.12	0.20	<20
EQUIP. BLANK (03/19/95)	<0.05	0.52	0.13	0.48	1.13	<20
SS-06-SG-20	<0.05	0.28	0.08	0.32	0.68	<20
SS-06-SG-21	0.05	0.74	0.17	0.68	1.64	<20
SS-06-SG-22	0.07	0.97	0.20	0.79	2.03	<20
SS-06-SG-23	0.05	0.60	0.14	0.57	1.36	<20
SS-06-SG-24	0.09	0.71	0.17	0.67	1.64	<20
SS-06-SG-25	0.06	0.49	0.14	0.54	1.23	<20
SS-06-SG-26	0.06	0.62	0.15	0.60	1.43	<20
SS-06-SG-26DUP	<0.05	0.60	0.19	0.74	1.53	<20

TABLE 2-1 (continued)
SOIL GAS SURVEY RESULTS AT SS-06
POL FUEL LINE SPILL
HOLLOMAN AFB, NM
MARCH 1995

Sample No.	Benzene (ug/l)	Toluene (ug/l)	Ethylbenzene (ug/l)	Xylenes (ug/l)	Total BTEX (ug/l)	TPH (ug/l)
SS-06-SG-27	0.06	0.50	0.15	0.62	1.33	<20
SS-06-SG-28	0.08	0.37	0.12	0.47	1.04	<20
SS-06-SG-29	<0.05	0.30	0.08	0.30	0.68	<20
EQUIP BLANK (03/20/95)	<0.05	0.17	0.06	0.22	0.45	<20
SS-06-SG-30	<0.05	0.23	0.08	0.32	0.63	<20
SS-06-SG-31	<0.05	0.14	<0.05	0.10	0.24	<20
SS-06-SG-32	<0.05	0.14	0.06	0.24	0.44	<20
SS-06-SG-33	<0.05	0.31	0.12	0.47	0.90	<20
SS-06-SG-34	<0.05	0.23	0.80	0.33	1.36	<20
SS-06-SG-35	<0.05	0.20	0.07	0.28	0.55	<20
SS-06-SG-35DUP	<0.05	0.19	0.07	0.27	0.53	<20
SS-06-SG-36	0.07	0.69	0.23	0.95	1.94	22
SS-06-SG-36DUP	0.07	0.69	0.23	0.95	1.94	22

[a]Samples analyzed for BTEX and TPH by EPA Methods Modified 5030/8020 and 8015.
ug/l = Micrograms per liter.
TPH = Total Petroleum Hydrocarbons as JP-4.
< = Indicates compound not detected at the stated reporting limit.

TABLE 2-2
SUMMARY OF GEOTECHNICAL SOIL ANALYTICAL RESULTS AT SS-06
POL FUEL LINE SPILL
HOLLOMAN AFB, NM
MARCH 1995

SAMPLE NO.	DEPTH (FT)	USCS IDENT	MOISTURE CONTENT (%wt)	LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX	MEDIAN GRAIN SIZE (mm)
SS-06-SB01-6-8	6-8	ML	42.9	42	38	4	0.0659
SS-06-SB02-6-8	6-8	ML	36.1	48	39	9	0.0102
SS-06-SB03-8-10	8-10	SM/SC	33.5	-	NON-PLASTIC	-	0.0104
SS-06-SB04-8-10	8-10	SC	25.2	36	20	16	0.0819
SS-06-SB05-4-6	4-6	CL	19.8	42	26	16	0.0069
SS-06-SB06-8-10	8-10	ML	24.7	38	31	7	0.0057

- = Not measured
USCS = Unified Soil Classification System
%wt = weight percent
FT = feet
mm = millimeter

TABLE 2-3
SUMMARY OF SOIL ANALYTICAL RESULTS AT SS-06
POL FUEL LINE SPILL
HOLLOMAN AFB, NM
MARCH 1995

CONSTITUENTS	COMPARATIVE		SS-06-SB-01-4-6	SS-06-SB-01-6-8	SS-06-SB-02-0-2	SS-06-SB-02-6-8	SS-06-SB-03-2-4	SS-06-SB-03-8-10	SS-06-SB-03-8-10D
	Background[a]	Risk-based Levels[a]							
SAMPLE DEPTH (feet)	–	–	4-6	6-8	0-2	6-8	2-4	8-10	8-10
VOLATILE ORGANICS - METHOD 8240 (ug/kg)									
All Constituents	N/A	N/A	ND	ND	ND	ND	ND	ND	ND
TOTAL PETROLEUM	N/A	1000[a]	<20	<20	<20	<20	<20	<20	<20
TAL METALS - METHODS 6000s AND 7000s (mg/kg)									
Aluminum	8,764	1,000,000	10,000	2,400	2,100	5,100	7,200	1,900	2,300
Barium	84	72,000	<100	20	<100	<100	28	<100	<100
Calcium	250,000	N/A	160,000	110,000	260,000	190,000	99,000	160,000	160,000
Chromium	6.60	1,000,000	<15	3.2	<15	<15	6.7	<15	<15
Iron	6,361	N/A	10,000	2,300	2,100	4,000	6,000	1,800	2,000
Lead	-2.32	400[a]	6.7	1.8	12	3.1	6.6	2.5	1.4
Manganese	146	5,100	310	33	76	59	110	22	38
Magnesium	14,656	N/A	19,000	2,400	7,000	14,000	13,000	3,400	5,100
Nickel	5.61	20,000	21	4.6	32	<20	7.4	<20	<20
Potassium	2,501	N/A	<2,500	718	<2,500	<2,500	1,900	<2,500	<2,500
Vanadium	15.46	7,200	28	5.4	<25	<25	19	<25	<25
Zinc	20.25	310,000	59	6.9	21	20	16	27	12

TABLE 2-3 (Continued)
SUMMARY OF SOIL ANALYTICAL RESULTS AT SS-06
POL FUEL LINE SPILL
HOLLOMAN AFB, NM
MARCH 1995

CONSTITUENTS	COMPARATIVE CONCENTRATIONS		SS-06-SB-04-4-6	SS-06-SB-04-8-10	SS-06-SB-05-4-6	SS-06-SB-05-10-12	SS-06-SB-06-4-6	SS-06-SB-06-8-10
	Background*	Risk-based Levels*						
SAMPLE DEPTH (feet)	--	--	4-6	8-10	4-6	10-12	4-6	8-10
VOLATILE ORGANICS - METHOD 8240 (mg/kg)								
All Constituents	N/A	N/A	ND	ND	ND	ND	ND	ND
TOTAL PETROLEUM	N/A	1000*	<20	<20	<20	<20	<20	<20
TAL METALS - METHODS 6000s AND 7000s (mg/kg)								
Aluminum	8,764	1,000,000	15,000	1,700	13,000	2,700	4,500	13,000
Barium	84	72,000	120	<20	130	51	<100	<100
Calcium	250,000	N/A	120,000	45,000	140,000	58,000	180,000	130,000
Chromium	6.60	1,000,000	19	<3.0	20	3.3	<15	<15
Iron	6,361	N/A	16,000	2,000	11,000	2,900	4,100	11,000
Lead	-2.32	400*	12	3.2	4.3	3.1	1.9	4.2
Manganese	146	5,100	280	46	190	100	48	86
Magnesium	14,656	N/A	16,000	2,600	32,000	3,600	7,300	20,000
Nickel	5.61	20,000	<20	<4.0	21	4.7	<20	<20
Potassium	2,501	N/A	3,400	530	3,600	720	<2,500	3,100
Vanadium	15.46	7,200	33	<5.0	36	7.3	<25	25
Zinc	20.25	310,000	59	6.3	75	10	21	71

TABLE 2-3 (Continued)
SUMMARY OF SOIL ANALYTICAL RESULTS AT SS-06
POL FUEL LINE SPILL
HOLLOMAN AFB, NM
MARCH 1995

[a] *Basewide Background Study Holloman AFB* (Radian, 1993).

[b] EPA Region III Risk-based levels (R.L. Smith, November 1994).

[c] NMED USTB Correspondence to Holloman AFB, dated November 2, 1992.

[d] EPA Action Level for residential exposure.

ND = No compounds detected for method specified.

ug/kg = Micrograms per kilogram

N/A = Not applicable/not established

mg/kg = Milligrams per kilogram

TAL = Target Analyte List

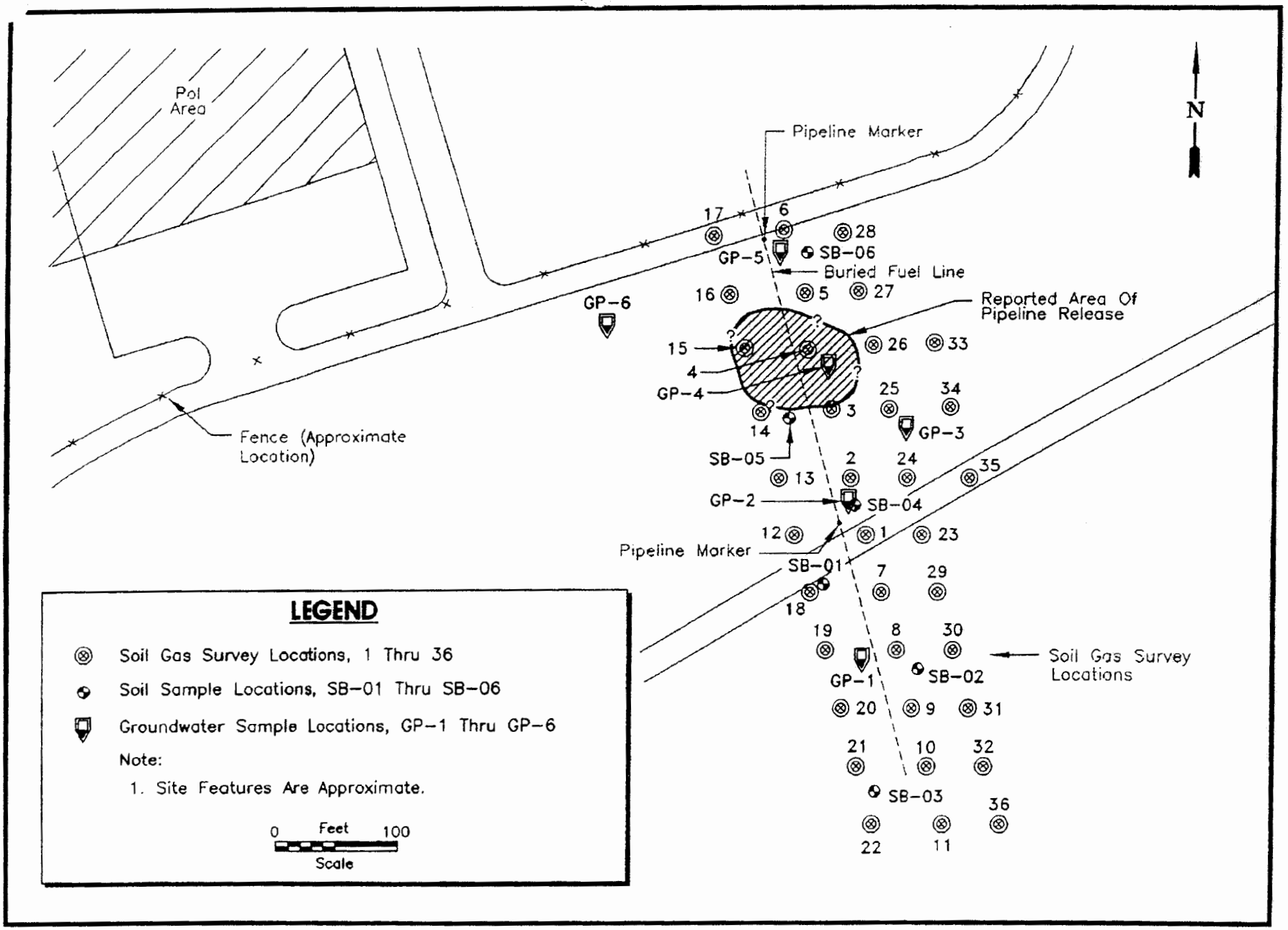
< = Indicates compound not detected at the stated reporting limit.

TABLE 2-4
SUMMARY OF GROUNDWATER ANALYTICAL RESULTS AT SS-06
POL FUEL LINE SPILL
HOLLOMAN AFB, NM
APRIL 1995

ANALYTES	COMPARATIVE CONCENTRATIONS		SS-06-GP-1	SS-06-GP-2	SS-06-GP-3 (4-28-95)	SS-06-GP-1D (4-27-95)	SS-06-GP-02D (4-27-95)	SS-06-GP-03 (4-2-95)
	Background[a]	Risk-based[b]						
VOLATILE ORGANICS - METHOD 8240 (ug/l)								
Acetone	N/A	3,700	ND	17	ND	ND	NA	ND
TAL METALS - METHODS 6000s and 7000s (ug/l)								
Aluminum	N/A	37,000	26,000	72,000	58,000	40,000	12,000	<10,000
Lead	19.9	N/A	<4.0	63	5.0	140	<4.0	<4.0
Zinc	253	11,000	<2,000	3,400	<2,000	<2,000	3,400	<1,000
pH - METHOD 150.1[c]								
pH	N/A	6-9	7.21	7.10	7.30	NA	NA	NA

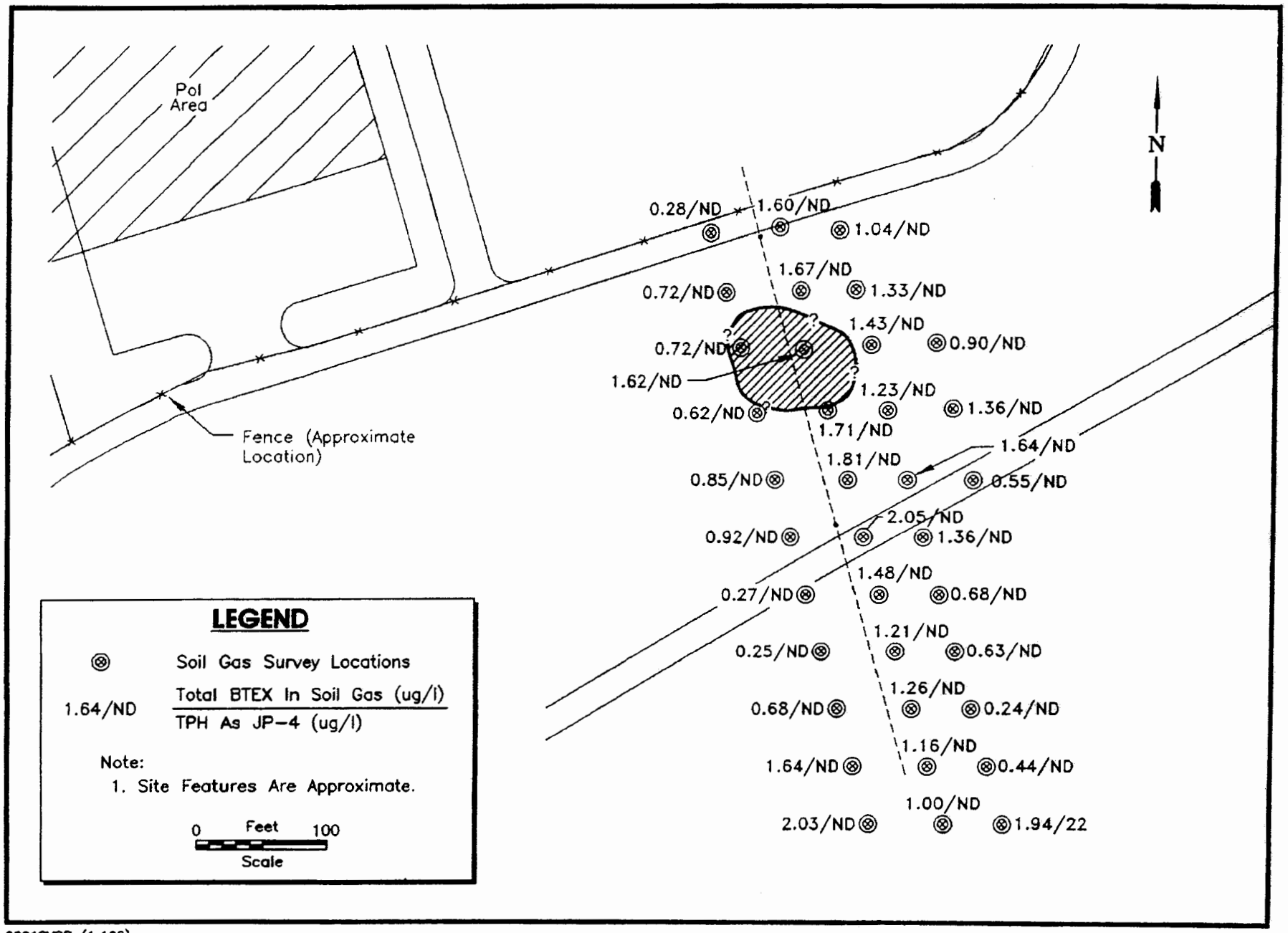
[a] *Basewide Background Study for Holloman AFB* (Radian, 1993).
[b] EPA Region III risk-based-levels (R.L. Smith, November 1994).
[c] pH by field instrumentation.

ug/l = Micrograms Per Liter
ND = No compounds detected for method specified.
N/A = Not applicable/not established
TAL = Target Analyte List
NA = Not analyzed
< = Indicates compound not detected at the stated reporting limit.



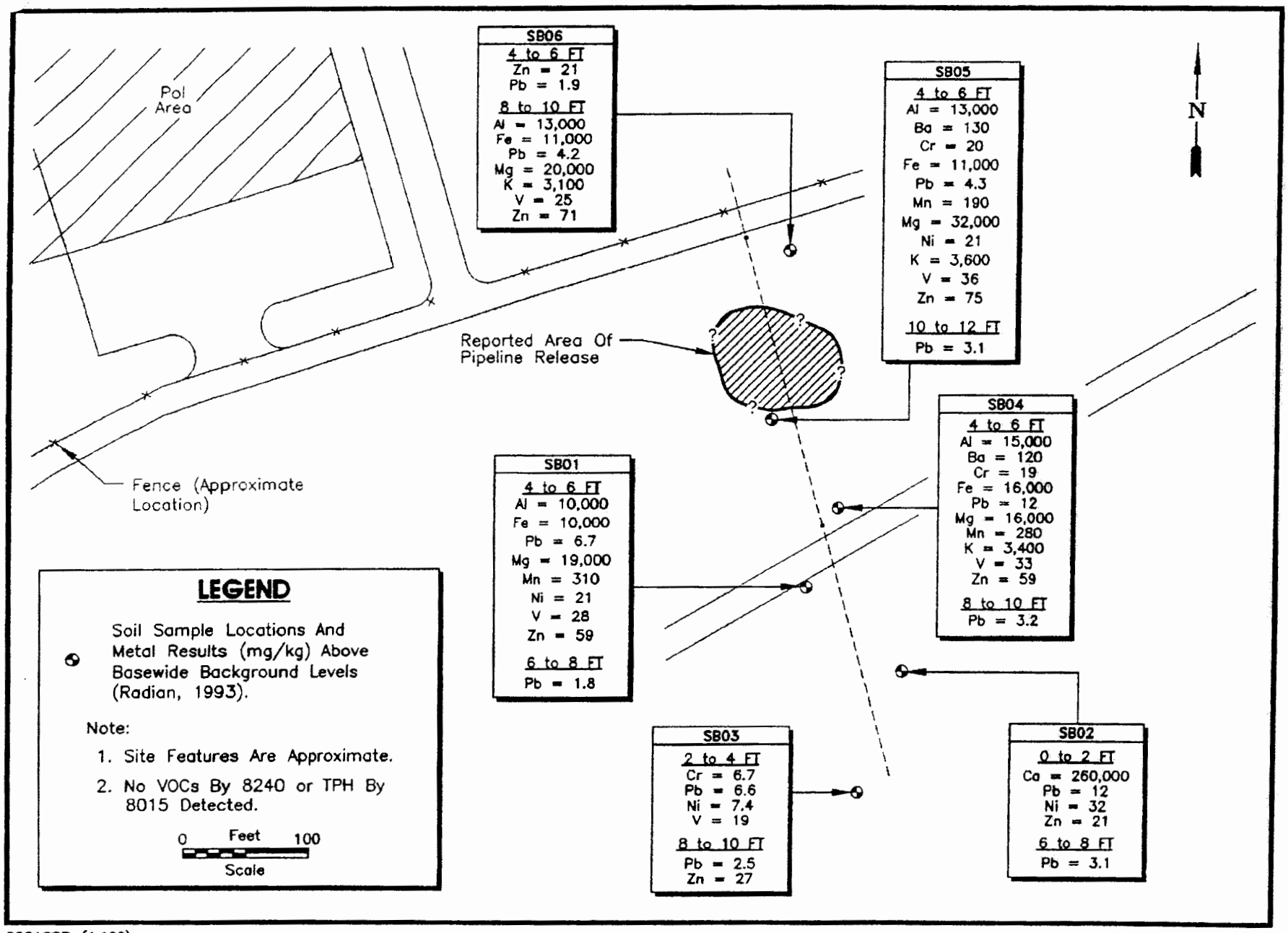
2201-ST2 (1:100)

Figure 2-1. Site Map
Site SS-06, JP-4 Fuel Line Spill



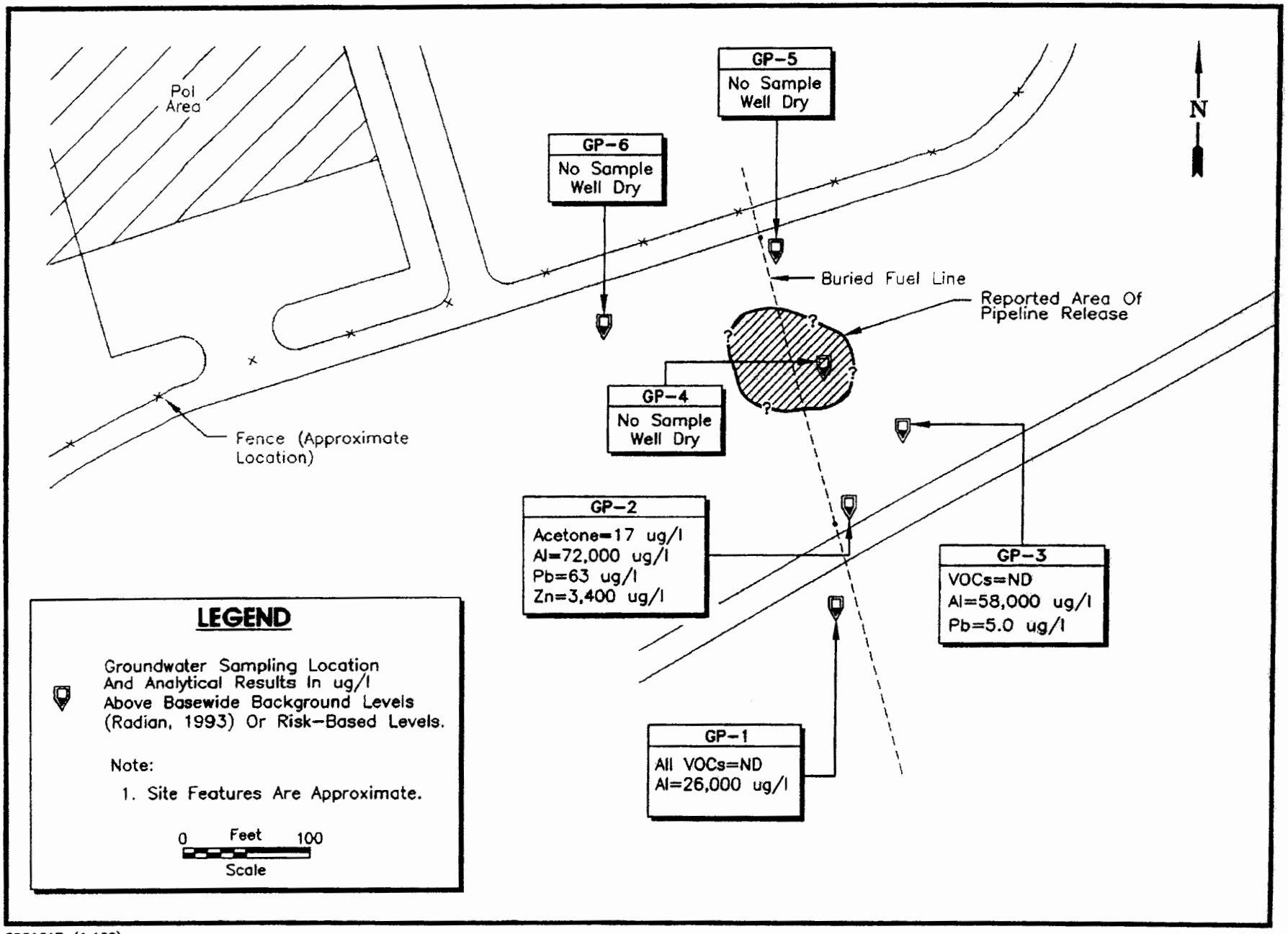
2201SVSR (1:100)

Figure 2-2. Soil Vapor Survey Results, March 1995
Site SS-O6, JP-4 Fuel Line Spill



2201SSR (1:100)

Figure 2-3. Soil Analytical Results, March 1995
Site SS-06, JP-4 Fuel Line Spill



2201GAR (1:100)

Figure 2-4. Groundwater Analytical Results, April 1995
Site SS-06, JP-4 Fuel Line Spill

HTW DRILLING LOG

HOLE NO.	SB-01
1. COMPANY NAME	Groundwater Technology
2. DRILLING SUBCONTRACTOR	Geo Environmental
SHEET	1 OF 1 SHEETS
3. PROJECT	PA/SI DO#1 WADs#3,5,9
4. LOCATION	HAFB Site SS-06
5. NAME OF DRILLER	J. Steerman
6. MANUFACTURERS DESIGNATION OF DRILL	Scorpion Rig
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT	DPT Split-spoon 1.5 inch diameter
8. HOLE LOCATION	SB-1 south of POL Yard
9. SURFACE ELEVATION	
10. DATE STARTED	03/24/95
11. DATE COMPLETED	03/24/95
12. OVERBURDEN THICKNESS	ft.
15. DEPTH GROUNDWATER ENCOUNTERED	9 ft.
13. DEPTH DRILLED INTO ROCK	ft.
16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED	
14. TOTAL DEPTH OF HOLE	10 ft.
17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY)	

18. GEOTECHNICAL SAMPLES	DISTURBED	UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES
8-10' @ SS-06	Y	N	NA

20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	OTHERS (SPECIFY)	OTHERS (SPECIFY)	OTHERS (SPECIFY)	21. TOTAL CORE REC.
4-6' & 6-8'	Y	Y				%

22. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHERS (SPECIFY)	23. SIGNATURE OF INSPECTOR
Abandoned	Bentonite	N		

ELEV. a	DEPTH b	DESCRIPTION OF MATERIALS c	FIELD SCREENING RESULTS d	GEOTECH SAMPLE OR CORE BOX NO. e	ANALYTICAL SAMPLE NO. f	BLOW COUNTS g	REMARKS/RECOVERY h
-1	1	0-2 ft.: Light brown SAND (SM), fine grained, dry. (2.5YR, 7/2).	0.0	NA			100%
-2	2	2-4 ft.: Brown silty SAND (SM), dry (2.5YR, 7/2).					
-3	3		10	NA			100%
-4	4	4-6 ft. Brown silty SAND (SM), moist (2.5YR, 5/1).					
-5	5		15	NA	SS-06 SB-1-4-6		100%
-6	6	6-8 ft. Brown silty SAND (SM), moist (2.5YR, 5/1). Lab USCS ID=ML					
-7	7		5.1	NA	SB-06 SB-1-6-8		100%
-8	8	8-10 ft. Wet, white silty SAND (SM) (2.5YR, 7/1).					
-9	9		15	NA			100%
-10	10						

HTW DRILLING LOG

HOLE NO.	SB-02
1. COMPANY NAME	Groundwater Technology
2. DRILLING SUBCONTRACTOR	Geo Environmental
SHEET	1 OF 1 SHEETS
3. PROJECT	DACW-45-94D-003 PA/SI
4. LOCATION	HAFB Site SS-06
5. NAME OF DRILLER	J. Steerman
6. MANUFACTURERS DESIGNATION OF DRILL	Scorpion Rig
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT	DPT Split-spoon 1.5 inch diameter
8. HOLE LOCATION	SB-1 south of POL Yard
9. SURFACE ELEVATION	
10. DATE STARTED	03/24/95
11. DATE COMPLETED	03/24/95
12. OVERBURDEN THICKNESS	ft.
15. DEPTH GROUNDWATER ENCOUNTERED	9 ft.
13. DEPTH DRILLED INTO ROCK	ft.
16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED	
14. TOTAL DEPTH OF HOLE	10 ft.
17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY)	

18. GEOTECHNICAL SAMPLES	DISTURBED	UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES
6-8'	Y	N	NA

20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	OTHERS (SPECIFY)	OTHERS (SPECIFY)	OTHERS (SPECIFY)	21. TOTAL CORE REC.
0-2' & 6-8'	Y	Y				%

22. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHERS (SPECIFY)	23. SIGNATURE OF INSPECTOR
Abandoned	Bentonite	N		

ELEV. a	DEPTH b	DESCRIPTION OF MATERIALS c	FIELD SCREENING RESULTS d	GEOTECH SAMPLE OR CORE BOX NO. e	ANALYTICAL SAMPLE NO. f	BLOW COUNTS g	REMARKS/RECOVERY h
-1	1	0-2 ft.: Light brown, silty SAND (SM) with gypsum, dry (2.5YR, 7/2).	1.8	NA	SS-06 SB-2-0-2		100%
-2 -3	2 3	2-4 ft. Red brown silty CLAY (CL) with gypsum, moist (2.5YR, 4/3).	2.0	NA			80%
-4 -5	4 5	4-6 ft. Red brown silty CLAY (CL) with gypsum, moist (2.5YR, 4/3). Lab USCS ID=ML	9.0	NA			100%
-6 -7	6 7	6-8 ft. Light brown, sily SAND (SM), loose, moist (2.5YR, 7/2).	11.0	NA	SB-06 SB-2-6-8		100%
-8 -9 -10	8 9 10	8-10 ft. Wet, light brown, silty SAND (SM), loose, moist, (2.5YR, 7/2).		NA			100%

HRK Form 55-2

PROJECT: 830012201 DACW-45-94D-003 PA/SI

HOLE NO.: SB-02

HTW DRILLING LOG

HOLE NO.	SB-03
1. COMPANY NAME	Groundwater Technology
2. DRILLING SUBCONTRACTOR	Geo Environmental
SHEET 1	OF 1 SHEETS
3. PROJECT	PA/SI DO#1 WADs#3,5,9
4. LOCATION	HAFB Site SS-06
5. NAME OF DRILLER	J. Steerman
6. MANUFACTURERS DESIGNATION OF DRILL	Scorpion Rid
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT	DPT Split-spoon 1.5 inch diameter
8. HOLE LOCATION	SS-06-SB-3 South of POL Yard
9. SURFACE ELEVATION	
10. DATE STARTED	03/24/95
11. DATE COMPLETED	03/24/95
12. OVERBURDEN THICKNESS	ft.
15. DEPTH GROUNDWATER ENCOUNTERED	9.5 ft.
13. DEPTH DRILLED INTO ROCK	ft.
16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED	
14. TOTAL DEPTH OF HOLE	10 ft.
17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY)	

18. GEOTECHNICAL SAMPLES	DISTURBED	UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES
8-10'	Y	N	NA

20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	OTHERS (SPECIFY)	OTHERS (SPECIFY)	OTHERS (SPECIFY)	21. TOTAL CORE REC.
2-4' & 8-10'	Y	Y				%

22. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHERS (SPECIFY)	23. SIGNATURE OF INSPECTOR
Abandoned	Bentonite	N		

ELEV. a	DEPTH b	DESCRIPTION OF MATERIALS c	FIELD SCREENING RESULTS d	GEOTECH SAMPLE OR CORE BOX NO. e	ANALYTICAL SAMPLE NO. f	BLOW COUNTS g	REMARKS/RECOVERY h
-1	1	0-1 ft. Black-gray, GRAVEL (GP), coarse, dry, no odor. 1-2 ft. Red brown silty SAND (SM), dry.	0.6	NA			100%
-2 -3	2 3	2-4 ft. Red brown silty SAND (SM), moist (2.5YR, 4/3).	14.2	NA	SB-06 SB-3-2-4		100%
-4 -5	4 5	4-6 ft. Red brown silty SAND (SM), moist (2.5YR, 4/3).	11.2	NA			100%
-6 -7	6 7	6-8 ft. Very light brown, silty SAND (SM) moist (2.5YR, 7/2).	6.9	NA			100%
-8 -9 -10	8 9 10	8-10 ft. Very light brown, silty SAND (SM) wet (2.5YR, 7/2). Lab USCS ID=SM/SC	47.2	NA	SB-06 SB-3-8-10		100%

HTW DRILLING LOG

HOLE NO.	SB-04
1. COMPANY NAME	Groundwater Technology
2. DRILLING SUBCONTRACTOR	Geo Environmental
SHEET	1 OF 1 SHEETS
3. PROJECT	PA/SI DO#1 WADs#3,5,9
4. LOCATION	HAFB Site SS-06
5. NAME OF DRILLER	J. Steerman
6. MANUFACTURERS DESIGNATION OF DRILL	Scorpion Rig
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT	DPT Split-spoon 1.5 inch diameter
8. HOLE LOCATION	South of POL Yard
9. SURFACE ELEVATION	
10. DATE STARTED	03/24/95
11. DATE COMPLETED	03/24/95
12. OVERBURDEN THICKNESS	ft.
15. DEPTH GROUNDWATER ENCOUNTERED	9.5 ft.
13. DEPTH DRILLED INTO ROCK	ft.
16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED	
14. TOTAL DEPTH OF HOLE	10 ft.
17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY)	

18. GEOTECHNICAL SAMPLES	DISTURBED	UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES
8-10'	Y	N	NA

20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	OTHERS (SPECIFY)	OTHERS (SPECIFY)	OTHERS (SPECIFY)	21. TOTAL CORE REC.
4-6' & 8-10'	Y	Y				%

22. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHERS (SPECIFY)	23. SIGNATURE OF INSPECTOR
Abandoned	Bentonite	N		

ELEV. a	DEPTH b	DESCRIPTION OF MATERIALS c	FIELD SCREENING RESULTS d	GEOTECH SAMPLE OR CORE BOX NO. e	ANALYTICAL SAMPLE NO. f	BLOW COUNTS g	REMARKS/RECOVERY h
-1	1	0-2 ft. Red brown silty SAND (SM), dry (2.5YR, 4/3).	0.0	NA			100%
-3	3	2-4 ft. Red brown silty SAND (SM), damp (2.5YR, 4/3).	128	NA			100%
-5	5	4-8 ft. Red brown silty SAND (SM), damp with gypsum crystals, (2.5YR, 4/3). Lab USCS ID=SC	120	NA	SB-06 SB-4-4-6		80%
-7	7	8-8 ft. Red brown silty SAND (SM), damp with gypsum crystals.	30.3	NA			80%
-9	9	8-10 ft. White, ligth brown silty SAND (SM), no odor, wet. (2.5YR, 7/2).	12.1	NA	SB-06 SB-4-8-10		

NRK Form 55-2

PROJECT: 830012201 PA/SI DO#1 WADs#3,5,9

HOLE NO.: SB-04

HTW DRILLING LOG

HOLE NO.	SB-05
1. COMPANY NAME	Groundwater Technology
2. DRILLING SUBCONTRACTOR	Geo Environmental
SHEET	1 OF 2 SHEETS
3. PROJECT	PA/SI DO#1 WADs#3,5,9
4. LOCATION	HAFB SS-06
5. NAME OF DRILLER	J. Steerman
6. MANUFACTURERS DESIGNATION OF DRILL	Scorpion Rig
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT	DPT Split-spoon 1.5 inch diameter
8. HOLE LOCATION	South of POL Yard
9. SURFACE ELEVATION	
10. DATE STARTED	03/24/95
11. DATE COMPLETED	03/24/95
12. OVERBURDEN THICKNESS	ft.
15. DEPTH GROUNDWATER ENCOUNTERED	13 ft.
13. DEPTH DRILLED INTO ROCK	ft.
16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED	
14. TOTAL DEPTH OF HOLE	14 ft.
17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY)	

18. GEOTECHNICAL SAMPLES	DISTURBED	UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES
4-6'	Y	N	NA

20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	OTHERS (SPECIFY)	OTHERS (SPECIFY)	OTHERS (SPECIFY)	21. TOTAL CORE REC.
4-6' & 10-12'	Y	Y				%

22. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHERS (SPECIFY)	23. SIGNATURE OF INSPECTOR
Abandoned	Bentonite	N		

ELEV. a	DEPTH b	DESCRIPTION OF MATERIALS c	FIELD SCREENING RESULTS d	GEOTECH SAMPLE OR CORE BOX NO. e	ANALYTICAL SAMPLE NO. f	BLOW COUNTS g	REMARKS/RECOVERY h
-1	1	0-2 ft. White silty SAND (SM) gypsum crystals, no odor, dry (2.5YR, 7/1).	372	NA			50%
-2	2	2-4 ft. Red brown silty SAND (SM) with gypsum crystals, dry (2.5YR, 4/3)	80	NA			100%
-3	3						
-4	4	4-6 ft. Red brown silty SAND (SM) with gypsum crystals, dry (2.5YR, 4/3). Lab USCS ID=CL	459	NA	SB-06 SB-5-4-6		100%
-5	5						
-6	6	6-8 ft. Light brown silty SAND (SM), damp (2.5YR, 7/2).	21.9	NA			75%
-7	7						
-8	8	8-10 ft. Red brown silty CLAY (CL) with sand, moist, stiff (2.5YR)	72	NA			100%
-9	9						
-10	10						

HTW DRILLING LOG

HOLE NO. SB-05

1. COMPANY NAME: Groundwater Technology

2. INSPECTOR: [illegible]

SHEET 2 OF 2 SHEETS

ELEV. a	DEPTH b	DESCRIPTION OF MATERIALS c	FIELD SCREENING RESULTS d	GEOTECH SAMPLE OR CORE BOX NO. e	ANALYTICAL SAMPLE NO. f	BLOW COUNTS g	REMARKS/RECOVERY h
		10-12 ft. Red brown silty CLAY (CL) with sand, moist, stiff (2.5YR, 4/3).					
-11	11		104	NA	SB-06 SB-5-10-12		100%
-12	12	12-14 ft. White, light brown silty SAND (SM), wet @ 13', (2.5YR, 7/2).					
-13	13		23.1	NA			50%
-14	14	BOH @ 14'.					
-15	15						
-16	16						
-17	17						
-18	18						
-19	19						
-20	20						
-21	21						
-22	22						
-23	23						
-24	24						
-25	25						
-26	26						
-27	27						
-28	28						

NRK Form 55-2

PROJECT: 830012201 PA/SI DO#1 WADs#3,5,9

HOLE NO.: SB-05

HTW DRILLING LOG

HOLE NO.	SB-06
1. COMPANY NAME	Groundwater Technology
2. DRILLING SUBCONTRACTOR	Geo Environmental
SHEET 1 OF 1 SHEETS	
3. PROJECT	PA/SI DO#1 WADs#3,5,9
4. LOCATION	HAFB Site SS-06
5. NAME OF DRILLER	J. Steerman
6. MANUFACTURERS DESIGNATION OF DRILL	Scorpion Rig
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT	DPT Split-spoon 1.5 inch diameter
8. HOLE LOCATION	South of POL Yard
9. SURFACE ELEVATION	
10. DATE STARTED	03/25/95
11. DATE COMPLETED	03/25/95
12. OVERBURDEN THICKNESS	ft.
15. DEPTH GROUNDWATER ENCOUNTERED	ft.
13. DEPTH DRILLED INTO ROCK	ft.
16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED	
14. TOTAL DEPTH OF HOLE	10 ft.
17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY)	

18. GEOTECHNICAL SAMPLES	DISTURBED	UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES
8-10'		Y	0

20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	OTHERS (SPECIFY)	OTHERS (SPECIFY)	OTHERS (SPECIFY)	21. TOTAL CORE REC.
4-6' & 8-10'	Y	Y	USACE MRD			%

22. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHERS (SPECIFY)	23. SIGNATURE OF INSPECTOR
Abandoned	Bentonite	N		

ELEV. a	DEPTH b	DESCRIPTION OF MATERIALS c	FIELD SCREENING RESULTS d	GEOTECH SAMPLE OR CORE BOX NO. e	ANALYTICAL SAMPLE NO. f	BLOW COUNTS g	REMARKS/RECOVERY h
-1	1	0-2 ft. White silty SAND (SM), loose, dry (10YR, 8/2).	7.2	NA			80% .12
-2	2	2-4 ft. Fine white silty SAND (SM), loose, dry (10YR, 8/2).					
-3	3		9.0	NA			100% .14
-4	4	4-6 ft. Fine white silty SAND (SM), loose, moist (10YR, 7/4).					
-5	5		152	NA			100%
-6	6	6-8 ft. Fine white silty SAND (SM), loose, moist (10YR, 7/4).					
-7	7		39	NA			80%
-8	8	8-10 ft. Stiff, moist, silty CLAY (CL), red. (5YR, 4/6). Lab USCS ID=ML.					
-9	9		15.1	NA			100%
-10	10						

Appendix A-8-1

Portions of: *Chemical Data Acquisition Plan (CDAP), Investigation of Four Waste Sites, Holloman Air Force Base, NM,* Radian Corporation, 2 February 1993

DCN 93-269-069-23-01
RCN 269-069-23-04

CHEMICAL DATA ACQUISITION PLAN (CDAP)

INVESTIGATION OF FOUR WASTE SITES
HOLLOMAN AIR FORCE BASE, NM

Prepared for:

49 SG/CEV
Holloman Air Force Base, NM

and

HQ ACC/DEVC
Langley Air Force Base, VA

Prepared by:

Radian Corporation
8501 N. MoPac Boulevard
P.O. Box 201088
Austin, Texas 78720-1088
512/454-4797

Under Contract No. DACW45-91-D-0018 with:

US Army Corps of Engineers
Omaha District
Omaha, Nebraska

2 February 1993

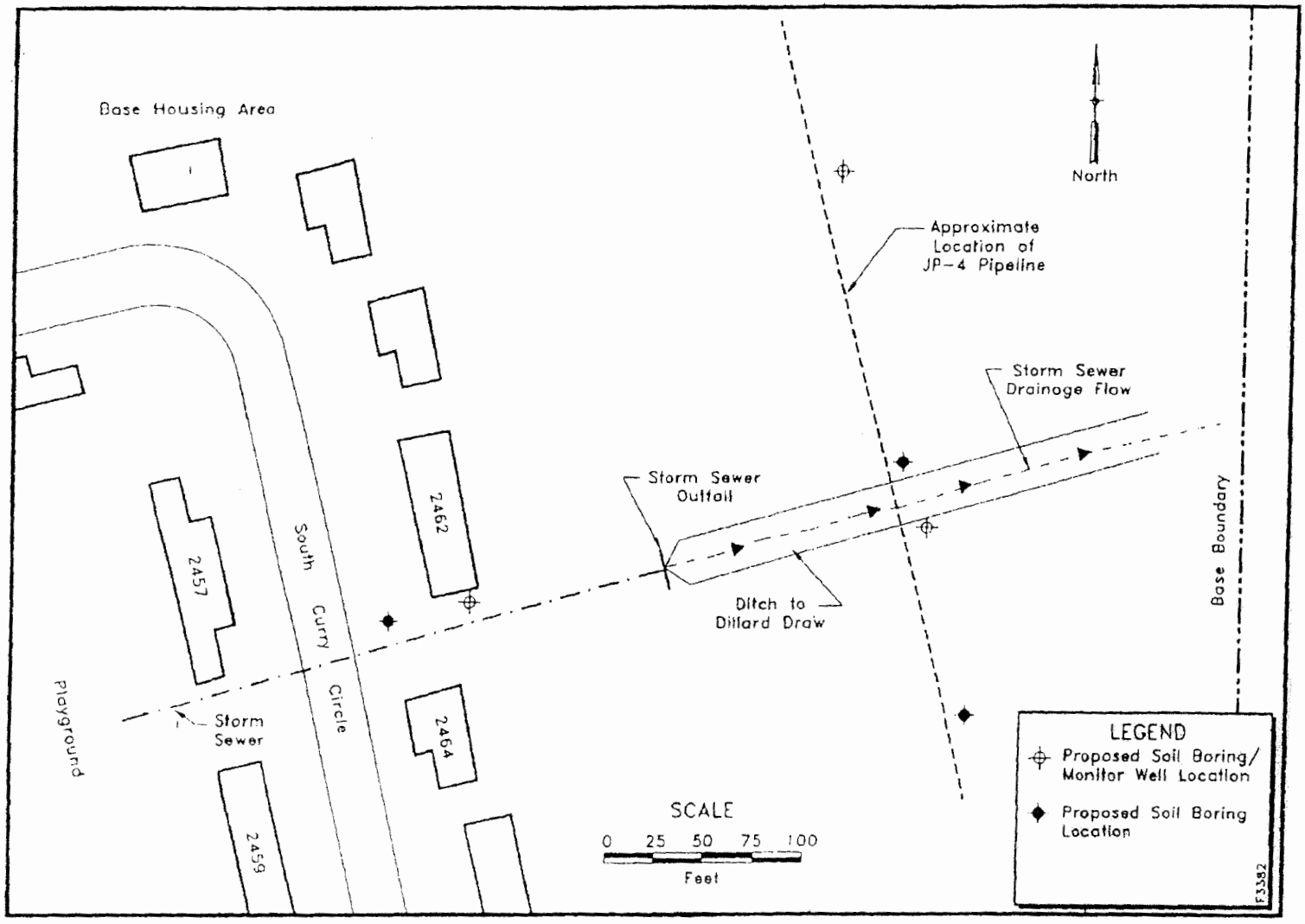


Figure 5-2. Site 12 Features and Proposed Soil Boring/Monitor Well Locations

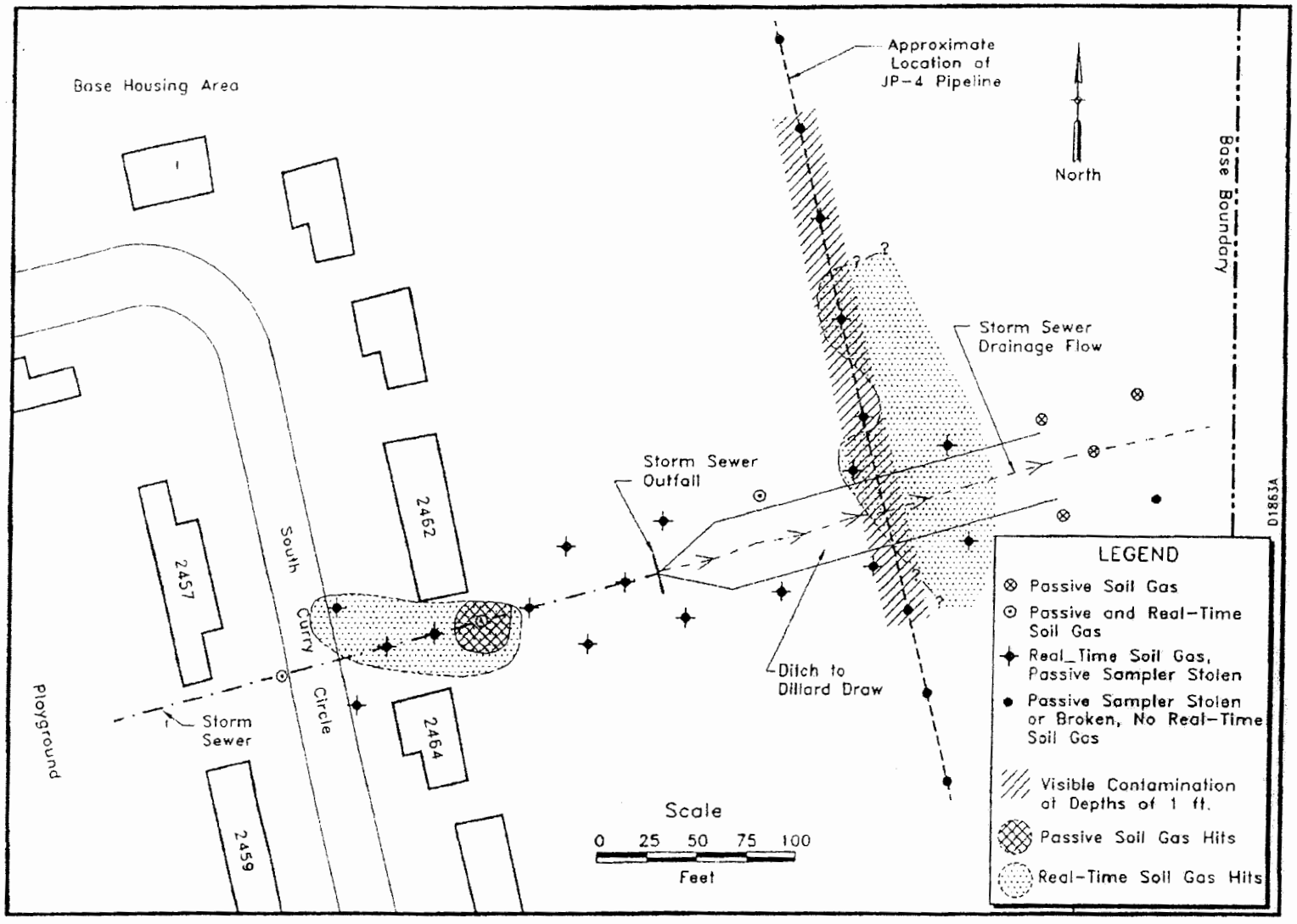
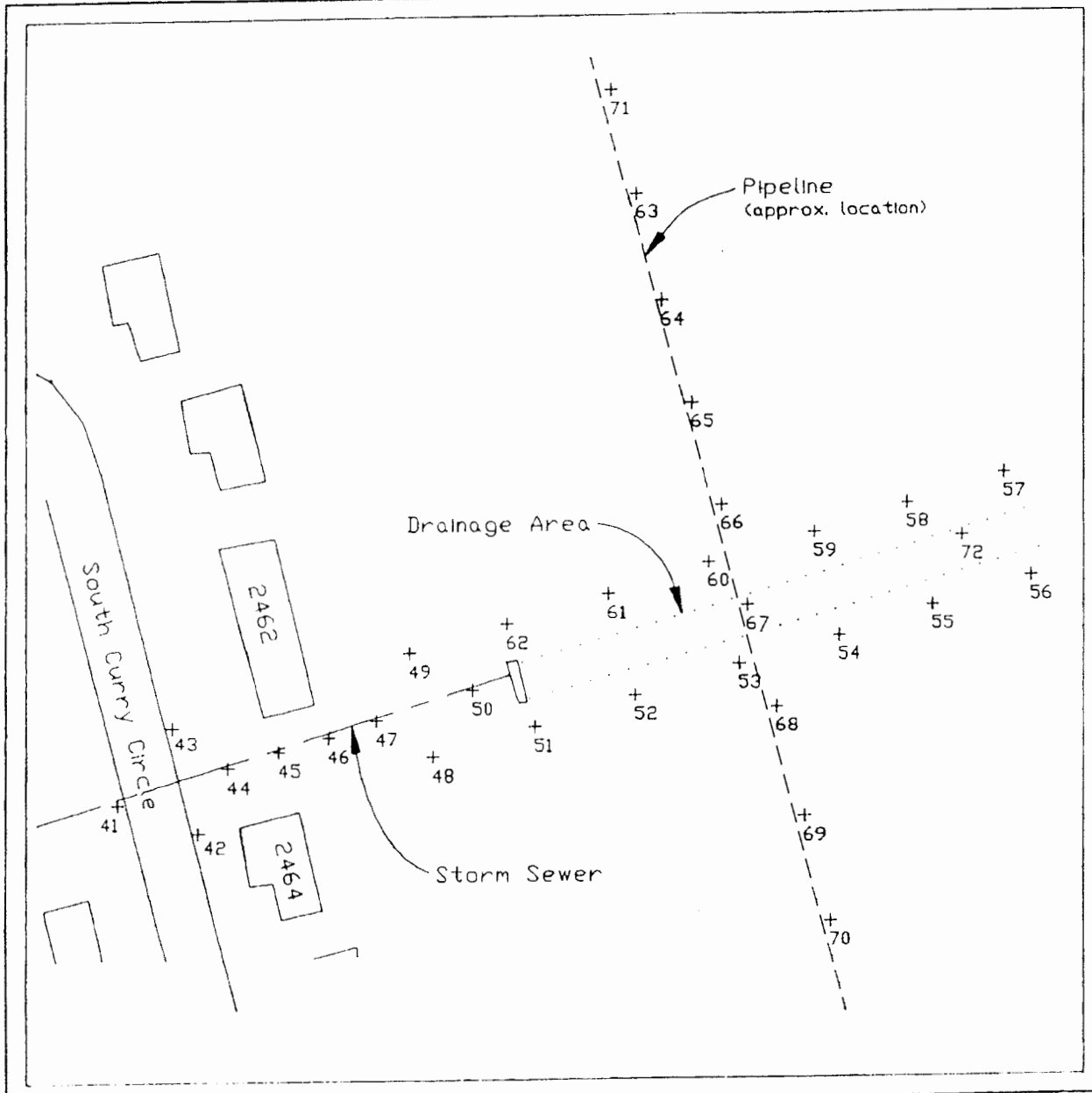


Figure 5-3. Passive and Real Time Soil Gas Survey Results Summary for Site 12

TABLE 1: Petrex Soil Gas Sampling Results* (cont'd)

	sample #	Aromatics (C6-C9)	Petroleum Hydrocarbons (C8-C13)	Chloroform	PCE	Comments
ite 12:	41	14429	272	N/ID	0	
	42	--	--	--	--	no data, missing
	43	--	--	--	--	no data, missing
	44	--	--	--	--	no data, missing
	45	--	--	--	--	no data, missing
	46	113961	761202	N/ID	N/ID	
	47	--	--	--	--	no data, missing
	48	--	--	--	--	no data, missing
	49	--	--	--	--	no data, missing
	50	--	--	--	--	no data, missing
	51	--	--	--	--	no data, missing
	52	--	--	--	--	no data, missing
	53	--	--	--	--	no data, missing
	54	--	--	--	--	no data, missing
	55	4397	378	N/ID	0	
	56	--	--	--	--	no data, broken
	57	1935	0	0	0	
	58	4198	0	0	0	
	59	--	--	--	--	no data, missing
	60	--	--	--	--	no data, missing
	61	12526	1431	N/ID	398	
	62	--	--	--	--	no data, missing
	63	--	--	--	--	no data, missing
	64	--	--	--	--	no data, missing
	65	--	--	--	--	no data, missing
	66	--	--	--	--	no data, missing
	67	--	--	--	--	no data, missing
	68	--	--	--	--	no data, missing
	69	--	--	--	--	no data, missing
	70	--	--	--	--	no data, missing
	71	--	--	--	--	no data, missing
	72	7042	244	N/ID	0	
A/QC:	73	632	0	0	0	replicate, sample #12
	74	2040	0	0	0	replicate, sample #19
	75	2031	0	0	0	replicate, sample #31
	76	4728	319	N/ID	N/ID	replicate, sample #36
	77	3256	0	0	0	replicate, sample #39
	78	5479	324	N/ID	233	replicate, sample #61
	79	10770	0	303	0	travel blank
	80	3975	0	263	0	travel blank
	81	2820	0	0	0	travel blank
	82	3455	0	0	0	travel blank

N/ID: compound Not Identified, signal derived from hydrocarbons.
* all data derived from CpTD-MS analysis; values in units of ion counts.



NERI
605 Parfet Street
Suite 100
Lakewood Colorado 80215
(303) 238-0090
176930E

LEGEND

+ Petrex Sample Location

N

0 37.5 75
FEET

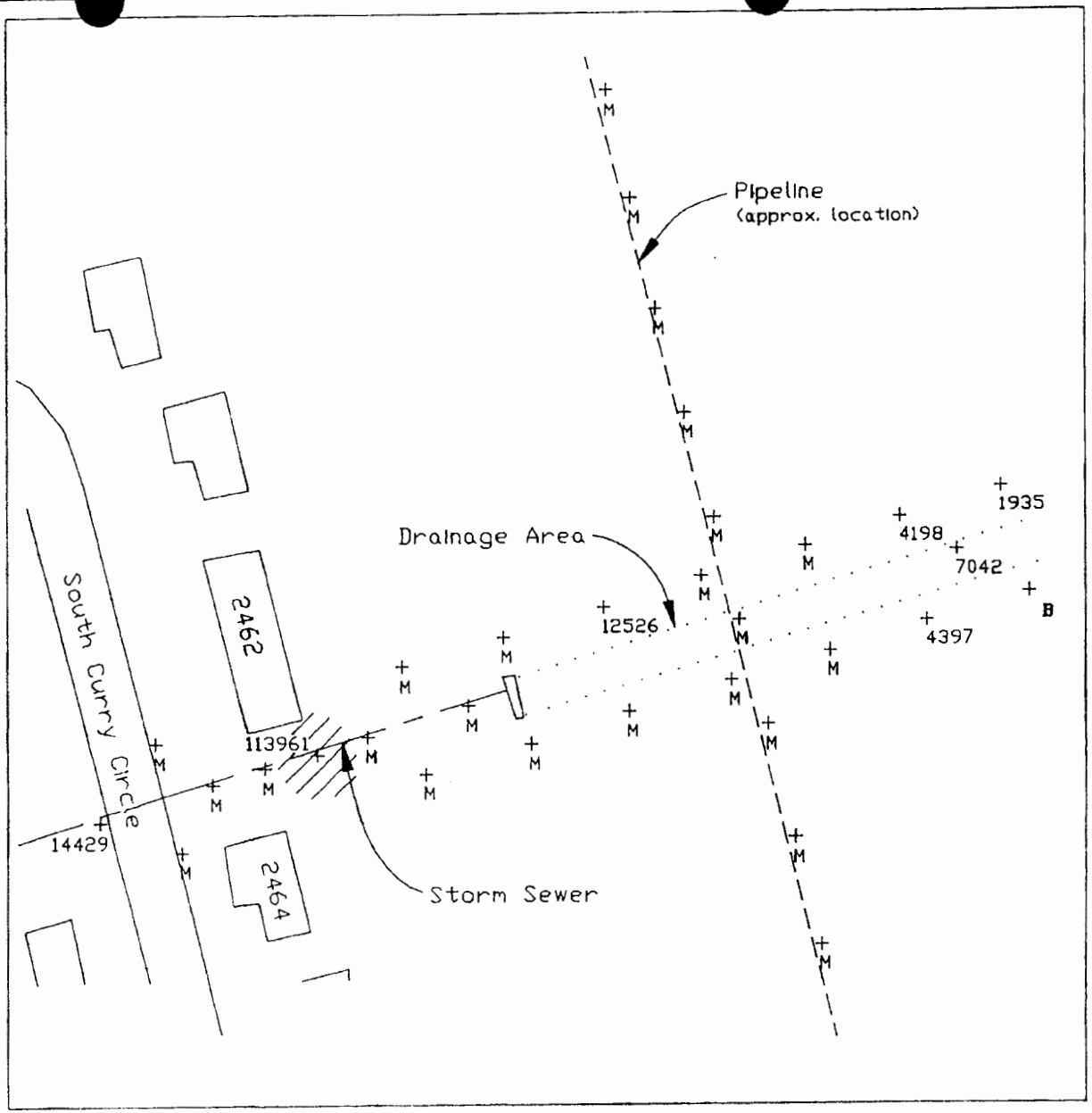
Radian Corporation

Sample Locations

Site 12
Holloman Air Force Base, Alamogordo, NM

Plate 8

December 14, 1992



NERI
805 Parfet Street
Suite 100
Lakewood Colorado 80215
(303) 238-0090
176930E

LEGEND

Ion Counts:

≥ 20,000

+ Petrex Sample Location

B Broken Sampler, No Data

M Missing Sampler, No Data

N

0 37.5 75
FEET

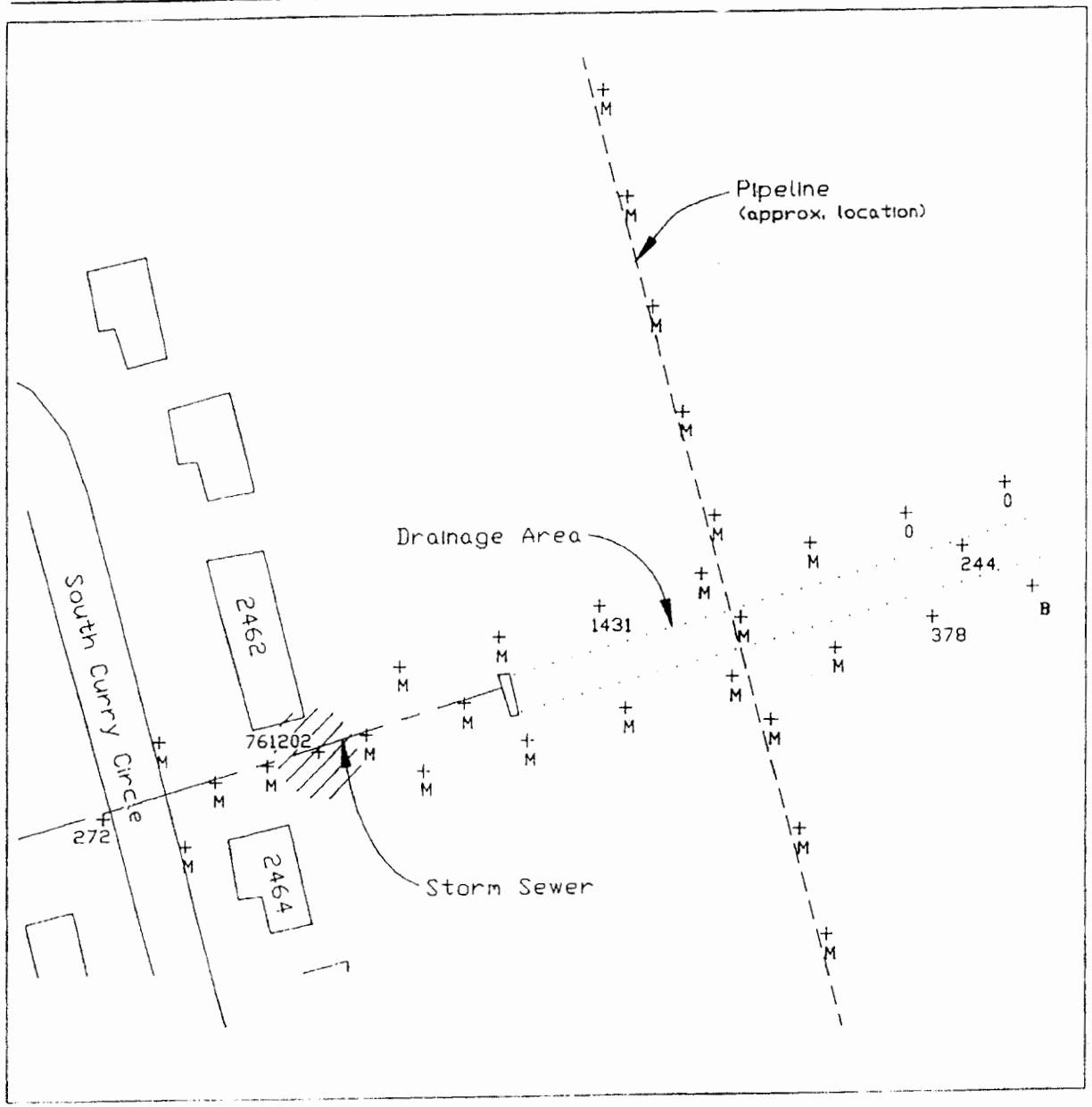
Radian Corporation

Relative Response
C_6 – C_9 Aromatic Hydrocarbons

Site 12
Holloman Air Force Base, Alamogordo, NM

Plate 9

December 14, 1992



NERI
605 Parfet Street
Suite 100
Lakewood Colorado 80215
(303) 238-0090
176930E

LEGEND

Ion Counts:

≥ 2,000

\+ Petrex Sample Location

B Broken Sampler, No Data

M Missing Sampler, No Data

N

0 37.5 75
FEET

Radian Corporation

Relative Response

C_8 – C_{13} Petroleum Hydrocarbons

Site 12

Holloman Air Force Base, Alamogordo, NM

Plate 10

December 14, 1992

Appendix A-8-2

Portions of: *Draft Final Preliminary Assessment and Site Investigation Report, Investigation of Four Waste Sites, Holloman Air Force Base, NM,* Radian Corporation, November 1993

DCN 93-269-069-23-02
RCN 269-069-23-07

PRELIMINARY ASSESSMENT AND SITE INVESTIGATION REPORT

INVESTIGATION OF FOUR WASTE SITES HOLLOMAN AIR FORCE BASE, NM

DRAFT FINAL

Prepared for:

49 CES/CEV
Holloman Air Force Base, NM

and

HQ ACC/DEVC
Langley Air Force Base, VA

Prepared by:

Radian Corporation
8501 N. MoPac Boulevard
P.O. Box 201088
Austin, Texas 78720-1088
512/454-4797

Under Contract No. DACW45-91-D-0018 with:

US Army Corps of Engineers
Omaha District
Omaha, Nebraska

November 1993

Section 4
SITE SS-12—JP-4 FUEL LINE SPILL SITE

Section 4 details the results of the IRP site investigation for Site SS-12.

4.1 Site Description

The JP-4 Fuel Line Spill Site is located immediately east of the main Base housing area near the Standard Transpipe JP-4 pipeline, the main pipeline serving the petroleum, oil, and lubricant (POL) area. Site features are illustrated in Figure 4-1.

In 1975, approximately 2000 gal. of JP-4 were spilled at the site. The spill was the result of a rupture in the fuel line from excessive pressure. The majority of the fuel was reportedly recovered when it collected in a pit and was pumped into a tank truck shortly after the spill. The date of occurrence, the quantity of fuel spilled, and the location of the spill could not be confirmed during the literature search.

In early 1992, an alleged fuel product was encountered while digging a trench for a storm sewer being installed approximately 250 ft west (hydrologically upgradient) of the pipeline.

4.2 Site Investigation

This investigation focused on two principal areas of possible contamination:

1. The segment of the JP-4 pipeline that ruptured in 1975 (BH-12-01, 02, 04, and 05); and
2. An area where the alleged fuel product was encountered during storm sewer installation (BH-12-03 and 06).

Soil and groundwater sampling locations are shown in Figure 4-1 (see Section 8 for explanation of symbols). A total of

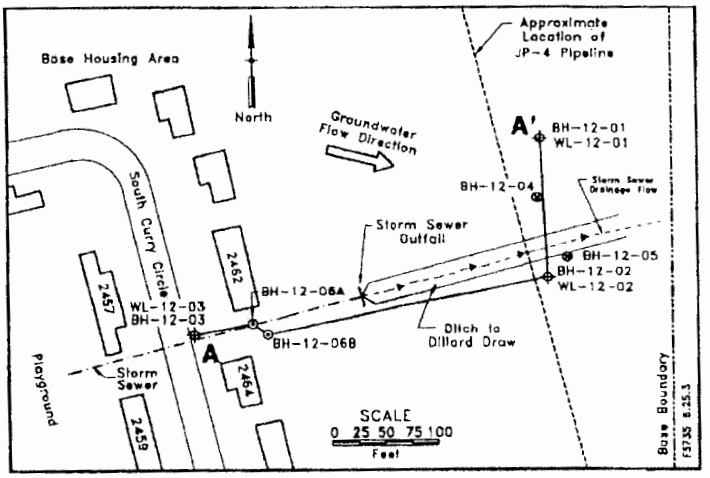


Figure 4–1 Site SS-12 Features

Table 4-1
Site SS-12 Investigation Summary

Suspected Contaminants	Types of Samples Collected	Results Summary
JP-4	One soil sample each from six soil borings	Kerosene in 1 sample; unidentified organics in diesel analysis in 1 sample*
		Unidentified organics in diesel analyses for 2 wells*
	One groundwater sample each from three groundwater monitoring wells	Toluene in 1 well; possible (unconfirmed) toluene in 1 other well†
		Benzene in WL-12-01 and 12-02
		Ethylbenzene, xylenes, and gasoline in WL-12-02

Note—Samples were analyzed for total fuel hydrocarbons (TFH). *Diesel analyses of both soil and groundwater samples showed the presence of organic species not matching the diesel pattern. †Toluene result did not meet confirmation criteria, indicating probable presence of compound other than toluene.

six soil samples and three groundwater samples were collected at Site SS-12 and submitted for chemical analysis. Table 4-1 lists the nature of the contaminants of concern, types of samples collected, and a summary of results for Site SS-12. Soil gas surveys were conducted at the site in November 1992, and results were reported in the *CDAP* (Radian, 1993).

Three of the soil borings were completed as monitor wells. The wells were installed in potential source areas to determine local groundwater flow direction and whether there has been a release to groundwater. Results of both the soil and groundwater analyses are summarized in Tables 4-2 and 4-3, respectively.

Table 4-2
Concentrations of TFH Analytes in Site SS-12 Soils

		SW8015ME—Extractable Fuel Hydrocarbons (µg/g)			
	Depth	Diesel		Kerosene	
Location	(ft)	Result	(RL)	Result	(RL)
BH-12-01	0–2	ND	(3.2)	ND	(6.5)
BH-12-02	0–2	ND	(3.1)	35	(6.1)
BH-12-03	3–5	ND	(3.1)	ND	(6.2)
BH-12-04	1.5–2	ND	(3.0)	ND	(6.0)
BH-12-05	0.5–1	ND	(3.2)	ND	(6.5)
BH-12-06	2–4	3.1[GB•]	(2.9)	ND	(5.8)

Note—RL = Reporting limit. ND = Not detected. Refer to Chapter 8 for explanation of footnote(s).

Table 4-3
Concentrations of TFH Analytes in Site SS-12 Groundwater

	SW8015ME* (µg/L)		SW8015MP—Purgeable Fuel Hydrocarbons (µg/L)									
	Diesel		Benzene		Ethylbenzene		Gasoline		Toluene		Xylenes (total)	
Location	Result	(RL)	Result	(RL)	Result	(RL)	Result	(RL)	Result	(RL)	Result	(RL)
WL-12-01	ND	(48)	0.49[C•]	(0.3)	ND	(0.3)	ND	(50)	0.66[C•]	(0.3)	ND	(0.5)
WL-12-02	170[GB•]	(48)	0.4[C•]	(0.3)	3.6[C]	(0.3)	670[G]	(50)	5.3[GB]	(0.3)	1.2[G•]	(0.5)
WL-12-03	170[GB•]	(40)	ND	(0.3)	ND	(0.3)	ND	(50)	ND	(0.3)	ND	(0.5)

Note—RL = Reporting limit. ND = Not detected. Refer to Chapter 8 for explanation of footnote(s).
*Extractable Fuel Hydrocarbons

4.3 Geology and Hydrogeology

The subsurface conditions at Site SS-12 were defined by direct sampling and observation of the drilling operations at the site. Drilling logs located in Appendix B provide a detailed description of site stratigraphy.

To correlate and interpret site stratigraphy, cross section A-A′, presented in Figure 4-2, was constructed from drilling logs and water-level data for Site SS-12. Figure 4-1 shows the location of the cross section. Site stratigraphy consists primarily of clay and clayey sand. Silt and silty sand lenses, ranging in thickness from 4 to 6 ft, are interbedded with the sand and clay in three of the four soil borings. This stratigraphy is typical of the alluvial, eolian, and playa deposits in the Tularosa Basin.

Groundwater occurs in clayey sand in a shallow unconfined aquifer approximately 3 ft BGL. A three-point plot using March 1993 water-level data was calculated to determine local groundwater flow direction and hydraulic gradient. Groundwater flow at the site is to the east–southeast toward Dillard Draw, as shown in Figure 4-1. The magnitude of the hydraulic gradient is approximately 1.8×10^{-3}. All water-level measurements and calculations are provided in Appendix B.

4.4 Conclusions

4.4.1 Presence or Absence of Contamination

Soil

As shown in Table 4-2, kerosene was detected in one soil sample from Site LF-12 (BH-12-02, 0–2-ft depth). Very low levels (just over reporting limit) of unidentified organic compounds eluting in the diesel range were also detected in one soil sample from the 2–4-ft depth at BH-12-06. As discussed in Appendix A, unidentified organic contaminants were detected at similar concentrations in laboratory blanks analyzed together with samples from Site LF-12. Therefore, the unidentified species detected in the sample from BH-12-06 are likely attributable to this low level laboratory contaminantion rather than to the presence of organic compounds in the sample itself. In both the field sample and the blank, the organic compounds detected were not iden-

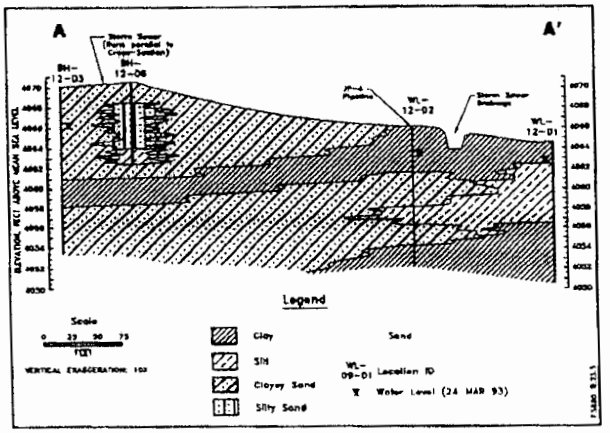


Figure 4–2 Site SS-12 Geologic Cross Section

DRILLING LOG

Project (PROJID)	Location (LOCID)	Inspector	Company (LOGCODE)	Date (LOGDATE)	Sheet 1 of 2
FOUR SITES (HOLL_4S)	BH-12-01	LEM	RADIAN (RAD)	18 FEB 93	

Depth	Graphic Log	Lithologic Description: Main Modifier	Predominant Lithology	Color	Munsell	Grain Size	Grading	Moisture	Plasticity	USCS Class (ASTM)	[redacted] (VVL)	Blow Counts	Sample Interval	Recovery	Observations and Comments
		SILTY	CLAY	BROWN	10YR 4/3			M	LOW	CL	STCL	2,7,7,8	0-2	0.7	
1															
2		SANDY	SILT	BROWN	10YR 5/3	VF	P	M	LOW	ML	SDSL	9,5,4,5	2-4	2.0	
3															WATER AT 3.5 FT.
4												3,2,3,3	4-6	2.0	
5															
6															
7															
8			CLAY	GREYISH BROWN	10YR 5/2			S	HIGH	CH	CLAY				
9															

F3713

DRILLING LOG

Project (PROJID)	Location (LOCID)	Inspector	Company (LOGCODE)	Date (LOGDATE)	Sheet 2 of 2
FOUR SITES (HOLL_4S)	BH-12-01	LEM	RADIAN (RAD)	18 FEB 93	

Depth	Graphic Log	Lithologic Description: Main Modifier	Predominant Lithology	Color	Munsell	Grain Size	Grading	Moisture	Plasticity	USCS Class (ASTM)	(VVL)	Blow Counts	Sample Interval	Recovery	Observations and Comments
												0,0,0,0	10-12	0.3	
11															
12												2,3,2,3	12-14	2.0	
13															
14															TD = 14 FT.
15															
16															
17															
18															
19															

F3713

DRILLING LOG

Project (PROJID)	Location (LOCID)	Inspector	Company (LOGCODE)	Date (LOGDATE)	Sheet
FOUR SITES (HOLL_4S)	BH-12-02	LEM	RADIAN (RAD)	18 FEB 93	1 of 2

Depth	Graphic Log	Lithologic Description: Main Modifier	Predominant Lithology	Color	Munsell	Grain Size	Grading	Moisture	Plasticity	USCS Class (ASTM) [redacted]	[redacted] (VVL)	Blow Counts	Sample Interval	Recovery	Observations and Comments
		SANDY	CLAY	BROWN	10YR 5/3	VF	P	M	LOW	CL	SDCL	3,3,4,4	0-2	2.0	
1															
2												3,3,5,5	2-4	2.0	
3															
		SILTY	CLAY	BROWN	10YR 5/3			M	LOW	CL	SDCL				
4															
		CLAYEY	SAND	BROWN	10YR 5/3	VF	P	M		SC	SDCL	7,8,8,6	4-6	2.0	
5															
6												2,2,2,2	6-8	2.0	
7															
8		SANDY	SILT	GREY	10YR 5/1	F	P	S		ML	SDSL	0,0,0,0	8-10	1.5	FOUL ODOR
9															

F3714

DRILLING LOG

Project (PROJIO)	Location (LOCID)	Inspector	Company (LOGCODE)	Date (LOGDATE)	Sheet 2 of 2
FOUR SITES (HOLL_4S)	BH-12-02	LEM	RADIAN (RAD)	18 FEB 93	

Depth	Graphic Log	Lithologic Description: Main Modifier	Predominant Lithology	Color	Munsell	Grain Size	Grading	Moisture	Plasticity	USCS Class (ASTM) [redacted]	[redacted] (VVL)	Blow Counts	Sample Interval	Recovery	Observations and Comments
11		CLAYEY	SAND	DK. GREY	2.5Y 4/1	F	P	S		SC	SDCL	0,0,1,5	10-12	2.0	FOUL ODOR
12			CLAY	DK. GREY BRN	2.5Y 4/2			S	HIGH	CH	CLAY	0,0,0,0	12-14	2.0	FOUL ODOR LESS DISCOLORATION IN CLAY LAYER
13															
14															TD = 14 FT.
15															
16															
17															
18															
19															

F3714

DRILLING LOG

Project (PROJID)	Location (LOCID)	Inspector	Company (LOGCODE)	Date (LOGDATE)	Sheet
FOUR SITES (HOLL_4S)	BH-12-03	LEM	RADIAN (RAD)	18 FEB 93	1 of 2

Depth	Graphic Log	Lithologic Description: Main Modifier	Predominant Lithology	Color	Munsell	Grain Size	Grading	Moisture	Plasticity	USCS Class (ASTM)	[redacted] (VVL)	Blow Counts	Sample Interval	Recovery	Observations and Comments
		CLAYEY	SAND	DK. GREY BRN	10YR 4/2	F	P	D		SC	SDCL	9,11,6,3	0-2	2.0	ALCOHOL ODOR
1															
2															
3												6,6,10,7	3-5	2.0	
4															
5												1,0,0,0	5-7	1.0	
6															
7															WATER AT 7.5 FT.
8															
9		SANDY	CLAY	LT. GREY	10YR 7/1	F	P	S	LOW	CL	SDCL		8-10		

F3715

DRILLING LOG

Project (PROJID)	Location (LOCID)	Inspector	Company (LOGCODE)	Date (LOGDATE)	Sheet 2 of 2
FOUR SITES (HOLL_4S)	BH-12-03	LEM	RADIAN (RAD)	18 FEB 93	

Depth	Graphic Log	Lithologic Description: Main Modifier	Predominant Lithology	Color	Munsell	Grain Size	Grading	Moisture	Plasticity	USCS Class (ASTM) [redacted]	[redacted] (VVL)	Blow Counts	Sample Interval	Recovery	Observations and Comments
												6,11,16,26	10-12	2.0	STAINED GREY FOUL ODOR
11															
12		CLAYEY	SAND	PALE BROWN	10YR 6/3	F	P	S	LOW	SC	SDCL	7,12,12,15	12-14	2.0	
13															
14															
15												6,13,20,39	14-16	2.0	
16															TD = 16.5 FT.
17															
18															
19															

F3715

DRILLING LOG

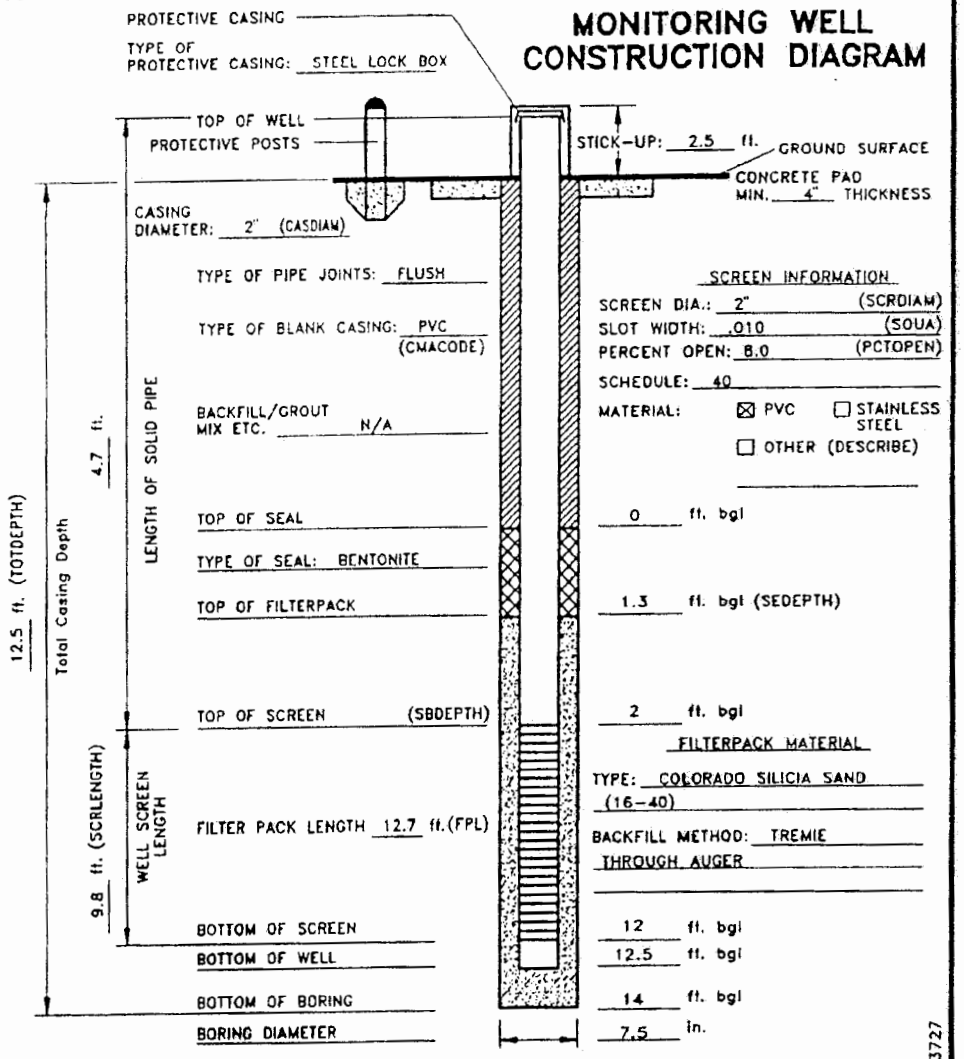
Project (PROJID)	Location (LOCID)	Inspector	Company (LOCCODE)	Date (LOGDATE)	Sheet 1 of 1
FOUR SITES (HOLL_4S)	BH-12-06	LEM	RADIAN (RAD)	18 FEB 93	

Depth	Lithologic Description: Main Modifier	Predominant Lithology	Color	Wunsell	Grain Size	Grading	Moisture	Plasticity	USCS Class (ASTM)	(VVL)	Blow Counts	Sample Interval	Recovery	Observations and Comments
	CLAYEY	SAND	DK. YELLOW BRN	10YR 4/4	F	P	D	LOW	SC	SDCL	6,8,9,11	0-2	2	
2	SILTY	SAND	YELLOWISH BRN	10YR 5/4	F	P	D		SM	SDSL	2,2,2,1	2-4	2	INTERBEDDED WITH CALICHE LAYERS
4														HIT STORM SEWER CONCRETE ON FIRST HOLE -MOVED SOUTH 5 FT.
5											8,6,6,9	4-6	1.5	
7	SANDY	SILT	V. PALE BRN	10YR 8/4	F	P	S	LOW	ML	SDSL		6-8	2	SOME CLAY WATER AT 7 FT.
8														TD 8.0 FT.

F3716

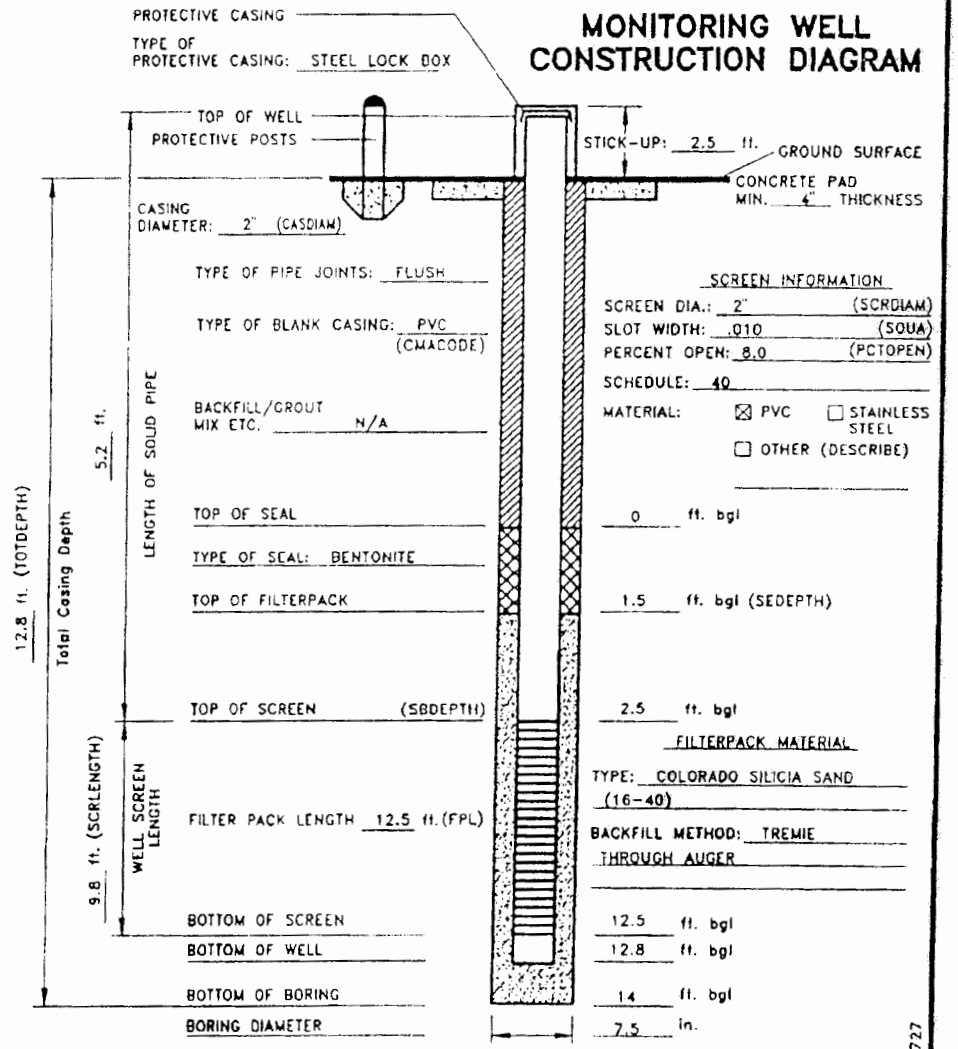
Project (PROJID) HOLLOMAN FOUR SITES (HOLL_4S)	Well I.D. (LOCID) WL-12-01
Well Owner (VVL WELCODE) USAF	Well Type (WL WTCODE) MONITOR WELL (MNW)
Installer LEM	Date Started (INSDATE) 18 FEB 93 / Date Completed 18 FEB 93
Location Coordinates: (NCORD) (North) 667903.12	(ECORD) (East) 556211.81
Elevation Top of Casing (MPELV) 4066.39 FT.	Completion Method (VVL WCMCODE) GRAVEL PACK W/ SCREEN (GS)
Sole Source Aquifer Code (VVL SAQCODE) N/A	
Drilling Method HOLLOW STEM AUGER	Completion Zone (VVL GZCODE) WATER TABLE AQUIFER (W)
Remarks (REMARKS)	

MONITORING WELL CONSTRUCTION DIAGRAM



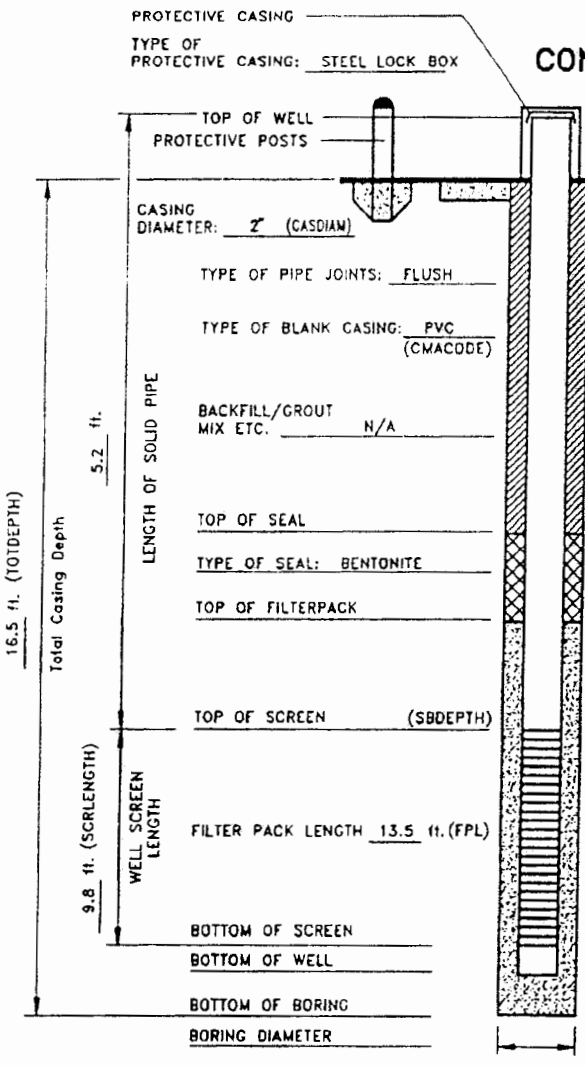
Project (PROJID) HOLLOMAN FOUR SITES (HOLL_4S)	Well I.D. (LOCID) WL-12-02
Well Owner (VVL WELCODE) USAF	Well Type (WL WTCODE) MONITOR WELL (MNW)
Installer LEM	Date Started (INSDATE) 20 FEB 93 — Date Completed 20 FEB 93
Location Coordinates: (NCORD) (North) 667768.80	(ECORD) (East) 556217.94
Elevation Top of Casing (MPELV) 4068.06 FT.	Completion Method (VVL WCMCODE) GRAVEL PACK W/ SCREEN (GS)
Sole Source Aquifer Code (VVL SAQCODE) N/A	
Drilling Method HOLLOW STEM AUGER	Completion Zone (VVL GZCODE) WATER TABLE AQUIFER (W)
Remarks (REMARKS)	

MONITORING WELL CONSTRUCTION DIAGRAM



Project (PROJID) HOLLOMAN FOUR SITES (HOLL_4S)	Well I.D. (LOCID) WL-12-03
Well Owner (VVL WELCODE) USAF	Well Type (WL WTCODE) MONITOR WELL (MNW)
Installer LEM	Date Started (INSDATE) 19 FEB 93 / Date Completed 19 FEB 93
Location Coordinates: (NCORD) (North) 667716.05	(ECORD) (East) 555883.96
Elevation Top of Casing (MPELV) 4069.85 FT.	Completion Method (VVL WCMCODE) GRAVEL PACK W/ SCREEN (GS)
Sole Source Aquifer Code (VVL SAQCODE) N/A	
Drilling Method HOLLOW STEM AUGER	Completion Zone (VVL GZCODE) WATER TABLE AQUIFER (W)
Remarks (REMARKS)	

MONITORING WELL CONSTRUCTION DIAGRAM



Appendix A-8-3

Portions of: *Technical Memorandum, Installation Restoration Program Sites SS-12, SD-27, and OT-45,* Foster Wheeler Environmental Corporation and Radian International, LLC, June 1996

DCN 96-670-008-16

TECHNICAL MEMORANDUM

INSTALLATION RESTORATION SITES
SS-12, SD-27, AND OT-45

Prepared for:

49 CES/CEV
Holloman Air Force Base, NM

and

HQ ACC/CEVR
Langley Air Force Base, VA

Prepared by:

Foster Wheeler Environmental Corporation
143 Union Blvd., Suite 1010
Lakewood, Colorado 80203
303/988-2202

Radian International LLC
8501 North Mopac Blvd.
Austin, Texas 78720
512/454-4797

Under Contract No. DACW45-94-D-0003, DO No. 02, WAD 03 with:

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

June 1996

Table 1-1
Summary of Analytical Results for IRP Site SS-12 *

Location ID	94-12-01						94-12-02			
Beginning Depth—End Depth (ft bgl)	(2-4)		(4-6)		(6-8)		(8-10)		(8-10)		(10-12)	
Volatile Organic Compounds (µg/kg)—SW8240												
Acetone	31 J	(50)	330	(50)	ND	(50)	160	(50)	ND	(50)	ND	(50)
Methylene Chloride	5.2	(5)	4.8 J	(5)	3.5 J	(5)	3.2 J	(5)	ND	(5)	5.6	(5)
Total Recoverable Petroleum Hydrocarbons (mg/kg)—E418.1												
TRPH	590	(25)	110	(25)	ND	(25)	27	(25)	36	(25)	ND	(25)

* Analyses performed by Missouri River Division, Corps of Engineers, Omaha Division Laboratory.

( ) = Detection limit.

ND = Not detected.

J = Estimated concentration; analyte measured below the detection limit.

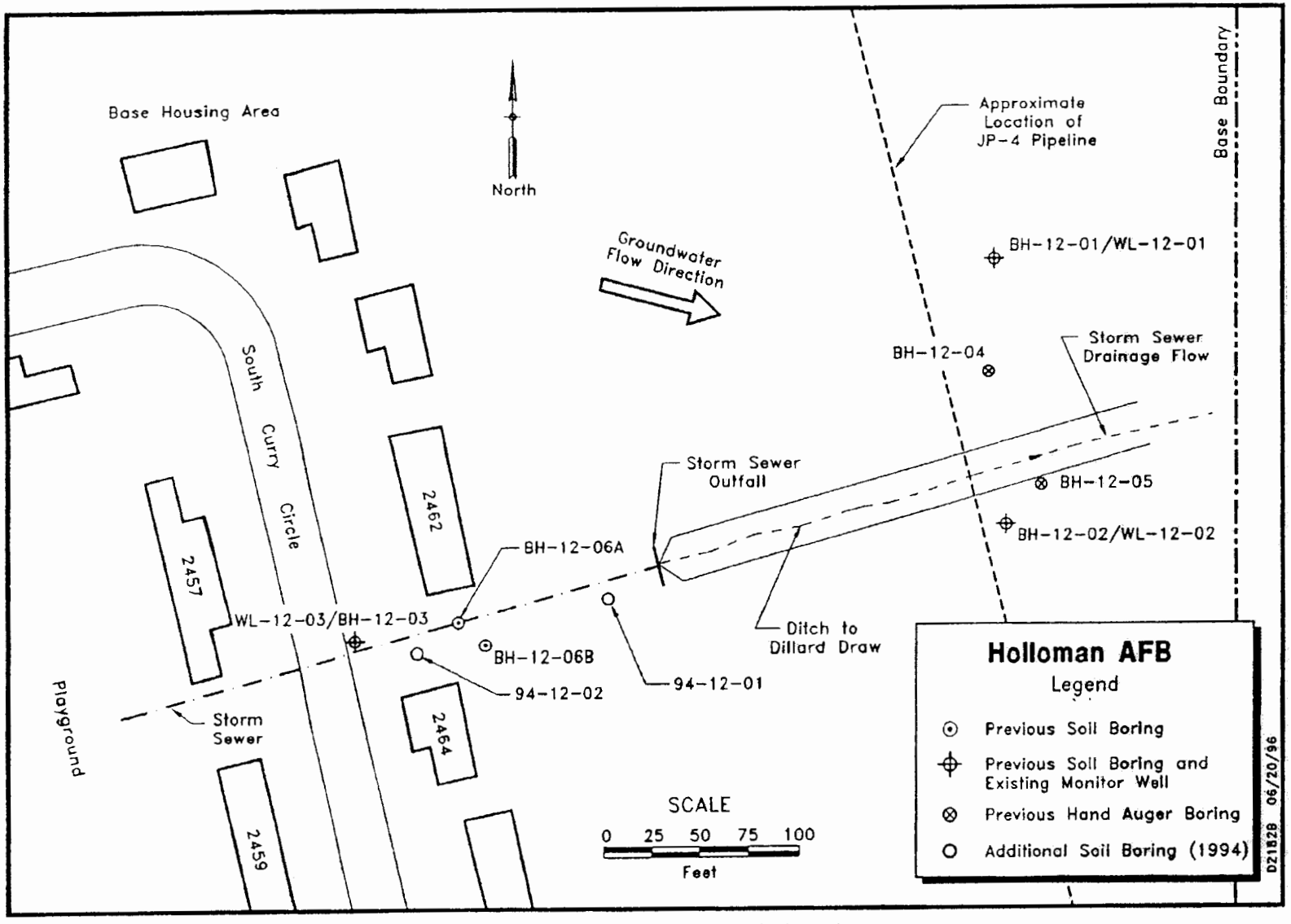


Figure 1-2. IRP Site SS-12 Soil Sample Locations

DPT SOIL BORING LOG

HOLE NO. 94-12-01

1. COMPANY NAME: Radian Corporation	2. DRILLING SUBCONTRACTOR: Target Environmental Services
SHEET 1 OF 1 SHEETS	
3. PROJECT	4. LOCATION: Holloman AFB, New Mexico
5. NAME OF DRILLER: T. RODEFFER	6. MANUFACTURERS DESIGNATION OF DRILL: GEOPROBE (DPT)
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: GEOPROBE; PERMANENT POINT; EW ROD; CONTROL ROD; 2' SOIL SAMPLER ACS; ACETATE ~~SAMPLER~~ LINER	8. HOLE LOCATION: IRP #12
	9. SURFACE ELEVATION
	10. DATE STARTED: 11/3/94
	11. DATE COMPLETED: 11/3/94
12. OVERBURDEN THICKNESS: NA	15. DEPTH GROUNDWATER ENCOUNTERED: ~6.5'
13. DEPTH DRILLED INTO ROCK: NA	16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED
14. TOTAL DEPTH OF HOLE: 10'	17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY)

18. GEOTECHNICAL SAMPLES	DISTURBED	UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES
		418.1	

20. SAMPLES FOR CHEMICAL ANALYSIS	SW 8240	~~METALS~~	SW 8270	SW 8080	TCLP	21. TOTAL CORE REC.
12	✓	✓	✓			

22. DISPOSITION OF HOLE	BACKFILL	MONITORING WELL	OTHERS (SPECIFY)	23. SIGNATURE OF INSPECTOR
	✓			[signature]

BKGD

$H_{m4} = 4m^2$

GRAPHIC LOG	DEPTH a	DESCRIPTION OF MATERIALS c	REMARKS d	CORE SCREEN (ppm) e	HEAD-SPACE (ppm) f	ANALYTICAL SAMPLE NO. g	PENETRATION RATE	RECOVERY
	0	PREPUNCHED HOLE TO 2' NO SAMPLE TAKEN				1525	HARD	
	2	SILTY SAND W/GRAVEL, DK. YELLOWISH BROWN, (10YR 4/4) DAMP, SOFT-FIRM, FINE-GRAINED, POORLY SORTED, ANG. HOMO., NONPLAS (SP-SM)	** see below	4.5	5.0	1610 94-SO-IRP12-01-01	MOD	1.5'/2'
	4	SAME AS ABOVE, CONTACT @ 5.8' SILTY SAND W/GRAVEL, V. DK. GRAYISH BROWN (10YR 3/2) DAMP, FINE-GRAINED, POORLY SORTED, HOMO SOFT, NONPLAS (SP-SM)	VISIBLE STAIN @ 5.8'	6.4	6.0	1637 94-SO-IRP12-01-02	MOD	1.5'/2'
	6	SILTY SAND, V. DARK GRAYISH BROWN, (10YR 3/2) SAT., SOFT, FINE-GRAINED, POORLY SORTED, HOMO, NONPLAS (SP-SM) CONTACT @ 6.2', SILTY SAND, LT. BROWNISH GRAY (10YR 6/2) SAT., V. SOFT, FINE-GRAINED POORLY SORTED, HOMO, NONPLAS (SP-SM)	VISIBLE STAIN ENDS @ 6.2'	6.2	5.6	1540 94-SO-IRP12-01-03	EASY	2'/2'
	8	SAME AS ABOVE		6.2	5.8	1600 94-SO-IRP12-01-04	EASY	2'/2'
	10	T.D. = 10'						

PROJECT: | HOLE NO.:

** Hole originally started @ 6 ft. Since saw staining @ 6 ft., took samples from 2-4' and 4-6 from hole adjacent (6") to original location.

DPT SOIL BORING LOG

HOLE NO. 94-12-02

1. COMPANY NAME: [illegible]
2. DRILLING SUBCONTRACTOR: Target Environmental Services
SHEET 1 OF 2 SHEETS
3. PROJECT:
4. LOCATION: Holloman AFB, New Mexico
5. NAME OF DRILLER: T. RODEFFER
6. MANUFACTURERS DESIGNATION OF DRILL: GEOPROBE
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: GEOPROBE PERM. POINT, EQ. ROD, CONTROL ROD, 3' SOIL SAMPLER ACETATE ~~SA~~ LINER
8. HOLE LOCATION: IRP # 12 NEXT TO HOUSE
9. SURFACE ELEVATION:
10. DATE STARTED: 11/3/94
11. DATE COMPLETED: 11/3/94
12. OVERBURDEN THICKNESS: N/A
13. DEPTH DRILLED INTO ROCK: N/A
14. TOTAL DEPTH OF HOLE: 12'
15. DEPTH GROUNDWATER ENCOUNTERED: ~~[illegible]~~ ~9.5'
16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED:
17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY):
18. GEOTECHNICAL SAMPLES: DISTURBED / UNDISTURBED
19. TOTAL NUMBER OF CORE BOXES:
20. SAMPLES FOR CHEMICAL ANALYSIS: 6 — 418.1 ✓, SW 8240 ✓, SW 8270 ✓, Metals, TCLP
21. TOTAL CORE REC.: BKGD H_{mu} = 4.5 ft
22. DISPOSITION OF HOLE: BACKFILL ✓, MONITORING WELL, OTHERS (SPECIFY)
23. SIGNATURE OF INSPECTOR: Andrew C. Steff

GRAPHIC LOG	DEPTH e	DESCRIPTION OF MATERIALS c	REMARKS d	CORE SCREEN (ppm) e	HEAD-SPACE (ppm) f	ANALYTICAL SAMPLE NO. g	PENETRATION RATE	RECOVERY
	0–6	Pre punched to 6.0' No samples taken.						
	6–8	No soil in sampler; proceed to next interval as per Jim Rowe's instructions. Some sample on tip; silty sand, pink, (5YR 8/4) damp, fine grained				1435	MOD	0'/2'
	8–10	Silty sand, light gray (10YR 7/2) ~~damp~~ wet sat., soft, fine-grained, poorly sorted, homo., non plas. (SP-SM)	GRAY STAIN	4.5	6.0	1445 94-SO-IRP12-02-01	SOFT	2'/2'

PROJECT: | HOLE NO.:

DPT SOIL BORING LOG

1. COMPANY NAME: Radian Corporation
2. INSPECTOR: ACS
HOLE NO.: 94-12-02
SHEET 2 OF 2 SHEETS

GRAPHIC LOG	DEPTH a	DESCRIPTION OF MATERIALS c	REMARKS d	CORE SCREEN (ppm) e	HEAD-SPACE (ppm) f	ANALYTICAL SAMPLE NO. g	PENET-RATION RATE	REC-OVERY
		SILTY SAND, Lt GRAY (10YR 7/2) DAMP, SOFT-FIRM, FINE-GRAINED, POORLY SORTED, Homo, NONPLAS (SP-SM) CONTACT @ 11.8	GRAY STAIN ENDS @ 11.8'	4.6	5.0	1500 94-SO-IRP12 -02-02	Mod	2'/2'
	12	SILTY SAND, PINK (7.5YR 8/4) SAT., FIRM FINE-GRAINED, POORLY SORTED, Homo. NONPLAS. (SP-SM)						
		T.D = 12'						
	14							
	16							
	18							
	20							
	22							
	24							
	26							
	28							

PROJECT: Holloman AFB Table 3 RFI

HOLE NO.:

Appendix A-9-1

Portions of: *Installation Restoration Program Records Search For Holloman Air Force Base, New Mexico*, CH_2M Hill, August 1983

File: R.L. 17A

181

INSTALLATION RESTORATION PROGRAM RECORDS SEARCH

For Holloman Air Force Base, New Mexico

CH2M HILL

Prepared for

AIR FORCE ENGINEERING AND SERVICES CENTER
DIRECTORATE OF ENVIRONMENTAL PLANNING
TYNDALL AIR FORCE BASE, FLORIDA 32403
AND
TACTICAL AIR COMMAND
DIRECTORATE OF ENGINEERING AND ENVIRONMENTAL PLANNING
LANGLEY AIR FORCE BASE, VIRGINIA 23665

AUGUST 1983

The overall score for this site was 43. The disposal of small confirmed quantities of hazardous waste resulted in a waste characteristics subscore of 60. A pathways subscore of 51 was given to the site.

k. Site No. 18--Chromic Acid Spill Site

The Chromic Acid Spill Site (overall score of 45) is located near Building 281 in the Main Base Area.

The 479th CRS maintained a chrome plating shop in Building 281 until the late 1970's. When the operation was discontinued, the full chromic acid vats were temporarily stored on the south side of the building. It is estimated that approximately 500 gallons of chromic acid were spilled on the ground in this storage area with some of the acid reaching the surface drainage ditch just west of the storage area. In 1982, ten yellow stained soil samples were collected and composited for hexavalent chromium analysis. The E.P. extraction quantity of hexavalent chromium found in the composite sample was equivalent to 0.600 mg/l.

The overall rating for this spill site was 45. A waste characteristics subscore of 60 was assigned as a result of the small confirmed disposal of hazardous waste materials. Due to the proximity of the surface drainage ditch (less than 50 feet), the pathways subscore was 57.

l. Site No. 20--Wastewater Treatment Plant Grit Burial Site

From 1942 to the present, all settled solids from the grit chamber located at the head of the waste treatment lagoons have been buried in shallow excavation pits (overall score of 33) just east of the fence surrounding the

Appendix A-9-2

Portions of: *Installation Restoration Program Phase II – Confirmation/Quantification Stage 1, Report (April 1984 to March 1985) for Holloman Air Force Base, New Mexico 88330,* Dames & Moore, March 6, 1987

INSTALLATION RESTORATION PROGRAM
PHASE II - CONFIRMATION/QUANTIFICATION
STAGE 1

REPORT (APRIL 1984 TO MARCH 1985)

FOR

HOLLOMAN AIR FORCE BASE
NEW MEXICO 88330

HEADQUARTERS TACTICAL AIR COMMAND
COMMAND SURGEON'S OFFICE (HQ TAC/SGPB)
BIOENVIRONMENTAL ENGINEERING DIVISION
LANGLEY AIR FORCE BASE, VIRGINIA 23665-5001

MARCH 6, 1987

PREPARED BY

DAMES & MOORE
1550 NORTHWEST HIGHWAY
PARK RIDGE, ILLINOIS 60068

USAF CONTRACT NO. F33615-83-D-4002, DELIVERY ORDER NO. 0025

APPROVED FOR PUBLIC RELEASE; DISTRIBUTION IS UNLIMITED

USAFOEHL TECHNICAL PROGRAM MANAGER

LT. COL. EDWARD BARNES
USAFOEHL/TS

USAF OCCUPATIONAL & ENVIRONMENTAL HEALTH LABORATORY (USAFOEHL)
TECHNICAL SERVICES DIVISION (TS)
BROOKS AIR FORCE BASE, TEXAS 78235-5501

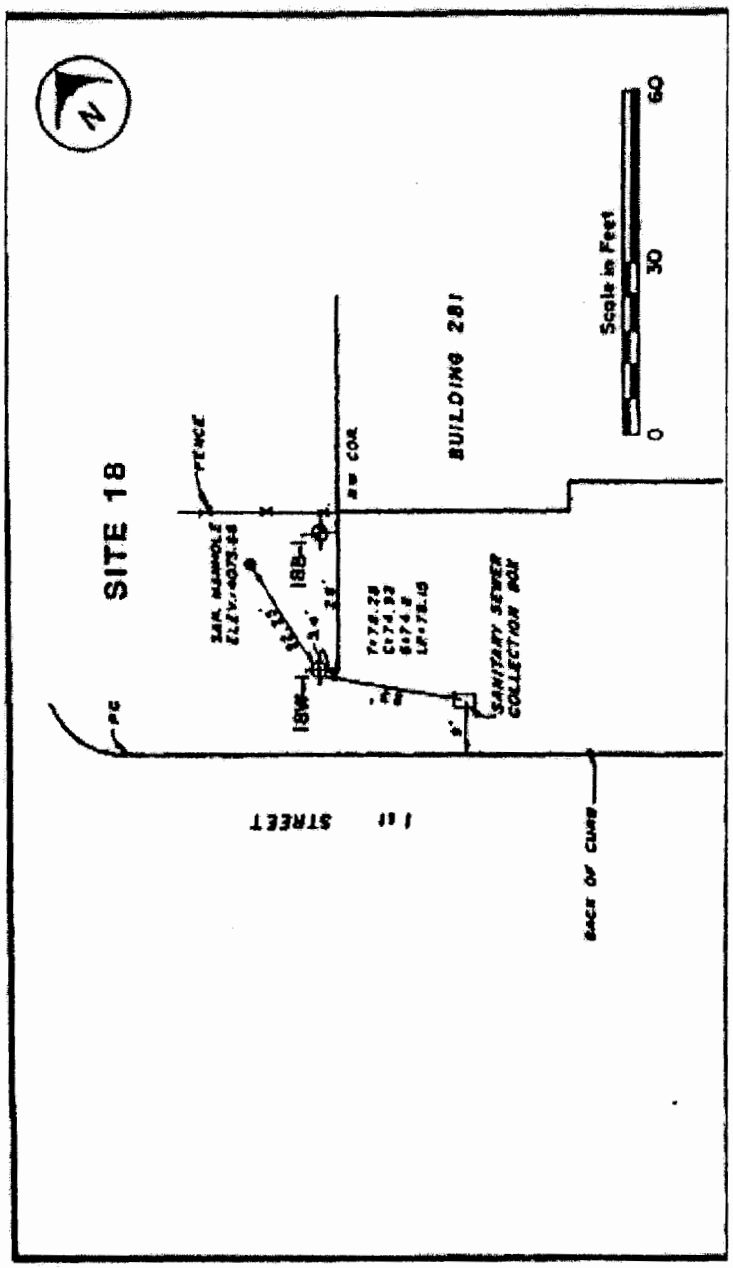


Fig. 10 SS-18 Site Map

Railroad	Water
Fence	Building
Storm Drain	ERP Site
Drainage Channel	Area of Concern
Stream	Area of Contamination

N

0 300 600

Feet

Holloman Air Force Base
New Mexico

SS-18, CHROMIC ACID SPILL SITE

Figure C3-18

UETL ANALYTICAL REPORT
Holloman IRP - Soil Analyses (1)

Parameter	Method	Units	Detection Limit	Date Received	Date Analyzed	18B1 0-1'	18B1 2.5-4'	18B1 5-6.5'
Chromium	218.1 (2)(4)	mg/L	0.05	10/16/84	12/05/84	*	*	*
Chromium (Hexavalent)	312.B (3)(4)	mg/L	0.004	10/16/84	12/05/84	*	*	*

(1) Results are not corrected for percent moisture.
(2) Methods for Chemical Analysis of Water and Wastes, E600/4-79-020, Revised March 1983, Modified for use with soil samples.
(3) "Standard Methods for the Examination of Wastes and Wastewater," for analysis on Technicon Auto Analyzer II, modified for use with soil samples.
(4) Samples have been extracted for EP Toxicity according to Method No. 1310 published in EPA Publication No. SW-846.
* Denotes value less than the limit of detection.

UBTL ANALYTICAL REPORT
Holloman IRP - Soil Analyses (1)

Parameter	Method	Units	Detection Limit	Date Received	Date Analyzed	18W1 0-1'	18W1 2.5-4'	18W1 5-6.5'
Chromium	218.1 (2)(4)	mg/L	0.05	09/27/84	12/05/84	*	*	*
Chromium (Hexavalent)	312.B (3)(4)	mg/L	0.004	09/27/84	12/05/84	*	*	*

(1) Results are not corrected for percent moisture.
(2) Methods for Chemical Analysis of Water and Wastes, E600/4-79-020, Revised March 1983, Modified for use with soil samples.
(3) "Standard Methods for the Examination of Wastes and Wastewater," for analysis on Technicon Auto Analyzer II, modified for use with soil samples.
(4) Samples have been extracted for EP Toxicity according to Method No. 1310 published in EPA Publication No. SW-846.
* Denotes value less than the limit of detection.

UBTL ANALYTICAL REPORT

Holloman IRP - Soil Analyses (1)

Parameter	Method	Units	Detection Limit	Date Received	Date Analyzed	18B1 Comp	31B2 Comp
Arsenic	7060 (2)(4)	mg/L	0.01	10/04/84	11/12/84	*	*
Barium	7080 (2)(4)	mg/L	0.1	10/04/84	11/12/84	17.	18.
Cadmium	7130 (2)(4)	mg/L	0.01	10/04/84	11/12/84	0.01	0.01
Lead	7421 (2)(4)	mg/L	0.01	10/04/84	11/12/84	*	*
Mercury	7470 (2)(4)	mg/L	0.0001	10/04/84	11/12/84	*	*
Selenium	7740 (2)(4)	mg/L	0.01	10/04/84	11/12/84	*	*
Silver	7760 (2)(4)	mg/L	0.01	10/04/84	11/12/84	0.02	0.02
Chromium	7190 (2)(4)	mg/L	0.05	10/04/84	11/12/84	*	*
Lindane	8080 (2)(4)	µg/L	0.02	10/04/84	11/12/84	*	*
Methoxychlor	8080 (2)(4)	µg/L	0.2	10/04/84	11/12/84	*	*
Endrin	8080 (2)(4)	µg/L	0.02	10/04/84	11/12/84	*	*
Toxaphene	8080 (2)(4)	µg/L	1.	10/04/84	11/12/84	*	*
2,4-D	8150 (2)(4)	µg/L	0.05	10/04/84	11/12/84	*	*
2,4,5-TP (Silvex)	8150 (2)(4)	µg/L	0.05	10/04/84	11/12/84	*	*
Ignitability	(3)(2)			10/04/84	(5)	NI	NI

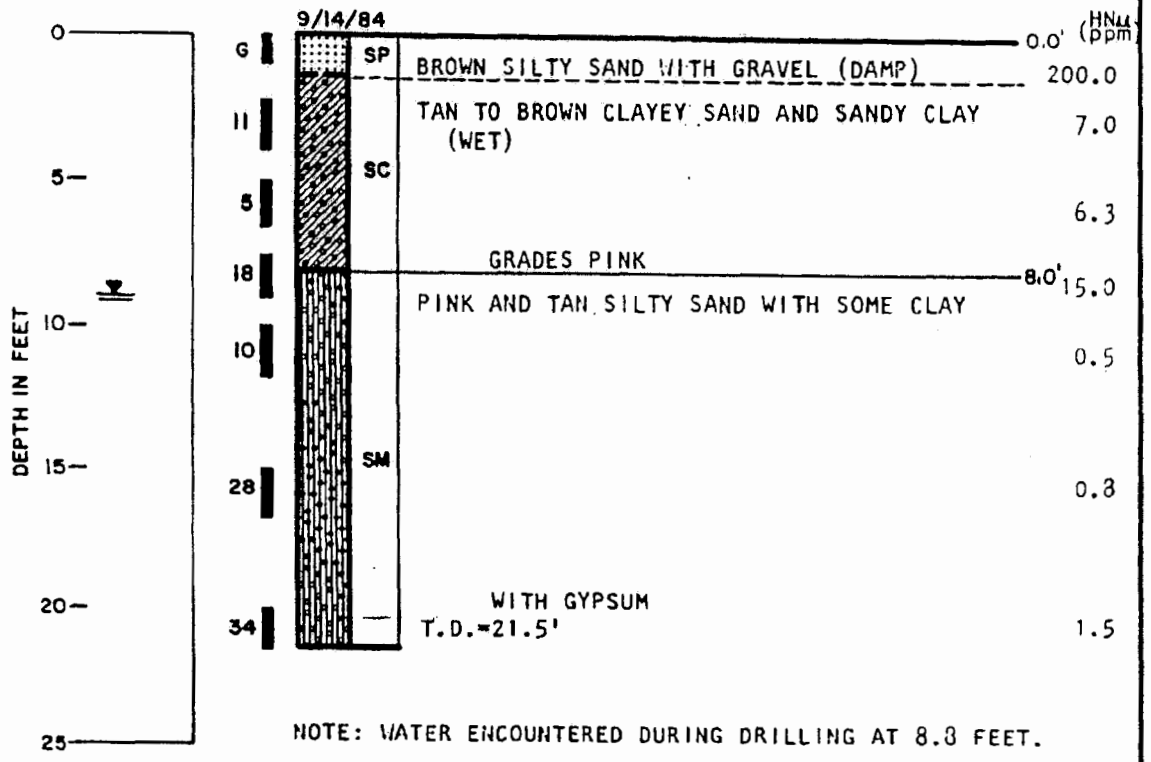
(1) All samples have been extracted for EP Toxicity according to Method No. 1310 published in EPA Publication No. SW-846.
(2) EPA Manual for "Test Methods for Evaluating Solid Waste," EPA Publication No. SW-846.
(3) Section 3 of EPA Publication No. SW-846.
(4) The analytical technique between the SW-846 methods and the methods in "Methods for Organic Chemical Analysis of Municipal and Industrial Wastewater" (EPA-600/4-82-057, July 1982) and "Methods for Chemical Analysis of Water and Wastes" (EPA 600/4-79-020, March 1983) are the same.
(5) Analyzed before 11/30/84.
* Denotes value less than the limit of detection.
NI Denotes the sample was not ignitabile.

UBTL ANALYTICAL REPORT
Holloman IRP - Water Analyses

Parameter	Method	Units	Detection Limit	Date Received	Date Analyzed	1W1	1W2	1W3	51W1	13W1	18W1	31W1	50W1
Arsenic	206.2 (1)	mg/L	0.01	10/04/84	10/29/84	*	*	*		0.01			
Cadmium	213.1 (1)	mg/L	0.01	10/04/84	10/29/84	0.09	0.21	0.24					
Nickel	249.2 (1)	mg/L	0.1	10/04/84	10/29/84	0.2	0.4	0.5					
Lead	239.2 (1)	mg/L	0.01	10/04/84	10/29/84	*	0.03	0.05				*	
Silver	272.1 (1)	mg/L	0.01	10/04/84	10/29/84	0.10	0.18	0.21					
Chromium	218.2 (1)	mg/L	0.1	10/04/84	10/29/84	*	*	*			*		
Chromium (Hexavalent)	312.B (4)	µg/L	4.	10/04/84	10/29/84						7.		
Oil & Grease	413.2 (1)	mg/L	0.6	10/04/84	10/29/84	4.2	3.4	5.3	85.			15	140
T.O.C.	415.1 (1)	mg/L	1.	10/04/84	11/26/84	14.	24.	7.	68.			170	95
T.O.X.	9020 (2)	µg/L	10.	10/04/84	11/27/84	140,000	200,000	220,000	27,000			17,000	120
Phenolics	420.2 (1)	µg/L	10.	10/04/84	11/02/84	*	*	20	290			*	*
Aldrin	608 (5)	µg/L	0.01	10/04/84	11/08/84	*	*	*					* (3)
Dieldrin	608 (5)	µg/L	0.01	10/04/84	11/08/84	*	*	*					*
Endrin	608 (5)	µg/L	0.01	10/04/84	11/08/84	*	*	*					*
Heptachlor	608 (5)	µg/L	0.01	10/04/84	11/08/84	*	*	*					* (3)
Heptachlor Epoxide	608 (5)	µg/L	0.02	10/04/84	11/08/84	*	*	*					* (3)
Lindane	608 (5)	µg/L	0.01	10/04/84	11/08/84	*	*	*					* (3)
Methoxychlor	608 (5)	µg/L	0.02	10/04/84	11/08/84	*	*	*					*
Diazinon	608 (5)	µg/L	0.1	10/04/84	11/08/84	*	*	*					*
Malathion	608 (5)	µg/L	0.1	10/04/84	11/08/84	*	*	*					*
Parathion	608 (5)	µg/L	0.1	10/04/84	11/08/84	*	*	*					*
p,p'-DDT	608 (5)	µg/L	0.02	10/04/84	11/08/84	*	*	*					*
o,p-DDT	608 (5)	µg/L	0.02	10/04/84	11/08/84	*	*	*					*
DDE	608 (5)	µg/L	0.02	10/04/84	11/08/84	*	*	*					*
DDD	608 (5)	µg/L	0.02	10/04/84	11/08/84	*	*	*					*

(1) "EPA Methods for Chemical Analysis of Water and Wastes," EPA 600/4-79-020, Revised March 1983
(2) EPA Manual "Test Methods for Evaluating Solid," SW 846, 2nd Ed., July 1982.
(3) LOD is elevated by 100 due to interfering chromatographic peaks.
(4) "Standard Methods for the examination of Wastes and Wastewater," for analysis on Technicon Auto Analyzer II.
(5) Organochlorine Pesticides and PCBs - Method 608, EPA Manual 600/4-82-057, July 1982.
* Denotes value less than the limit of detection.

HOLLOMAN AFB
BORING 18-BI



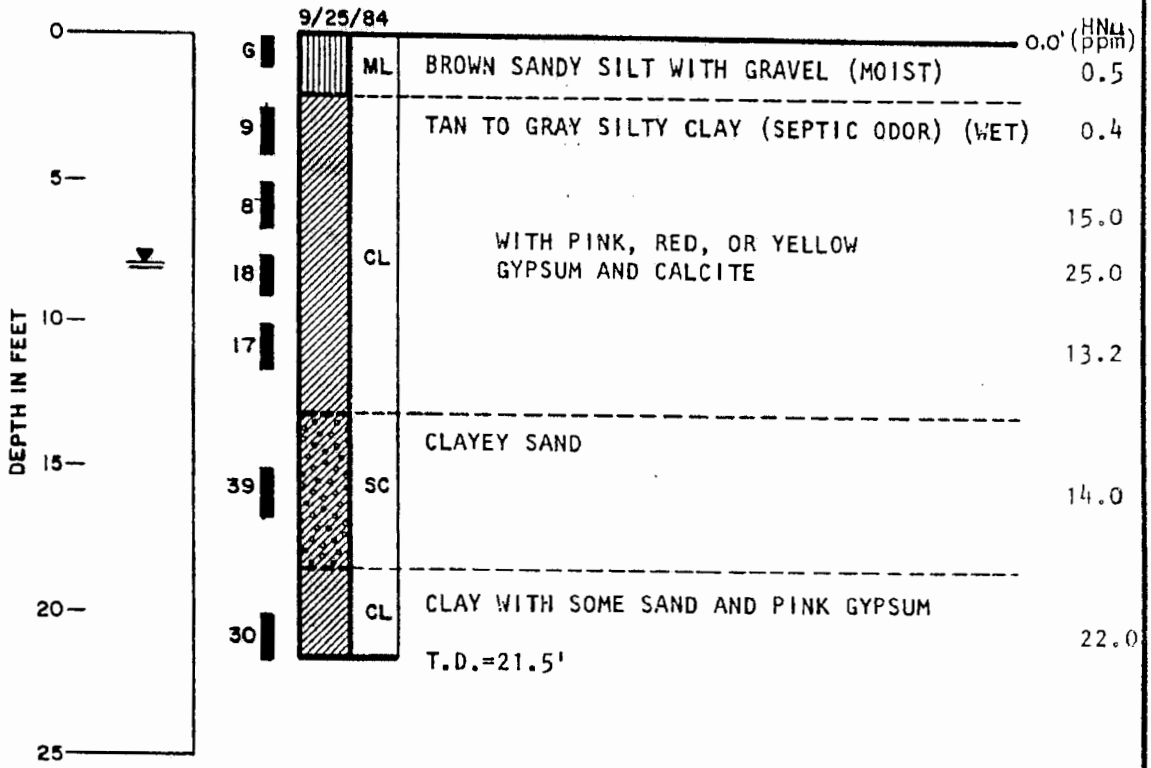
NOTE: WATER ENCOUNTERED DURING DRILLING AT 8.8 FEET.

LOG OF BORING

Dames & Moore

PLATE C-12

HOLLOMAN AFB
BORING 18-W1



NOTE: STATIC WATER LEVEL MEASURED 10/2/84.

LOG OF BORING

Dames & Moore

PIEZOMETER DETAIL INFORMATION SHEET

GROUND SURFACE ELEVATION 4074.8

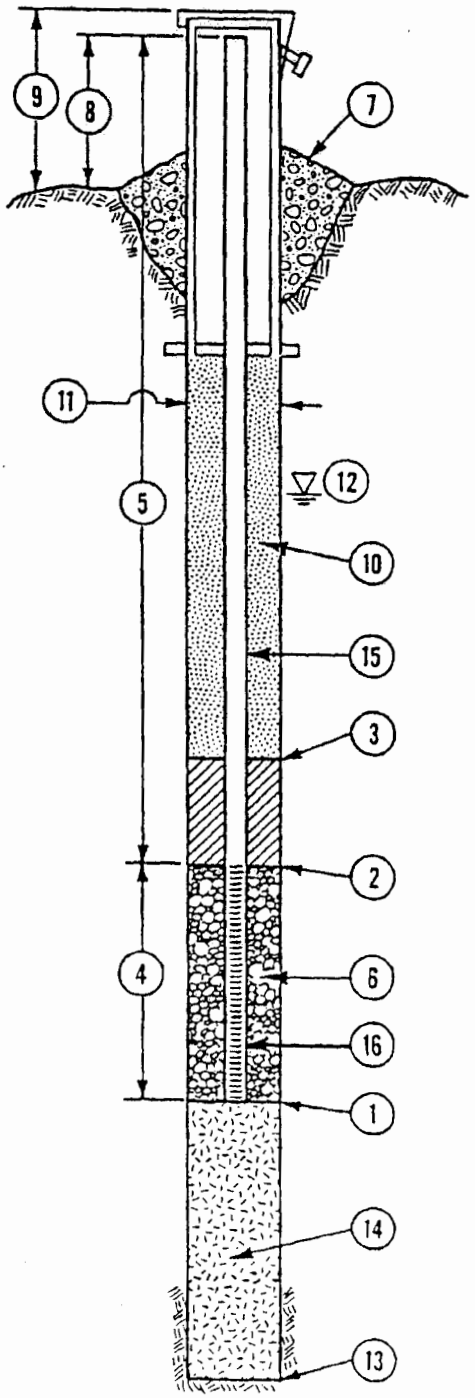
TOP OF WELL CASING ELEVATION 4078.15

JOB NUMBER 01016-210-07

BORING NUMBER 18-W1

DATE 9/25/84

LOCATION Hollomon AFB



1. DEPTH TO BOTTOM OF WELL POINT OR SLOTTED PIPE 21.5 FEET.*
2. DEPTH TO BOTTOM OF SEAL (IF INSTALLED) 8 FEET.*
3. DEPTH TO TOP OF SEAL (IF INSTALLED) 5 FEET.*
4. LENGTH OF WELL SCREEN 10 FEET. SLOT SIZE 0.010.
5. TOTAL LENGTH OF PIPE 23 FEET AT 2 INCH DIAMETER.
6. TYPE OF PACK AROUND WELL POINT OR SLOTTED PIPE gravel.
7. CONCRETE CAP. YES NO (CIRCLE ONE)
8. HEIGHT OF WELL CASING ABOVE GROUND 3.3 FEET.
9. PROTECTIVE CASING? YES NO (CIRCLE ONE) HEIGHT ABOVE GROUND ____ FEET. LOCKING CAP? YES NO (CIRCLE ONE)
10. TYPE OF UPPER BACKFILL concrete.
11. BOREHOLE DIAMETER 7.25 INCHES.
12. DEPTH TO GROUND WATER 8.31 FEET.**
13. TOTAL DEPTH OF BOREHOLE 21.5 FEET.*
14. TYPE OF LOWER BACKFILL none.
15. PIPE MATERIAL Sch 40 PVC. Screw Joint
16. SCREEN MATERIAL Sch 40 PVC. MACHINE CUT

*(DEPTH FROM GROUND SURFACE)

**(DEPTH FROM TOP OF PROTECTIVE CASING)

PIEZOMETER INSTALLATION DETAILS

Dames & Moore

Appendix A-10-1

Portions of: *Draft Final Remedial Investigation (RI) Report, Investigation, Study and Recommendation for 29 Waste Sites, Holloman Air Force Base, NM,* Radian Corporation, June 1992

RADIAN
CORPORATION

DCN 92-269-004-16-07
RCN 269-004-16-06

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Austin, TX 78720-1088
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(512) 454-4797

REMEDIAL INVESTIGATION (RI) REPORT

INVESTIGATION, STUDY AND RECOMMENDATION FOR 29 WASTE SITES HOLLOMAN AIR FORCE BASE, NM

Volume I

DRAFT FINAL

Prepared for:

49 SG/CEV
Holloman Air Force Base, NM

Prepared by:

Radian Corporation
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P.O. Box 201088
Austin, Texas 78720-1088

Under Contract No. DACW45-89-D-0515 with:

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

June 1992

5.0 PRELIMINARY ASSESSMENT REPORT FOR SITE 42 AND SITE 51

This section presents the Preliminary Assessment (PA) for two disposal sites, the Radioactive Waste Burial Site (Site 42) and the Primate Research Lab (PRL) Borehole Disposal Site (Site 51). The task of compiling data for this PA is part of the remedial response process within the U.S. Air Force IRP. This preliminary assessment work has been conducted in accordance with guidelines set forth by the Comprehensive Environmental Response, Compensation and Liability Act of 1980 (CERCLA) as amended by the Superfund Amendments and Reauthorization Act of 1986 (SARA), and as prescribed in *Guidance for Performing Preliminary Assessments Under CERCLA* (U.S. EPA, 1991). The purpose of this PA was to:

- Collect information about conditions at Site 42 and Site 51 to assess the threat posed to human health and the environment; and
- Determine the need for additional CERCLA/SARA or other appropriate action.

The scope of the PA included a review of available file information, a site reconnaissance, and a comprehensive receptor identification. All references cited for the PA (*PA Reference*) are listed in Section 5.3 and contained in Appendix G, Attachment 1. Attachment 2 of the Appendix G contains the PA scoresheets for both sites and Attachments 3 and 4 contain all other supportive material for Sites 42 and 51, respectively.

This section contains site-specific information for Site 42 and Site 51 that includes site description, operational history, waste characteristics, pathway and environmental hazard assessment, and conclusions.

5.1 Site 42, Radioactive Waste Burial Site

5.1.1 Site Description, Operational History, and Waste Characterization

Information about this site was gathered from existing records, telephone conversations with site personnel, and a site reconnaissance. However, because the site has been inactive for years, waste-specific information has not been verified. IRP Site 42 is listed on Table 1 of Holloman's HSWA Permit. Its RCRA name and identification are the Radioactive Waste Disposal Area, SWMU 111.

Location

As shown on the Base map contained in Figure 5-1, Site 42 is located approximately 6.5 miles from the northern outskirts of the Main Base Area. Figure 5-2 shows the physiographic features at the site. The site is located east of Range Road 9 and south of Hay Draw in the undeveloped northeastern area of Holloman AFB. The geographic coordinates are 32° 57' 06" N latitude and 106° 06' 12" W longitude (PA References 1 and 2).

Site Description

Site 42 is located in a secluded area in the North Base on flat terrain that gently slopes to the southwest (PA Reference 1). It consists of a buried concrete cylinder surrounded by a three-strand barbed-wire fence (40 ft x 50 ft x 4 ft) with a three-strand gate on a moveable fence post. Warning signs indicating radioactive waste disposal (in both Spanish and English) are located approximately 10 ft outside each side of the fence (PA References 3 and 4). Figure 5-1 shows a sketch of the site and Figure 5-3 presents photos of the fence and surface features of the buried concrete cylinder.

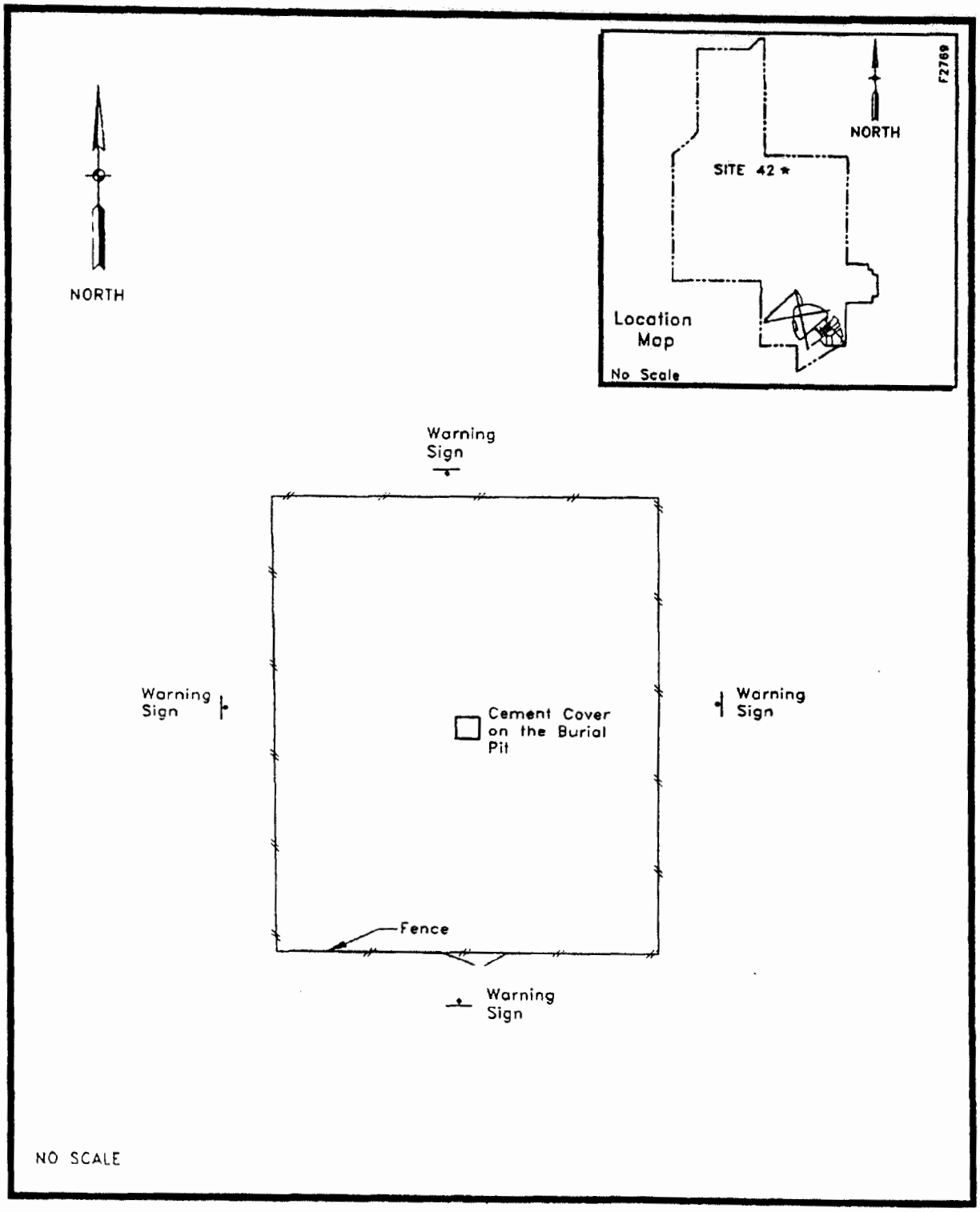


Figure 5-1. Location of Burial Pit at Site 42

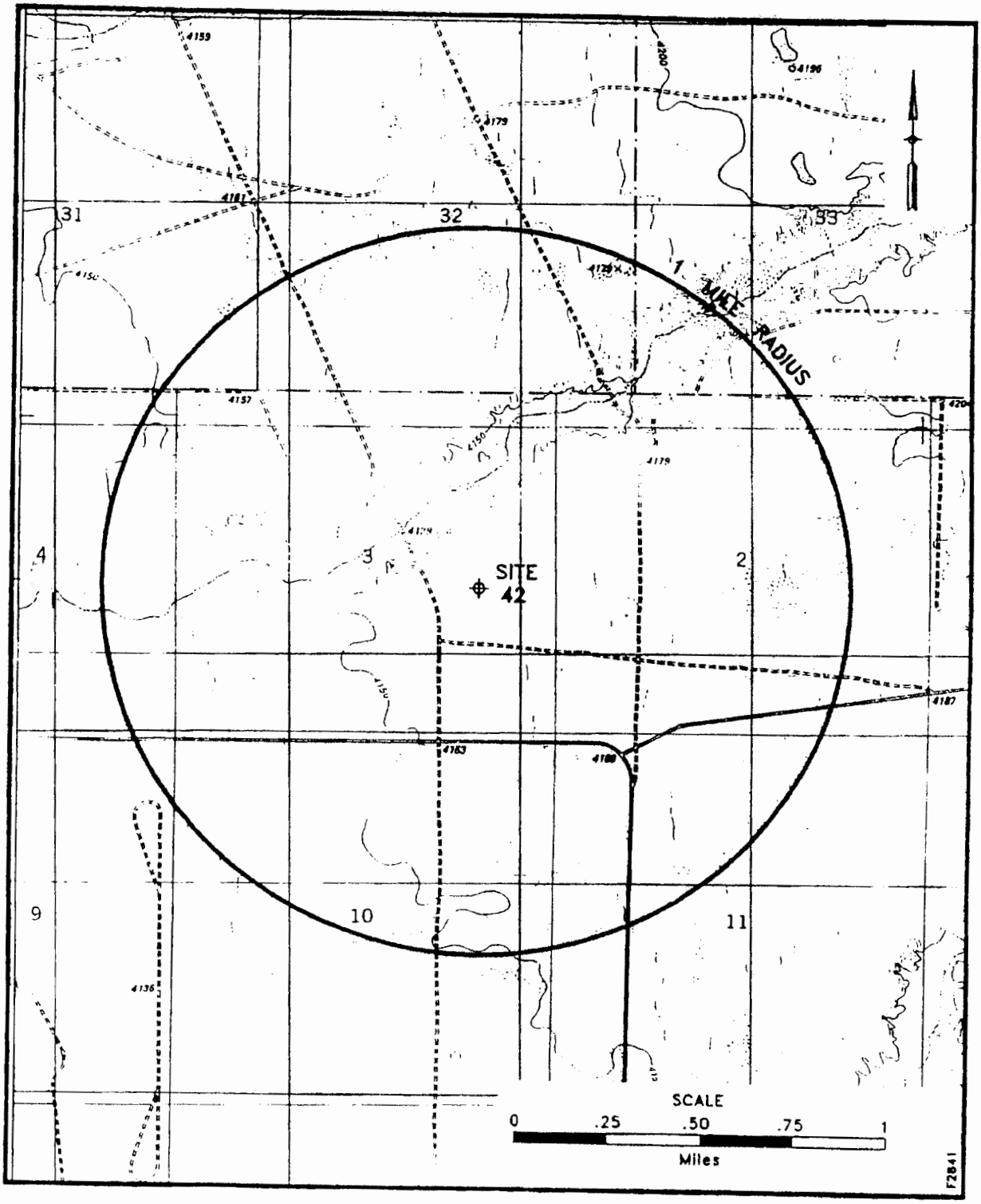


Figure 5-2. Physiographic Map Illustrating Location of Site 42

Warning signs and fence surrounding radioactive waste burial site

3-ft by 3-ft concrete slab indicating the location of the buried concrete cylinder

Figure 5-3. Photos of Site 42

Operational History and Waste Characteristics

Site 42 was created in the 1950s by the U.S. Air Force to bury radioactive waste in accordance with Technical Order TO 00-110A-1 (PA References 5 and 6). This site was closed during or prior to 1959 when the Air Force rescinded general authority to bury radioactive waste (PA Reference 7). It is unknown whether hazardous wastes or constituents were placed in the concrete cylinder along with the radioactive wastes (PA Reference 3).

The buried concrete cylinder contains unknown quantities of wastes. Suspected wastes include animal carcasses containing low-level radioactivity and contaminated pharmaceutical supplies (lab gowns, syringes, etc.) (PA References 8, 9, and 10). This cylinder is 10 ft long, 5.5 ft in diameter, with an opening 8 ft long and 1.5 ft in diameter, and is buried at a depth of 2 to 4 ft. The location, shown in Figure 5-3, is indicated by a 3-ft x 3-ft concrete slab, 4 in. thick (PA Reference 5).

Periodic monitoring (including soil samples and surface readings) conducted by Holloman AFB's Bioenvironmental Engineering (and formerly by Environmental Health Services) has shown normal levels of radioactivity for the site (PA References 7 and 11). Table 5-1 lists results from surface samples taken at the site in February, 1990. The results indicate no significant differences between background radioactivity levels of the soil taken approximately 100 ft southwest of the site and levels found in the soil taken 8 ft southeast of the concrete pad locating the burial site. During Radian's site reconnaissance in February 1991, measurements were taken using portable alpha and beta/gamma detectors (PA Reference 4). The results again indicated background radioactivity levels supporting previous sampling results. Other monitoring results, from 1976 to present, are presented in Appendix G, Attachment 3.

Table 5-1

Site 42 Monitoring Results, February 1991

Constituent	Burial Site Results[a,b]	Background Results[a,c]
Actinium 228	0.9 +/- 0.08	-
Bismuth 212	0.4 +/ 0.2	-
Bismuth 214	0.7 +/- 0.07	-
Cesium 134	<0.041	<0.042
Cesium 137	0.44 +/- 0.038	0.3 +/- 0.032
Cobalt 60	<0.024	<0.019
Gross Alpha	5.9 +/- 4.1	10. +/- 5.4
Gross Beta	12. +/- 0.93	19. +/- 1.1
Lead 212	0.82 +/- 0.06	-
Lead 214	0.68 +/- 0.06	-
Potassium 40	9.9 +/- 0.62	14. +/- 0.67
Radium 226	0.59 +/- 0.4	1.1 +/- 0.42
Thallium 208	0.3 +/- 0.03	-
Thorium 228	0.8 +/- 0.06	-
Thorium 232	0.89 +/- 0.08	0.73 +/- 0.082
Thorium 234	1.1 +/- 0.3	-
Uranium 238	1.2 +/- 0.6	-

[a] Results are in picocuries per gram dried.

[b] Soil sample taken 8 feet southeast of concrete pad (Site 42).

[c] Soil sample taken approximately 100 feet southwest of Site 42.

5.1.2 Groundwater Pathway

Hydrogeologic Setting

Site 42 is located in the Tularosa Basin and has similar geologic and hydrogeologic settings to sites investigated under the RI. For a description of these settings, refer to Subsections 2.2 and 2.3 of the RI Report. These subsections describe the geology and hydrogeology for Holloman AFB including groundwater sources, groundwater use, and well inventories.

Groundwater Targets

The population within the Tularosa Basin (Holloman AFB, White Sands Missile Range Headquarters, and the community of Alamogordo) obtains drinking water from Bonita Lake (60 miles northeast of the basin) and from springs and alluvial sources in the Sacramento, Organ, and San Andres Mountains which are at least 8 miles from the sites (refer to Section 2.3.2). No water supply wells are located on Base because of poor groundwater quality. The nearest production well downgradient of Holloman AFB is a livestock well located 3.5 miles west of the Base (PA Reference 12).

Groundwater Conclusions

A release of hazardous substances from Site 42 to the groundwater is not suspected. Periodic monitoring and sampling of soil indicate that concentrations of radioactive elements present in the site soil are comparable to background concentrations. Because no waste has impacted the soil, it is unlikely that contaminants have migrated to groundwater.

5.1.3 Surface Water Pathway

Hydrogeologic Setting

Tularosa Basin is a closed basin where water is channeled intermittently by draws and arroyos to naturally occurring playa lakes. In the draws and playa lakes, water is lost to evaporation and infiltration. Overland drainage flows west approximately 1000 ft into Hay Draw. This draw flows southwest to the Lost River drainage basin. The basin was formed by damming Lost River to control flooding events (PA Reference 13).

Beyond the dam, Lost River ends 1 mile into the White Sands National Monument (10 miles downstream from Site 42). But because the river is usually dry, water flows into the monument only during extremely heavy rainfall events. Most water is lost to evaporation before it reaches the National Monument.

Surface Water Targets

There are no drinking water intakes or fisheries located anywhere downstream of the site. As stated in Section 5.1.2, the area population receives drinking water from Bonita Lake (60 miles upstream) or from mountain springs (8 miles southeast).

However, the peregrine falcon (federally designated endangered species) has been seen in the general area (PA Reference 14). For a more extensive listing of endangered species inhabiting the surrounding areas, refer to *Holloman AFB Baseline Risk Assessment*, Appendix K, (Radian Corporation, 1992).

Surface Water Conclusions

There is no indication that contaminants have been released from Site 42. Therefore, surface water has not been impacted by the buried waste. Additionally, there are no receptors such as fisheries or drinking water intakes downstream from the site (PA Reference 15).

5.1.4 Soil Exposure and Air Pathways

Physical Conditions

As shown in Figure 5-3, Site 42 has a ground cover consisting of clumps of grass, cacti, and weeds up to 2 ft tall, which adequately protect the soil from erosion (PA Reference 11 and 16). The site, totally enclosed by a fence, is located in a remote undeveloped area of the Base.

Soil and Air Targets

Site 42 has no residents or workers within a 4-mile radius and is located in a remote area.

Soil Exposure and Air Pathway Conclusions

The soil exposure and air pathways for Site 42 pose minimal threats because the waste is encased in concrete, buried under 2 to 4 ft of soil cover at a remote location, and no radioactivity above background valves has been detected.

5.1.5 Summary and Conclusions

In the 1950s, the U.S. Air Force encased an unknown type and quantity of radioactive wastes in a buried concrete container. The site has been periodically monitored and no contamination is present (radioactivity levels at the site are equivalent to levels in the surrounding area). No release to the groundwater, surface water, or air is suspected due to the type of encasement and the site's remote location.

5.1.6 Recommendations

Provided that monitoring (as completed to date by Base Bioenvironmental Engineering) of the site continues, site closeout/no further action appears warranted for Site 42. Appropriate documentation in the form of a Decision Document will be prepared to record and summarize the data presented in this PA. Additionally, Holloman AFB is required to submit a request to EPA Region VI for a Class III permit modification, with appropriate supporting documentation, to terminate the corrective action compliance schedule for SWMU 111.

If future monitoring measurements indicate radioactivity at measurements exceeding background levels, additional investigation of the site is recommended at that time to determine if the measurements are the result of a release from the cylinder.

5.2 Site 51, Primate Research Lab Borehole Disposal Site

5.2.1 Site Description, Operational History, and Waste Characterization

Information for this site was gathered from interviews with past and present employees, existing records, and site reconnaissance. Because records describing disposal

G.3

Background Information for Site 42

PA REFERENCE 3

A.T. Kearney, Inc. RCRA Facility Assessment, Preliminary Review/ Visual Site Inspection Report. Work Assignment No. R26-05-49. St. Paul, Minnesota, 1988. pp 5-332 to 5-334, 7-35 to 7-36

REF 3
PAGE 1 OF 6

RCRA FACILITY ASSESSMENT

PRELIMINARY REVIEW/VISUAL SITE INSPECTION REPORT

Holloman Air Force Base
New Mexico
NM6572124422

Prepared for:

U.S. Environmental Protection Agency
Region VI
1455 Ross Avenue
Dallas, Texas 75202-2733

Prepared by:

A.T. Kearney, Inc.
Three Lagoon Drive, Suite 170
Redwood City, California 94065

and

DPRA Incorporated
245 East 6th Street, Suite 813
St. Paul, MN 55101

Contract No. 68-01-7374
Work Assignment No. R26-05-49

September 1988

REF 3
PAGE 2 OF 6

SWMU 111 - Radioactive Waste Disposal Area

DESCRIPTION

Unit Type: Landfill (IRP Site 42).

Location: Located east of Range Road 9 and south of Hay Draw in northeastern area of Holloman AFB.

Purpose of Unit: Storage of radioactive materials.

Period of Operation: Early 1950s - 1959.

Dimensions/Volume: Materials were buried in a concrete cylinder 10 feet long and 5.5 feet in diameter. Cylinder is buried two to four feet below grade with a four inch thick concrete cover.

Material of Construction: ___ Steel ___ Wood _x_ Concrete
___ FRP ___ Plaster ___ Earthen

Underlain By: ___ Concrete ___ Asphalt ___ Gravel

___ Grass _x_ Soil

Environmental: ___ Indoors _x_ Outdoors _x_ Below Ground

___ In Ground ___ Above Ground

___ Less than 1000 ft to Surface Water

___ Less than 1000 feet to Drinking Water Well

___ Less than 1000 feet to Residences

Details: The cylinder is enclosed in concrete and buried below the ground. A 40 foot by 60 foot barbed wire fence surrounds the site. Signs are posted warning of radioactive waste disposal.

CLOSURE INFORMATION

___ Active
_x_ Inactive/Physically Present
___ Closed Under State or EPA
___ Other

REGULATORY STATUS

___ RCRA
___ State or local permit
_x_ Not regulated

WASTES MANAGED

_x_ Solids	___ Corrosive	___ Organics
___ Liquids	___ Flammable	___ Inorganics
___ Gases	___ Reactive	___ Metals
___ Sludges		

Details: Radioactive wastes; it is not known whether hazardous wastes or hazardous constiuents were disposed with the radioactive wastes.

Source of Wastes: Unknown

Disposition of Waste: Buried wastes at this site have not been removed.

RELEASE CONTROLS

___ Liner	___ Diking	___ Sewer Connection
___ Level Controls	___ Overflow Controls	___ Corrosion Protection
___ Leak Detection	_x_ Cover	

Details: Radioactive materials are contained in a cylinder which has a concrete cover.

MONITORING

_x_ Monitoring Wells	___ Downgradient Wells
___ Upgradient Wells	___ Surface Water Monitoring

Monitoring Frequency: Periodic measurements and soil analyses are conducted. No radioactivity has been detected outside the container.

RELEASE HISTORY

___ Past Release to Air	___ VSI Noted Release to Air
___ Past Release to Soil/Groundwater	___ VSI Noted Release to Soil/Groundwater
___ Past Release to Surface Water	___ VSI Noted Release to Surface Water
___ Past Release to Subsurface Gas	___ VSI Noted Release to Subsurface Gas

VSI Noted Release Conditions: There were no releases observed from the unit during the VSI.

Details of Past Releases: There was no evidence of past releases observed during the VSI or noted in the file information.

REF 3
PAGE 4 OF 6

RELEASE POTENTIAL

Air	_x_ Low	___ Medium	___ High
Soil/Groundwater	_x_ Low	___ Medium	___ High
Surface Water	_x_ Low	___ Medium	___ High
Subsurface Gas Generation	_x_ Low	___ Medium	___ High

Details of Release Potential: Periodic measurements and soil analyses have indicated that there have been no radioactive leaks from the cylinder. It is not known whether hazardous constituents were placed in the cylinder or whether they are properly contained.

REFERENCES: V-1, V-2

PHOTOGRAPHS: 7-11

SWMU 107 - Main Base Substation PCB Disposal Area

Suggested Further Action: An RFI is suggested for this unit. *

Reasons: This area was used for disposal of transformer oils, possibly containing PCBs, directly on the ground surface. There were no release controls associated with this activity and the soil was never cleaned up. Therefore, an RFI is suggested to determine the magnitude and extent of subsurface contamination.

SWMU 108 - MOBSS Landfill Disposal Trench

Suggested Further Action: An RFI is suggested for this unit. *

Reasons: This inactive landfill contains drums of outdated pesticides. The pesticide drums were disposed in unlined trenches and covered. No other release controls were employed. Therefore, subsurface soil sampling is suggested to determine whether releases of hazardous constituents has occurred.

SWMU 109 - Old Base Landfill

Suggested Further Action: An RFI is suggested for this unit. *

Reasons: Domestic wastes, and possibly waste oils and solvents, and incinerator ash has been disposed in this unit. The wastes were placed in unlined trenches in direct contact with soil and then covered. No other release controls were employed at this unit. Therefore, an RFI is suggested to determine the magnitude and extent of the subsurface contamination.

SWMU 110 - POL Rubble Disposal Area

Suggested Further Action: No further action is suggested at this time.

Reasons: The disposal area was used for disposal of wood, sheet metal, wire, and rails. The materials were disposed directly on the ground surface. There is no evidence that hazardous wastes or constituents have ever been managed at this unit.

SWMU 111 - Radioactive Waste Disposal Area

Suggested Further Action: An RFI is suggested for this unit. *

Reasons: Radioactive wastes were placed in a concrete cylinder and buried into the ground at this unit. The containment features of the concrete unit are not known, and it is also not known whether other hazardous wastes or constituents were disposed with the radioactive wastes. Therefore, subsurface soil sampling should be conducted as a part of an RFI to determine whether hazardous constituents have been released.

SWMU 112 - RATSCAT Disposal Area

Suggested Further Action: No further action is suggested at this time.

Reasons: The disposal area formerly contained inert missile debris, guns, aircraft parts, foam, and wood. All wastes were removed from this location, and the area was graded flat. There is no evidence that hazardous wastes or constituents have ever been managed at this unit.

SWMU 113 - Sludge Disposal Trenches

Suggested Further Action: An RFI is suggested for this unit. *

Reasons: Wastes including grease, oily sludge, and wastewater treatment plant sludges were disposed in unlined trenches. The trenches now receive only treatment plant sludge. When a trench is filled it is covered. Therefore, since the grease, oily sludge, and treatment plant wastes may contain hazardous constituents, an RFI is suggested to determine the magnitude and extent of subsurface contamination.

SWMU 114 - Tetraethyl Lead Disposal Area

Suggested Further Action: An RFI is suggested for this unit. *

Reasons: Tetraethyl lead wastes were disposed in an unlined pit in this area and elevated concentration of lead (1,000 ppm) have been detected in soil samples. Therefore, an RFI is suggested to determine the magnitude and extent of subsurface contamination.

SWMU 115 - West Area Landfill #1

Suggested Further Action: An RFI is suggested for this unit. *

Reasons: The known wastes disposed in this landfill included rubbish, plastic sheets, boxes, and empty cans. Several 55-gallon drums containing an unknown waste were also

PA REFERENCE 5

Letter from: Capt. F.R. Sprester, USAF,

Holloman AFB Radiation Protection Section

To: Dr. T. Wolff of the Radiation Protection Section,

New Mexico Environmental Improvement Agency,

Date: 9 September 1977

/SGPM

REF 5

PAGE 1 OF 2

9 September 1977

Dr. Ted Wolff
Radiation Protection Section
Environmental Improvement Agency
P. O. Box 2348
Santa Fe, NM 87501

Dear Sir:

This is to inform you that a radioactive waste disposal site exists on Holloman Air Force Base, New Mexico. If a New Mexico Environmental Improvement Agency permit is required to maintain the site, please notify Environmental Health Services in writing.

The site is located north of the main base area (see Figure 1). It is fenced and has signs erected to prevent unauthorized access. The attached photograph shows the area is isolated with the nearest human activity approximately two miles away.

The site was created in the 1950's. Former Air Force personnel present during the internment operation described the vault to be a concrete cylinder approximately ten feet in length and five and one-half feet in diameter (10'x5½'). The opening of the vault was eight feet in depth and one and one-half feet in diameter (8'x1½').

Investigations by this office indicate that no records of the exact type or quantity of radioactive material were maintained. The cylinder is buried at a depth of 2-4 feet with a concrete cover (3'x3', 4 inches thick) to indicate the exact location.

Environmental Health Services monitors the site on a periodic basis using a AN/PDR-27 and PAC-1S radiacmeter equipment. The last survey was conducted on 23 March 1977 with the following results:

EQUIPMENT	READINGS	TYPE RADIATION
AN/PDR-27	Maximum of 0.04mR/hr	β , γ
PAC-1S	Zero CPM	α

These readings are interpreted to be normal background radiation.

Disinternment of the site is not considered necessary or practical. Removal of buried waste will only be accomplished when there is a mission essential need for the site. All disinternment action will

require approval of headquarters USAF and will comply with Nuclear Regulatory Commission (NRC) rules and regulations.

The general authority to bury radioactive waste was rescinded in 1959 and since then the Air Force has converted to NRC approved contractor disposal.

Should you have any questions concerning the above, please call (505) 479-6511, extension 7461 or 3905.

SIGNED

FORREST R. SPRESTER, Capt, USAF, PSC
Base Radiation Protection Officer

Atch: Figure

PA REFERENCE 6

Letter from: Lt. Gen. R.A. Patterson, USAF, Surgeon General

To: Air Force Commands

Subject: Radioactive Waste Disposal Sites

Date: 16 July 1974

REF 6
PAGE 1 OF 2

DEPARTMENT OF THE AIR FORCE
HEADQUARTERS UNITED STATES AIR FORCE
WASHINGTON, D.C. 20314

REPLY TO ATTN OF: SG

16 JUL 1974

SUBJECT: Radioactive Waste Disposal Sites

TO:

AAC	AFLC	ATC	CINCSAC	MAC	USAFSO
ADC	AFRES	AU	CINCUSAFE	~~TAC~~	USAFSS
AFCS	AFSC	CINCPACAF	HQ COMD USAF	USAFA	

(Surgeon/Civil Engineer)

1. In the early 1950's it was common practice in the United States to bury radioactive waste. The Air Force adopted this practice and developed a technical order (TO 00-110A-1) which specified procedures to be followed. In 1959 the general authority to bury radioactive waste was rescinded and the Air Force converted to a contractor disposal system (TO 00-110N-2).

2. This headquarters directed an Air Force-wide survey to determine the location of these burial sites. Forty-six bases were identified as possessing radioactive burial sites (see Atch 1). This study also indicated there were no records of the exact type or quantity of radioactive material disposed of in the sites. Generally, the buried radioactive waste could be categorized into (a) electron tubes containing radionuclides (b) low level radioactive wastes generated in nuclear weapons maintenance operations, and (c) radioluminescent materials containing radium.

3. Disinterment of all radioactive burial sites is not considered necessary or practical. Removal of buried waste should only be accomplished when there is a mission essential need for the site. When the site location is disposed of as excess property, an attempt will be made to obtain a permanent easement for the burial site. If the prospective property owner is not agreeable to this condition, the site will be disinterred. The Base Civil Engineer, in conjuction with the USAF Radiological Health Laboratory, is responsible for developing disinterment procedures which are consistent with good health physics practices. Material removed will be disposed of in accordance with TO 00-110N-2. Unless there are specific records indicating buried radioactive material was licensed by the Atomic Energy Commission (AEC), no license for the disinterment process will be requested from the AEC. All disinterment actions require prior approval of this headquarters.

4. All existing burial sites will be located on Tab C-1 of the Base Master Plan and accounted for on real property records. Each site will be permanently posted with an appropriate warning sign (see Atch 2).

Underwrite Your Country's Might - Buy U.S. Savings Bonds

REF 6
PAGE 2 OF 2

5. Appropriate Air Force directives will be revised to reflect the policy. This letter expires on 1 July 1975 unless sooner rescinded or superseded.

FOR THE CHIEF OF STAFF

ROBERT A. PATTERSON, Lt General, USAF, MC
Surgeon General

2 Atch
1. List of AF Burial Sites
2. Burial Site Warning Sign

Copy to: AFISC/SG
AFISC/SEL
AFISC/IGM
NGB/SG
AFMPC/SG
ARPC/SG
AFDSDC/SG
AFAFC
DMAAC
USAFSAM/EDEO
AFSC/VN

PA REFERENCE 7

Letter from: 2Lt. R.J. Andreoli, USAF,

Holloman AFB Environmental Health Services Chief

To: Information Office

Subject: Radioactive Waste Disposal Site

Date: 22 January 1980

KAW BURIAL SITE

File 136 cw

REF 7
PAGE 1 OF 1

SGPM/3303/Autovon 867-3303 22 January 1980

Radioactive Waste Disposal Site

Information Office

1. A radioactive waste disposal site is located in the North Area of Holloman AFB, NM. This site was created during the 1950's and closed during or prior to 1959. This was when the Air Force rescinded general authority to bury radioactive waste and converted to a contractor disposal system.

2. The radioactive waste is buried in a concrete cylinder which is ten feet in length and five and one-half feet in diameter. The opening of the cylinder is eight feet in length and one and one-half feet in diameter.

3. The cylinder is buried at a depth of two-four feet with a concrete cover (3' x 3' x 4-inches thick) to indicate the location of the site.

4. The site is in an isolated portion of the base and is fenced in. Warning signs are present and are written in both Spanish and English.

5. This site is periodically monitored by Environmental Health Services. No significant radioactivity has been found by this office during any surveys of the site.

6. If you have any questions, call extension 3303 or autovon 867-3303.

Robert J. Anderoli

ROBERT J. ANDREOLI, 2Lt, USAF, BSC
Chief, Environmental Health Services

Cy to: SG
SGPAE/Langley AFB, Va

PA REFERENCE 8

Memo for the record by: Maj. S.T. Cordts, USAF,

Holloman AFB Bioenvironmental Engineering Chief

Subject: Survey of the Radioactive Waste Burial Site

Date: 12 October 1988

REF 8
PAGE 1 OF 1

Memo for the Record 12 Oct 88

Survey of the Radioactive Waste Burial Site

A survey was performed 5 October 1988 of the identified Holloman radioactive waste burial site by Major Cordts, MSgt Gordon and A1C Baldwin of the Bioenvironmental Engineering Services. No measurements were made of radiation levels during this survey, since radiation levels were measured on 7 Sep 88 by Lt Hewitt and A1C Baldwin and levels at that time were the same as or less than background. During the survey on 5 Oct 88, it was noted that:

The surface appearance of the buried wastes is a concrete slab approximately 4 feet square at the ground's surface, with the words "RADIO ACTIVE" scratched on the surface. There are no protrusions through the slab and no cracks in it. Anecdotal information is that there is a 2 foot diameter steel tube encased in concrete under the slab and it contains animal carcasses which were sacrificed after experimentation with radioactive materials.

The site is surrounded by a 3 strand barbed wire fence in good condition, approximately 4 feet high in a rectangle 30 feet by 50 feet. Approximately 10 feet outside each side of the fence, there is a warning sign (bilingual), warning people of the buried radioactive material and that digging is not allowed unless with the approval of Base Civil Engineers and Base Medical Services. All signs are in very good condition.

Ground cover consists of clumps of grass, cacti and weeds, up to 2 feet tall. There are many rodent holes in the area, including one within a foot of the concrete slab. Measurements of radiation levels at the surface have reportedly never been elevated, though, indicating that the rodents are not bringing radioactive contamination to the surface, even in the unlikely event that the tube and concrete have ruptured.

The site is in a remote desert area, with the closest building estimated to be 2 miles away. Access to the site is by way of a deteriorated gravel road, going approximately 500 yards north of a seldom traveled gravel road. The only routine activity occurring in the area is inspection of a power transmission line, which is approximately 800 yards west of the burial site. (Distances estimated from Sheet 9 of Base Map, scale 1"=400'.)

The next survey is scheduled for September 1989.

Stuart T Cordts

STUART T.CORDTS, Major, USAF, BSC
Chief, Bioenvironmental Engineering

(MFRWASTE)

Atch 2

PA REFERENCE 9

Telephone conversation with: Col. F.R. Sprester,

Former Holloman AFB Bioenvironmental Engineering Chief

Date: 4 April 1992

REF 9
PAGE 1 OF 1

RADIAN CORPORATION

TELEPHONE CALL RECORD
☐ Incoming Call
☐ Outgoing Call

Project No.	
Project Name	Holloman AFB
Date	3 April 92
Time	200pm
Person Calling	Bob Borger
Activity	Radian
Person Called	Col. Forrest Spresser
Activity	March AFB (714)655 3952
General Subject	Past activities at Site 42

Distribution

TOPICS DISCUSSED AND ACTION TAKEN

Col Spresser stated that he conducted interviews with local workers (in the 70's - 76or77) that constructed and filled the concrete encasement/vault. He said that the only materials that were reportedly placed in the vault were monkeys that had been injected with radio isotopes (that died) and the syringes, gowns, and other things that were contaminated. He couldn't remember the types of isotopes (plutonium, uranium?) but he thought that information was written down elsewhere (it isn't). He said to contact Mr. Bob Andreoli for further information.

Signature: RC Borger

9-85-21364

PA REFERENCE 10

Telephone conversation with: Mr. R.J. Andreoli,

Former Holloman AFB Environmental Health Services Chief

Date: 7 April 1992

REF 10
PAGE 1 OF 1

RADIAN CORPORATION

TELEPHONE CALL RECORD
☐ Incoming Call
☐ Outgoing Call

Project No.	
Project Name	HOLLOMAN AFB PA
Date	7 April 92
Time	1400
Distribution	
Person Calling	Bob Borger
Activity	Radian
Person Called	Mr. Bob Andreoli
Activity	White Sands Missile Facility ~~(505) 678 2224~~
General Subject	Prior Activities at Site 42

TOPICS DISCUSSED AND ACTION TAKEN

Mr. Andreoli stated that he, as Col Spresser, believed that the contents of the vault were contaminated, experimented on, monkeys and lab wastes from experimentation. He remembers recommending to have the site exhumed/remediated, but that decision was rejected. So the decision to continue monitoring was made. He also said that drawings of the concrete vault were once at Holloman CE department. But, when he tried to re find them, they were gone. He remembers that the structure was solid concrete with a small open area in the center (as described by Spresser).

Signature: R. L. Borger

9-85-21364

PA REFERENCE 11

Letter from: Lt. Col. S.T. Cordts, USAF,

Holloman AFB Bioenvironmental Engineering Chief

To: 833CSG/DEV

Subject: Survey of the Radioactive Waste Burial Site

Date: 4 June 1990

REF 11
PAGE 1 OF 6

Kall Burial Site

SGPB (7812)

4 June 1990

Survey of the Radioactive Waste Burial Site

833CSG/DEV

1. A survey was performed 15 February 1990 of the identified Holloman Air Force Base radioactive burial site, by Major Stuart Cordts and 2Lt Charles Cole of the Bioenvironmental Engineering Section. The survey was conducted as described in the HQ TAC/SGPB letter 88-38, which references a HQ AFOMS/SGPR letter (attached). Soil samples were taken within the site boundaries and of background soil, and the recently received analysis results are attached. During the survey of 15 Feb 90, it was noted that:

a. The site is surrounded by a 3-strand barbed wire fence approximately 4 feet high in a rectangle approximately 30 feet by 50 feet. A gate consisting of 3-strand barbed wire on a movable fence post is secured by a wire, and thus provides minimally controlled access to the actual site. The fence is in good condition. Warning signs are placed approximately 10 feet outside each side of the fence. The warning signs had proper symbols and lettering and were bilingual. Of the 4 signs, 2 had a bullet hole each but were still legible.

b. The burial site is marked with a cement pad approximately 3 feet square supposedly at the burial location. Surrounding ground cover consisting of clumps of grass, cacti and weeds, up to 2 feet tall, adequately protect the soil from erosion. There are many rodent holes in the area, including an old hole about 8 feet SE of the slab. Measurements were taken with an AN/PDR-27T and AN/PDR-56 at the location of the old burrow hole, and a soil sample was also taken. Measurements were also made and a soil sample taken of a background site approximately 100 feet SW of the burial site. All instrument measurements were "background" and the soil analysis results indicate no significant differences between the soil at the burial site and the background sample.

2. All requirements contained in the HQ TAC/SGPB letter (88-38) were met with the exception of the fencing. The guidance in the higher headquarters policy letter is that the fencing will be anti-personnel fencing such as chain link type fencing. Since I believe only low level radioactive waste in animal carcasses are buried in an encased concrete pipe at the site, such that it

would take much effort to deliberately violate the buried encasement, and since the signs and fencing adequately prevent inadvertent digging, present security is adequate in my opinion. On 4 June 1990, I contacted Lt Colonel David Potts at HQ TAC/SGPB, and he concurred that the barbed-wire fencing met the intent of anti-personnel fencing.

3. If you have any questions or comments about this letter, please contact myself at extension 7812.

Stuart T Cordts

STUART T. CORDTS, Lt Col, USAF, BSC
Chief, Bioenvironmental Engineering

3 Atch
1. Policy Letter
2. Site Soil Sample
3. Background Sample

(Z2:RADFEB90)

REF 11
PAGE 3 OF 6

RADIOLOGICAL SAMPLING DATA

(Use this space for mechanical imprint)

OEHL USE ONLY

WORKPLACE OR SITE IDENTIFIER: 0087

BASE: Holloman AFB

ORGANIZATION:

WORKPLACE OR SITE: Rad. Burial Site

DATE COLLECTED (YYMMDD): 910121 15

TIME COLLECTION BEGAN (24 hour clock): 1030

BLDG NO./LOCATION: NA

ROOM/AREA: NA

MAIL REPORTS TO (Circle if changed)

ORIGINAL	0087	833d Med Gp/SGPB, HAFB, N.M. 88330
COPY 1		
COPY 2		

SAMPLE COLLECTED BY (Name, Grade, AFSC): Stuart T Cordts STUART T. CORDTS, MAJ

SIGNATURE: 9125A

AUTOVON: 867-7812

REASON FOR SUBMISSION: R R

A-ACCIDENT/INCIDENT C-COMPLAINT F-FOLLOWUP/CLEANUP N-NPDES
R-ROUTINE BACKGROUND/PERIODIC SURVEY O-OTHER (Specify)

EMPLOYEE NAME:

EMPLOYEE SSN:

EMPLOYEE WEIGHT: LBS.

AGE:

SEX: ☐ MALE ☐ FEMALE

BASE SAMPLE NUMBER: GS 90 1604

OEHL PID NUMBER (OEHL USE ONLY):

COLLECTION METHOD (enter letter code)
C-Composite
G-Grab
V-Single Void
T-24 Hour Void
W-Wipe/Swipe
O-Other

SAMPLE TYPE (enter letter code)
X-Air, Ambient/Gen. Area
Y-Air, Emission, Source
Z-Air, Breathing Zone
B-Blood
O-Biological, Other
F-Food
G-Gas/Air, Compressed
H-Human
M-Industrial Material
R-Nasal Swab
D-Residue/Ash
L-Sludge
S-Soil
W-Surface Contaminant
C-Unclassified/Other
U-Urine
V-Vegetation
T-Waste, Hazardous, Toxic
N-Water, Nonpotable
P-Water, Potable

PRESERVATION GROUP: N Ø

R1-NITRIC ACID, pH < 2.0 (plastic container) N0-NONE
R2-HYDROCHLORIC ACID, pH < 2.0 (with $Na_2S_2O_3$ in glass container)

ANALYSES REQUESTED

☒ GROSS ALPHA ☐ GAMMA ☐ TRITIUM ☐ PLUTONIUM ☐ RADON ☐ DRINKING WATER STANDARDS (AFR 161-44)
☒ GROSS BETA ☐ CARBON 14 ☐ URANIUM ☐ RADIUM ☐ STRONTIUM
☐ OTHER (specify) Primary Gamma

AIR FILTER DATA	COLLECTION TIME min	FLOW RATE	VOLUME COLLECTED

REMARKS

Location of radioactive burial site. Soil sample 8' SE of SE corner of cement pad. Old burrow soil, no recent animal digging signs anywhere around

Readings on AN/PDR-27T, S/N 1551, were background (< .05 mR/hr).

Readings on AN/PDR-56, S/N 1053, were 0 CPM on lowest scale.

AF FORM 2753 DEC 84 PREVIOUS EDITION WILL BE USED.

REF 11
PAGE 4 OF 6

SAMPLE ANALYSIS RESULTS REPORTED ON 04-MAY-1990
USAF OCCUPATIONAL AND ENVIRONMENTAL HEALTH LABORATORY
BROOKS AIR FORCE BASE, TEXAS 78235-5501

OEHL ID

19000234

833 MEDICAL GROUP/SGPB
HOLLOMAN AFB NM 88330-5300

BASE ADDRESS CODE: R00087Z

IDENTIFICATION:
Base Sample #: GS901604 Burial Site
OEHL ID: 19000234
Type of Sample: SOIL
Workplace or Site ID: 00087 HOLLOMAN AFB, NM
15 Feb 90 Date Collected: 13-FEB-90 Time Collected: 1030
Date Received: 26-FEB-90
Date Completed: 03-MAY-90

SAMPLE WEIGHT 1241 GRAMS DRY.

ACTINIUM 228		0.9	+/-	0.08	PICOCURIES PER GRAM DRIED
BISMUTH 212		0.4	+/-	0.2	PICOCURIES PER GRAM DRIED
BISMUTH 214		0.7	+/-	0.07	PICOCURIES PER GRAM DRIED
CESIUM 134	<	0.041			PICOCURIES PER GRAM DRIED
CESIUM 137		0.44	+/-	0.038	PICOCURIES PER GRAM DRIED
COBALT 60	<	0.024			PICOCURIES PER GRAM DRIED
GROSS ALPHA		5.9	+/-	4.1	PICOCURIES PER GRAM DRIED
GROSS BETA		12.	+/-	0.93	PICOCURIES PER GRAM DRIED
LEAD 212		0.82	+/-	0.06	PICOCURIES PER GRAM DRIED
LEAD 214		0.68	+/-	0.06	PICOCURIES PER GRAM DRIED
POTASSIUM 40		9.9	+/-	0.62	PICOCURIES PER GRAM DRIED
RADIUM 226		0.59	+/-	0.4	PICOCURIES PER GRAM DRIED
THALLIUM 208		0.3	+/-	0.03	PICOCURIES PER GRAM DRIED
THORIUM 228		0.8	+/-	0.06	PICOCURIES PER GRAM DRIED
THORIUM 232		0.89	+/-	0.08	PICOCURIES PER GRAM DRIED
THORIUM 234		1.1	+/-	0.3	PICOCURIES PER GRAM DRIED
URANIUM 238		1.2	+/-	0.6	PICOCURIES PER GRAM DRIED

RESULTS ACCURATE TO 2 SIGNIFICANT FIGURES.
ERROR TERM AT 95% CONFIDENCE LEVEL.

Mark C. Wrobel, Capt, USAF, BSC
Health Physicist
AUTOVON 240-2061

Atch 2

REF H
PAGE 6 OF 6

RADIOLOGICAL SAMPLING DATA

(Use this space for mechanical imprint)

OEHL USE ONLY

WORKPLACE OR SITE IDENTIFIER: 0087

BASE: Holloman AFB

ORGANIZATION:

WORKPLACE OR SITE: Rad Burial Site, Background

DATE COLLECTED (YYMMDD): 910215

TIME COLLECTION BEGAN (24 hour clock): 1045

BLDG NO./LOCATION: NA

ROOM/AREA: NA

MAIL REPORTS TO (Circle if changed)

ORIGINAL	0087	8332 Med Gp/SGPB, HAFB, N.M. 88330
COPY 1		
COPY 2		

SAMPLE COLLECTED BY (Name, Grade, AFSC): STUART T. CORDTS, Major 9125A

SIGNATURE: Stuart T Cordts

AUTOVON: 867-7812

REASON FOR SUBMISSION: BR

A-ACCIDENT/INCIDENT C-COMPLAINT F-FOLLOWUP/CLEANUP N-NPDES
R-ROUTINE BACKGROUND/PERIODIC SURVEY O-OTHER (Specify)

EMPLOYEE NAME:

EMPLOYEE SSN:

EMPLOYEE WEIGHT: LBS.

AGE:

SEX: ☐ MALE ☐ FEMALE

BASE SAMPLE NUMBER: GS 90 1605

OEHL PID NUMBER (OEHL USE ONLY)

COLLECTION METHOD (enter letter code)
C-Composite
G-Grab
V-Single Void
T-24 Hour Void
W-Wipe/Swipe
O-Other

SAMPLE TYPE (enter letter code)

X-Air, Ambient/Gen. Area	H-Human	C-Unclassified/Other
Y-Air, Emission, Source	M-Industrial Material	U-Urine
Z-Air, Breathing Zone	R-Nasal Swab	V-Vegetation
B-Blood	D-Residue/Ash	T-Waste, Hazardous, Toxic
O-Biological, Other	L-Sludge	N-Water, Nonpotable
F-Food	S-Soil	P-Water, Potable
G-Gas/Air, Compressed	W-Surface Contaminant	

PRESERVATION GROUP: N Ø

R1-NITRIC ACID, pH < 2.0 (plastic container) N Ø-NONE
R2-HYDROCHLORIC ACID, pH < 2.0 (with $Na_2S_2O_3$ in glass container)

ANALYSES REQUESTED

☒ GROSS ALPHA ☐ GAMMA ☐ TRITIUM ☐ PLUTONIUM ☐ RADON ☐ DRINKING WATER STANDARDS (AFR 161-44)
☒ GROSS BETA ☐ CARBON 14 ☐ URANIUM ☐ RADIUM ☐ STRONTIUM
OTHER (specify) PRIMARY GAMMA

AIR FILTER DATA	COLLECTION TIME min	FLOW RATE	VOLUME COLLECTED

REMARKS

BACKGROUND SOIL. TOPSOIL 1' X 8" X 2" deep. SAMPLING LOCATION 30' NORTH OF OLD BUILDING FOUNDATION WHICH IS APPROXIMATELY 100' SW OF RADIOACTIVE BURIAL SITE.

READINGS WERE BACKGROUND ON PDR-27T S/N 1551, OP CHECK PRIOR, LAST CALIBRATED 31 JAN 90

READINGS WERE NONE CPM DETECTED ON PDR-56, S/N 1053 OP CHECK PRIOR, LAST CALIBRATED 89156 JULIAN

AF FORM 2753 DEC 84 PREVIOUS EDITION WILL BE USED.

REF 11
PAGE 6 OF 6

SAMPLE ANALYSIS RESULTS REPORTED ON 06-APR-1990
USAF OCCUPATIONAL AND ENVIRONMENTAL HEALTH LABORATORY
BROOKS AIR FORCE BASE, TEXAS 78235-5501

OEHL ID

19000235

833 MEDICAL GROUP/SGPB
HOLLOMAN AFB NM 88330-5300

BASE ADDRESS CODE: R00087Z

IDENTIFICATION:
Base Sample #: GS901605 Background Soil
OEHL ID: 19000235
Type of Sample: SOIL
Workplace or Site ID: 00087 HOLLOMAN AFB, NM
Date Collected: 15-FEB-90 Time Collected: 1045
Date Received: 26-FEB-90
Date Completed: 04-APR-90

SAMPLE WEIGHT 1387 GRAMS DRY

CESIUM 134	<	0.042			PICOCURIES PER GRAM DRIED
CESIUM 137		0.3	+/-	0.032	PICOCURIES PER GRAM DRIED
COBALT 60	<	0.019			PICOCURIES PER GRAM DRIED
GROSS ALPHA		10.	+/-	5.4	PICOCURIES PER GRAM DRIED
GROSS BETA		19.	+/-	1.1	PICOCURIES PER GRAM DRIED
POTASSIUM 40		14.	+/-	0.67	PICOCURIES PER GRAM DRIED
RADIUM 226		1.1	+/-	0.42	PICOCURIES PER GRAM DRIED
THORIUM 232		0.73	+/-	0.082	PICOCURIES PER GRAM DRIED
URANIUM 235	<	0.097			PICOCURIES PER GRAM DRIED

RESULTS ACCURATE TO 2 SIGNIFICANT FIGURES.
ERROR TERM AT 95% CONFIDENCE LEVEL.

Mark C. Wrobel, Capt, USAF, BSC
Health Physicist
AUTOVON 240-2061

Atch 3

RADIOACTIVE BURIAL SITE

FILE

SGPM

21 January 1982

Monitoring of the Radioactive Waste Disposal Site

DEEV

1. Capt Forrest Sprester, Bioenvironmental Engineer, and AMN Jeffery Hamilton, Environmental Health Specialist, conducted an annual evaluation of the integraty of the Radioactive Waste Disposal Site on 21 February 1981. Air Force criteria published by the Surgeon General entitled "Radioactive Waste Disposal Sites" was used as a guide in conducting the evaluation.

2. The site was monitored using Air Force Radiac equipment in the area of the concrete slab marking the container location. Measurements taken on and around the slab were provided to you in a letter dated 26 February 1981. During the survey, we noted that small animals had burrowed around the slab bringing soil and rock to the surface that may have been contaminated with radioactive waste. Therefore, soil samples were collected and sent to USAF Occupational and Environmental Health Laboratory for analysis.

3. The results of the analysis are presented below with a comparison to other radiological analyses of soil samples collected on Holloman AFB.

Radiological Analysis of
Holloman AFB Soils

CONSTITUENTS (Picocuries per gram dry)	Radioactive Waste Disposal Site (1981)	Radiation Decon Sump Bldg 844 (1976)	North End of Test Track (1979) Average Value	Background Main Area Of Base	Environmental Average1/
Gross Alpha	5	6	4	6	-----
Gross Beta	16	7	8	7	-----
Potassium 40	10	4.1	3.9	4.2	0.1-5.2
Cesium 137	0.32	0.29	0.37	0.29	1
Thorium 232	0.56	0.15	0.39	0.16	0.65
Uranium 238	1.0	1.1	1.5	1.2	0.4
Radium 226	0.13	0.24	0.13	0.49	0.73

1/ Average or range background data in the United States as per Environmental Radioactivities, by Eisenbud, Academic Press, 1973.

4. The results of the analysis indicate the constituents are within the normal environmental limits for the Holloman Area. The results can be considered the baseline results for Radioactive Waste Disposal Site and may be used for comparison in future evaluations.

5. If you have any questions pertaining to the above, please feel free to call me at extension 3303.

FORREST R. SPRESTER, Capt, USAFR, BSC
Senior Bioenvironmental Engineer

Cy to: 833CSG/CC
833CSG/DECD
833CSG/JA

File ~~[illegible]~~
11

MEMO FOR THE RECORD

28 April 1981

On 28 February 1981, a soil sample was collected by Capt Forrest Sprester, Reserve Bio-Environmental Engineer,and AMN Jeffery D. Hamilton, Environmental Health Specialist at the North Area Radiation Disposal Site. This was sent to OEHL, Brooks AFB for analysis. Attachment 1 shows the analysis results.

Jeffery D. Hamilton

JEFFERY D. HAMILTON, AMN, USAF
Environmental Health Specialist

1 Atch
Sample Analysis Results

01-APR-81 A0872

SAMPLE ANALYSIS RESULTS

USAF HOSP HOLLOMAN/SGPM
HOLLOMAN AFB NM 88330

USAF OCCUPATIONAL AND ENVIRONMENTAL HEALTH LABORATORY(AFSC)
BROOKS AFB,TEXAS 78235

IDENTIFICATION	TYPE OF SAMPLE	DATE RECEIVED	OEHL NUMBER
81-0005	SOIL	02-MAR-81	18100191

GROSS ALPHA	5.	PICOCURIES PER GRAM DRY
GROSS BETA	16.	PICOCURIES PER GRAM DRY
POTASSIUM 40	10.	PICOCURIES PER GRAM DRY
CESIUM 137	.23	PICOCURIES PER GRAM DRY
THORIUM 232	.56	PICOCURIES PER GRAM DRY
URANIUM 238	1.0	PICOCURIES PER GRAM DRY
RADIUM 226	<.13	PICOCURIES PER GRAM DRY

AMON J. CLAY
CHIEF,RADIOANALYTICAL SERVICES BR .
AUTOVON 240-2061

DATE COMPLETED 27-MAR-81

HAFB Radioactive Waste Disposal Site

SGPM 22 December 1976

Holloman AFB Radioactive Waste Disposal Site

49CSG/CC
49CSG/DE
IN TURN

1. An environmental survey of the Radioactive Waste Disposal Site, located in the north area of Holloman AFB (see Attachment 1), was conducted 20 December 1976 in accordance with the AF/SG Surgeon General letter entitled "Radioactive Waste Disposal Sites" dated 16 July 1974. The survey was conducted by Captain Forrest Sprester and A1C Dennis Price, Environmental Health Service, USAF Hospital, Holloman AFB, NM.

2. Purpose: The purpose of the annual survey is to monitor radioactive levels and physical security of the site to insure compliance with current Air Force standards.

3. Findings: The physical security of the disposal site is unsatisfactory. The security fence, 800 feet in length, has been completely disassembled and removed from the site. More than half of the fence posts have been removed. The four radioactive waste disposal caution signs are standing up to 200 feet away from the 3' x 3' concrete slab covering the radioactive waste container. A small, badly-faded sign adjacent to the concrete slab is the only indication that radioactive waste is contained beneath the concrete. The concrete slab has numerous cracks. Following are the readings taken at the site:

EQUIPMENT	READINGS	TYPE RADIATION
AN/PDR 27	MAX .04 MR/HR	β, γ
PAC-1-S	0	α

The above radiation readings are interpreted to be background radiation.

4. Recommendation: It is recommended that the site be properly restored to comply with the aforementioned AF/SG letter or the applicable Civil Engineering Technical Order. The Air Force still does not permit burial of radioactive waste as a means of disposal, but maintenance of past disposal sites must be continued. Since the security fence no longer exists and the area appears to be favored for motor bikes and other recreation vehicles, action should be taken to secure the site. The caution signs, except the one at the concrete slab, are in good condition and need only to be moved an adequate distance from the disposal site. There are 4" x 4" posts lying around the site that are of sufficient length and quantity to be utilized. Barbed wire, which is readily available to Civil Engineering, will provide an excellent fencing material. A locked gate should be provided to allow site access for Environmental Health personnel to monitor the site. A metal sign, two-feet square, should be constructed adjacent to the slab and marked with appropriate caution for radioactive materials (see Attachment 2). Attachment 3 is a sketch of the above proposed changes.

5. This is a repeat discrepancy from Environmental Health Report entitled "Radioactive Waste Disposal Area on Holloman Air Force Base" dated 6 February 1976.

6. Should you have further questions concerning the above, please call Captain Forrest Sprester, Bioenvironmental Engineer, at extension 7461.

FOR THE COMMANDER

FORREST R. SPRESTER, Capt, USAF, BSC
Chief, Environmental Health Service

3 Atchs:
1. Location Map
2. Caution Sign
3. Proposed Changes

Cys To: JA
SEG

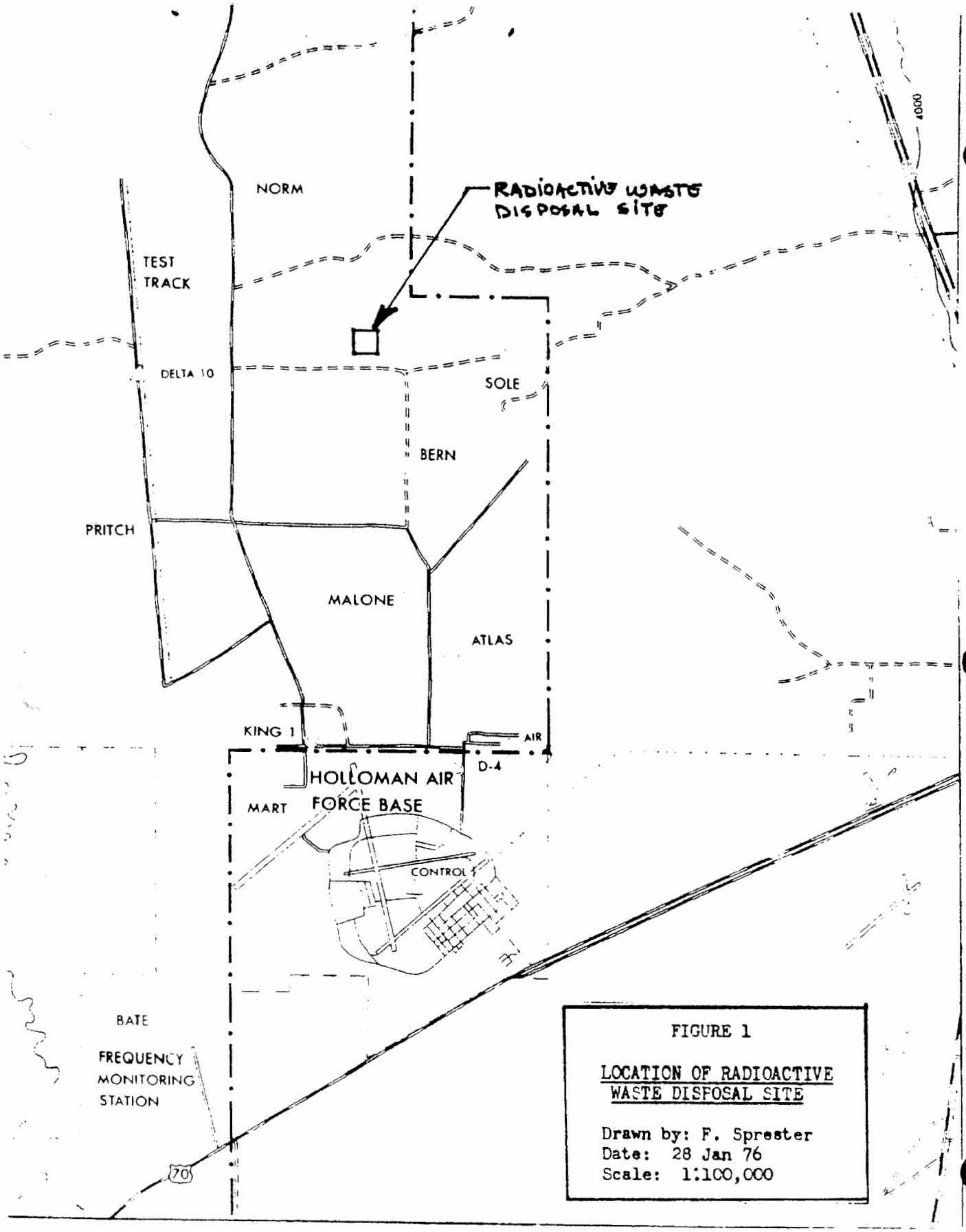


FIGURE 1

LOCATION OF RADIOACTIVE WASTE DISPOSAL SITE

Drawn by: F. Sprester
Date: 28 Jan 76
Scale: 1:100,000

SCPM

6 February 1976

Radioactive Waste Disposal Area on Holloman Air Force Base

49 CSG/CC
DE
IN TURN

1. A field survey was conducted on 16 January 1976 by Capt Forrest Sprester, Bioenvironmental Engineer, and TSgt Robert Boudreaux, Environmental Health Technician, of the the radioactive waste disposal area located in the north area of Holloman Air Force Base (see Figure 1). The survey was conducted to determine if the physical condition of the site had changed since last surveyed in 1973.

2. The condition of the site was found to be very poor. The fence, 800 feet in length, has been completely disassembled and removed from the site. Fence posts, 4 inch by 4 inch by 6 feet, have been pulled out and stacked at various locations. The four radioactive waste disposal caution signs are presently standing up to 200 feet away from the concrete slab which covers the rarioactive waste. A small faded sign, adjacent to the concrete slab is the only indication that radioactive waste is contained beneath the concrete. The concrete slab has numerous cracks. Using radiac equipment, AN/PDR 27, gamma radiation was measured at the cracks of .05 milliroentgens per hour. This can be interpreted as background radiation but will be monitored by Environmental Health at least yearly to insure no further increases occur. Photographs were taken of the site and are attached to this report.

3. It is recommended that the site be properly restored in accordance with TAC/SGS letter dated 5 August 1974, entitled Radioactive Waste Disposal Sites. At the present time the Air Force does not permit burial of radioactive waste as a means of disposal. But, maintenance of past disposal sites must be continued, not only for environmental reasons, but for obvious health reasons as well.

4. According to Mr Chris Gallegos, former Holloman AFB Planning Engineer, this burial site was selected for several reasons. They were: Its secluded location, the site was not in use at the time and the existence of a high fence precluded a large expenditure for construction. Since the fence no longer exists and the area appears to be favored for motor bikes, action should be taken to again secure the site. The caution signs are in excellent condition and need only to be moved to an adequate distance from the disposal area. The wooden posts that are stacked on

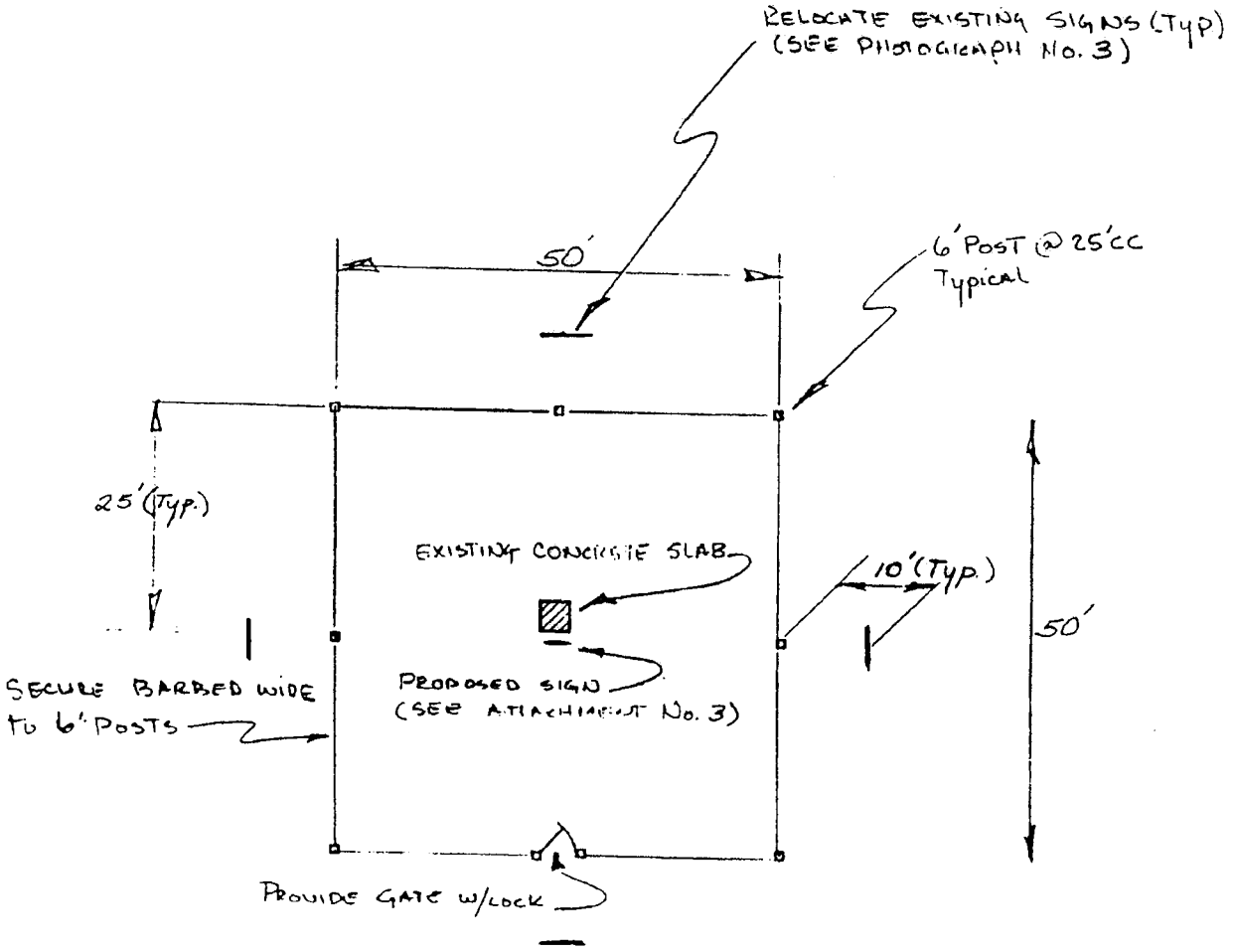
the site can still be utilized, leaving only fence material to be secured and placed.

5. Barbed wire which is readily available would provide an excellent barrier. A small locked gate should be provided to allow entry for Environmental Health personnel to periodically monitor the site. A steel sign two feet square should be constructed adjacent to the slab marked with the appropriate caution for nuclear materials, Attachment #3. Attached Figure 4 is a sketch of the above proposed changes.

6. Should you have further questions concerning the above, please feel free to call Capt Forrest R. Sprester, Bioenvironmental Engineer, at 7461.

W. M. RUNKLE, LtCol, USAF, MC
Commander

1 Atch
Study of the Radioactive Waste
Disposal Site



ATTACHMENT 3.

RADIOACTIVE WASTE DISPOSAL AREA
PROPOSED CHANGES

Drawn by: F Sprester
Date: 14 Jan 76
Scale: 1"=20'

Appendix A-11-1

Portions of: *Draft Final Remedial Investigation (RI) Report, Investigation, Study and Recommendation for 29 Waste Sites, Holloman Air Force Base, NM,* Radian Corporation, June 1992

RADIAN CORPORATION

DCN 92-269-004-16-07
RCN 269-004-16-06

(Mailing Address)
P.O. Box 201088
Austin, TX 78720-1088
(Shipping Address)
8501 North Mopac Blvd.
Austin, TX 78759
(512) 454-4797

REMEDIAL INVESTIGATION (RI) REPORT

INVESTIGATION, STUDY AND RECOMMENDATION FOR 29 WASTE SITES HOLLOMAN AIR FORCE BASE, NM

Volume I

DRAFT FINAL

Prepared for:

49 SG/CEV
Holloman Air Force Base, NM

Prepared by:

Radian Corporation
8501 North MoPac Blvd.
P.O. Box 201088
Austin, Texas 78720-1088

Under Contract No. DACW45-89-D-0515 with:

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

June 1992

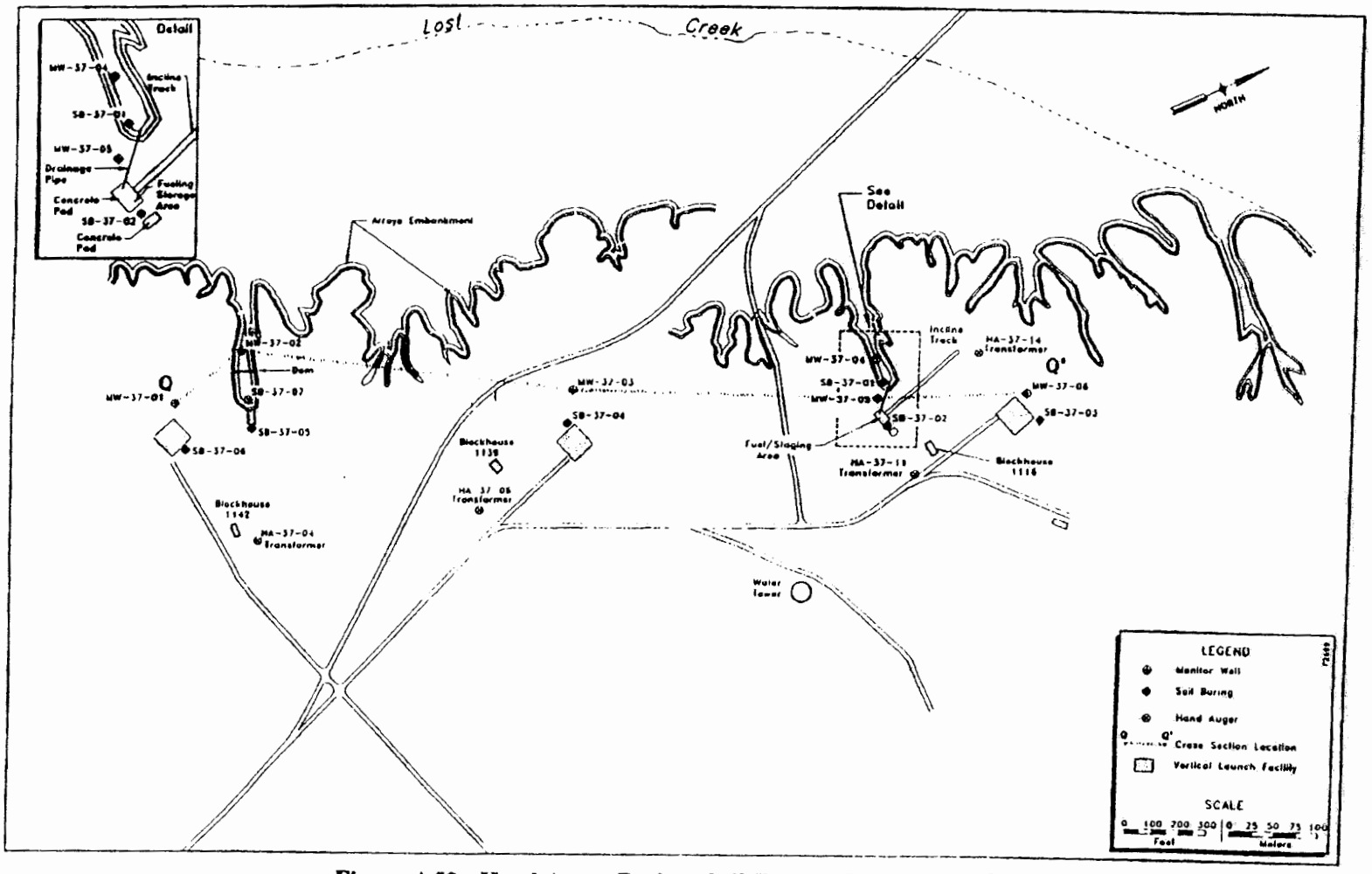


Figure 4-58. Hand Auger Boring, Soil Boring, Monitor Well, and Cross Section Locations for Site 37

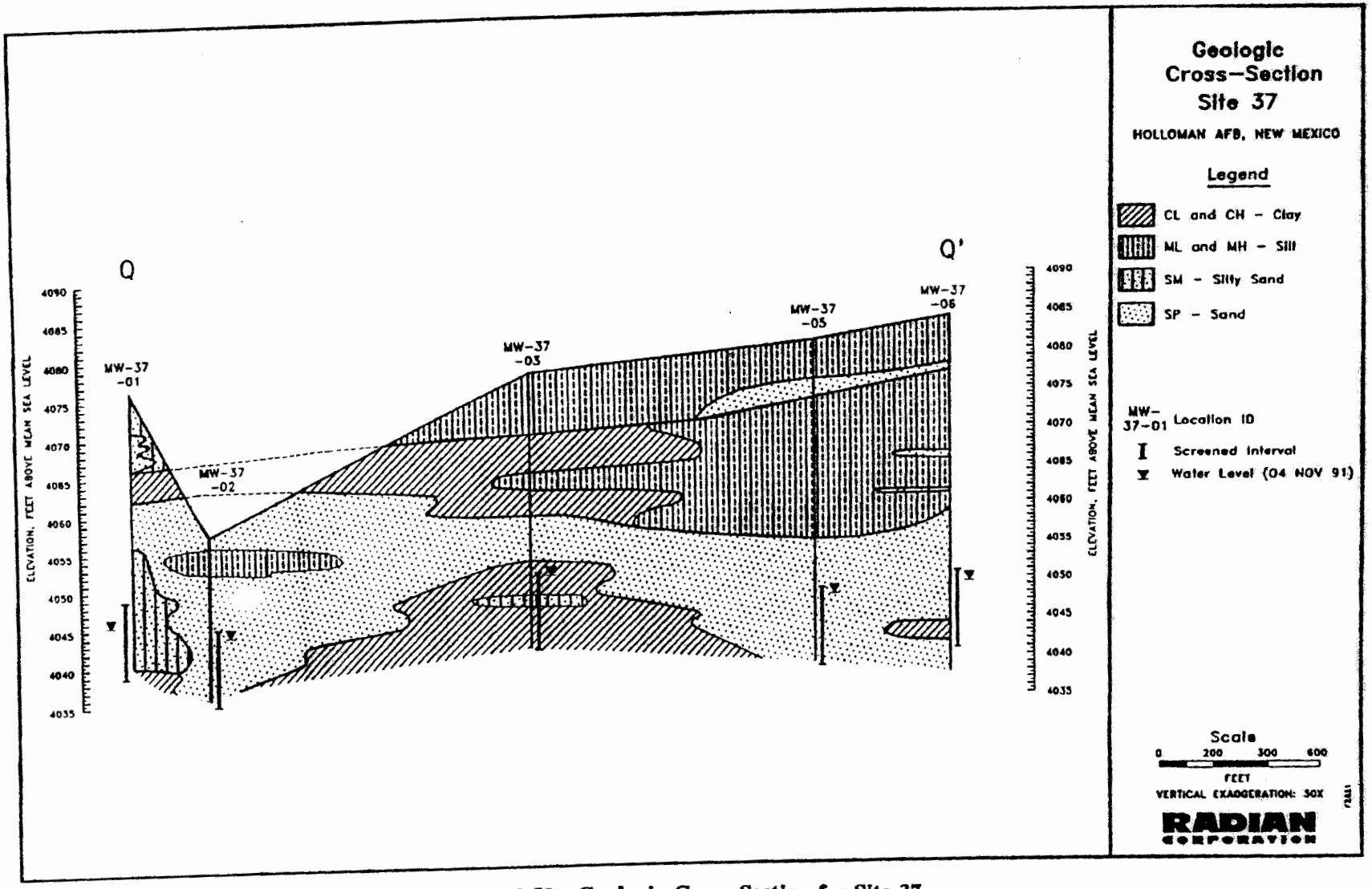


Figure 4-59. Geologic Cross Section for Site 37

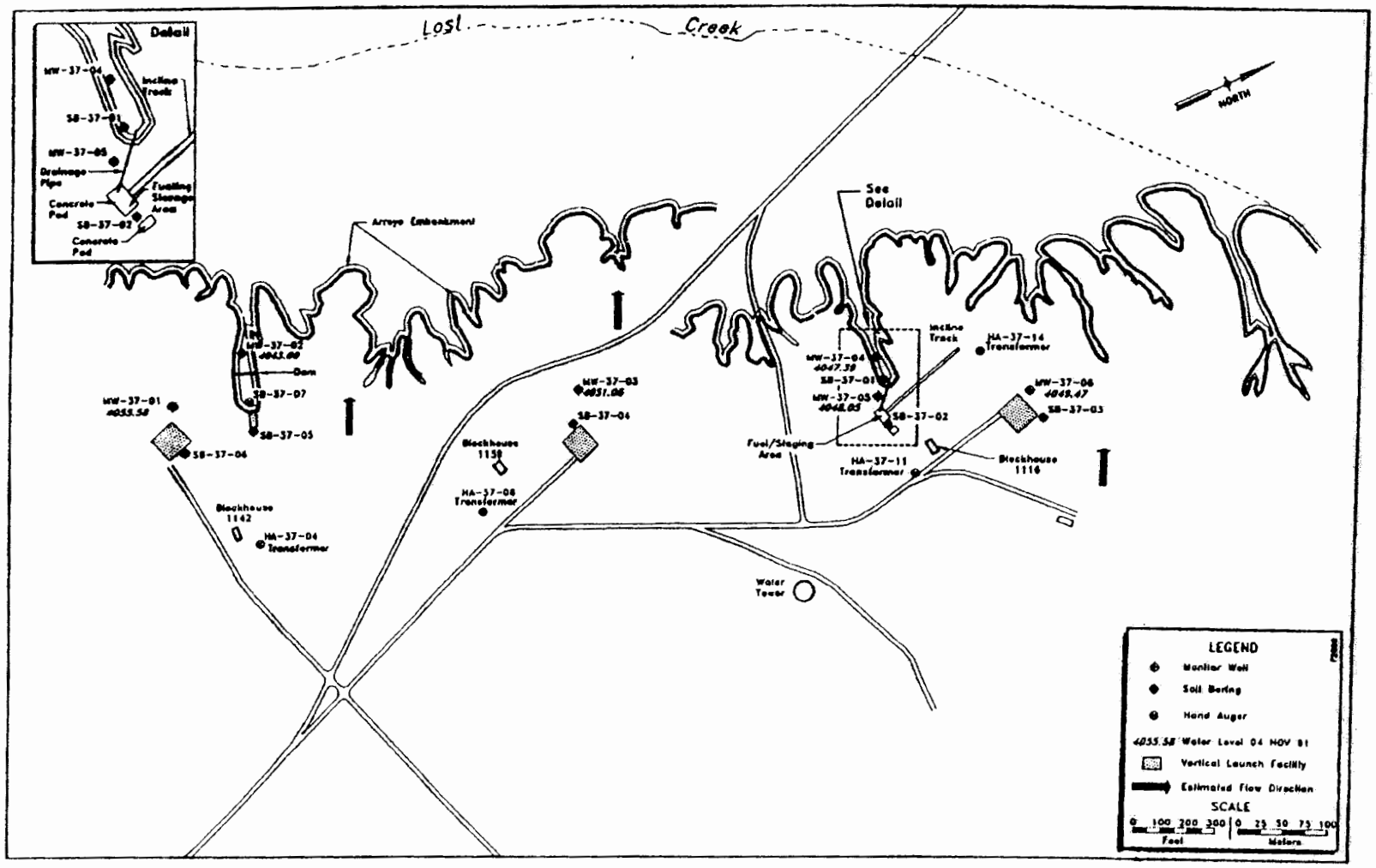


Figure 4-60. Monitor Well Locations and Groundwater Elevations for Site 37

Table 4-77

Concentrations of PCBs and Total Recoverable Petroleum Hydrocarbons in Site 37 Step-Down Transformer Station Samples

					[illegible] - PCBs (mg/kg)			
			[illegible] (mg/kg)		PCB-1254		PCB-1260	
Location	Sample ID	Depth	Result	(D.L.)	Result	(D.L.)	Result	(D.L.)
HA-37-04	91JULH037-018	0 - 2 ft	30600	(10.3)	ND	(12)	ND	(12)
HA-37-06	91JULH037-020	0 - 2 ft	141	(10.5)	9.2 J	(12)	ND	(12)
HA-37-11	91JULH037-025	0 - 2 ft	79.70	(10.1)	ND	(12)	80 C	(12)
HA-37-14	91JULH037-028	0 - 2 ft	21.60 @	(10.2)	ND	(310)	3200 C	(310)

NOTE: Table presents only constituents detected in soil at this site.
ND = Not Detected, at the reported detection limit.
J = Detected below the detection limit.
C = Presence and quantitation of analyte confirmed by second column analysis.

Table 4-78

Concentrations of Inorganic Analytes in Site 37 Soil Samples

Location	[illegible]		[illegible]		[illegible]		[illegible]	
Sample ID Depth	[illegible] 2.5 - 4.5 ft		[illegible] 10 - 12 ft		[illegible] 2.5 - 4.5 ft		[illegible] 8 - 12 ft	
Analyte	Result	(DL)	Result	(DL)	Result	(DL)	Result	(DL)
SW6010 - Metals (mg/kg)								
Beryllium	0.78 @	(0.41)	ND	(0.91)	ND	(0.80)	ND	(0.39)
Cadmium	ND	(1.0)	ND	(2.3)	ND	(2.0)	ND	(0.97)
Chromium	13	(2.0)	9.6 @	(4.5)	4.4 @	(4.0)	8.0 @	(1.9)
Copper	ND	(4.1)	ND	(9.1)	ND	(8.0)	ND	(3.9)
Nickel	10 @	(4.1)	ND	(9.1)	ND	(8.0)	ND	(3.9)
Zinc	32	(4.1)	19 @	(9.1)	23 @	(8.0)	16 @	(3.9)
SW7060 - Arsenic (mg/kg)	3.0	(0.45)	1.5 @	(0.48)	1.4 @	(0.42)	0.88 @	(0.44)
SW7421 - Lead (mg/kg)	6.5	(1.3)	2.4	(0.36)	1.6	(0.32)	5.9 @	(1.3)

Table 4-78

(Continued)

Location:	SB-37-03				SB-37-04			
Sample ID: Depth:	91JULJH037-003 0 - 2 ft		91JULJH037-004 7.5 - 9.5 ft		91JULJH037-007 5 - 7 ft		91JULJH037-008 15 - 17 ft	
Analyses	Result	(DL)	Result	(DL)	Result	(DL)	Result	(DL)
SW6010 - Metals (mg/kg)								
Beryllium	ND	(0.77)	ND	(0.35)	ND	(0.40)	ND	(0.75)
Cadmium	ND	(1.9)	ND	(0.87)	ND	(0.99)	ND	(1.9)
Chromium	5.5 @	(3.8)	2.6 @	(1.7)	4.7 @	(2.0)	14 @	(3.8)
Copper	14 @	(7.7)	ND	(3.5)	ND	(4.0)	ND	(7.5)
Nickel	ND	(7.7)	ND	(3.5)	4.0 @	(4.0)	14 @	(7.5)
Zinc	26 @	(7.7)	5.8 @	(3.5)	12 @	(4.0)	30 @	(7.5)
SW7060 - Arsenic (mg/kg)	1.6 @	(0.47)	1.2 @	(0.43)	1.8 @	(0.41)	2.6	(0.41)
SW7421 - Lead (mg/kg)	14	(0.35)	1.1 @	(0.32)	1.6	(0.30)	3.7	(0.30)

Table 4-78

(Continued)

Location	SB-37-05				SB-37-06			
Sample ID	[illegible]		[illegible]		[illegible]		[illegible]	
Depth (ft)	[illegible]		[illegible]		2.5 - 4.5 ft		[illegible]	
Analyte	Result	(D.L.)	Result	(D.L.)	Result	(D.L.)	Result	(D.L.)
SW6010 - Metals (mg/kg)								
Beryllium	ND	(0.82)	ND	(0.45)	ND	(0.80)	ND	(0.51)
Cadmium	4.7 @	(2.1)	ND	(1.1)	ND	(2.0)	ND	(1.3)
Chromium	6.5 @	(4.1)	2.9 @	(2.2)	ND	(4.0)	5.8 @	(2.5)
Copper	ND	(8.2)	ND	(4.5)	ND	(8.0)	ND	(5.1)
Nickel	ND	(8.2)	ND	(4.5)	ND	(8.0)	5.7 @	(5.1)
Zinc	16 @	(8.2)	4.7 @	(4.5)	ND	(8.0)	15 @	(5.1)
SW7060 - Arsenic (mg/kg)	2.3	(0.45)	1.4 @	(0.44)	1.2 @	(0.48)	1.8 @	(0.39)
SW7421 - Lead (mg/kg)	3.8	(0.34)	0.70 @	(0.33)	1.9	(0.28)	0.51 @	(0.21)

Table 4-78

(Continued)

Location	SB-37-07			
Sample ID: Depth:	91JULH037-01.1 3 - 4 ft		91JULH037-01.4 3 - 5 ft	
Analyte	Result	(DL)	Result	(DL)
SW6010 - Metals (mg/kg)				
Beryllium	0.57 @	(0.40)	ND	(0.37)
Cadmium	ND	(1.0)	ND	(0.92)
Chromium	10	(2.0)	4.0 @	(1.8)
Copper	6.1 @	(4.0)	4.1 @	(3.7)
Nickel	8.0 @	(4.0)	ND	(3.7)
Zinc	26	(4.0)	9.6 @	(3.7)
SW7060 - Arsenic (mg/kg)	3.5	(0.45)	1.2 @	(0.38)
SW7421 - Lead (mg/kg)	14	(1.2)	1.7	(0.26)

NOTE: Table presents only constituents detected in soil at this site.
@ = Measured result is less than five times the detection limit.
ND = Not Detected, at the reported detection limit.

Table 4-79

Concentrations of Organic Analytes in Site 37 Soil Samples

Location:	SB-37-01				SB-37-02			
Sample ID: Depth:	91JUL1H037-001 2.5 - 4.5 ft		91JUL1H037-002 10 - 12 ft		91JUL1H037-003 2.5 - 4.5 ft		91JUL1H037-004 10 - 12 ft	
Analyte	Result	(DL)	Result	(DL)	Result	(DL)	Result	(DL)
EPA 418.1 - TRPH (mg/kg)	ND	(11.0)	ND	(12.3)	ND	(12.0)	10.8 @	(10.7)
SW8240 - Volatile Organics (µg/kg)								
1,1-Dichloroethene	ND	(120)	25 J	(120)	ND	(120)	ND	(130)
Ethyl benzene	ND	(120)	ND	(120)	ND	(120)	3.0 J	(130)
Methylene chloride	370 B@	(120)	450 B@	(120)	1400 B	(120)	110 JB	(130)
Tetrachloroethene	ND	(120)	ND	(120)	ND	(120)	33 J	(130)
Toluene	7.9 J	(120)	7.8 JB	(120)	10 JB	(120)	8.9 J	(130)
Xylenes	ND	(120)	ND	(120)	ND	(120)	8.9 J	(130)
Location:	SB-37-03				SB-37-04			
Sample ID: Depth:	91JUL1H037-005 0 - 2 ft		91JUL1H037-006 7.5 - 9.5 ft		91JUL1H037-007 5 - 7 ft		91JUL1H037-008 15 - 17 ft	
Analyte	Result	(DL)	Result	(DL)	Result	(DL)	Result	(DL)
EPA 418.1 - TRPH (mg/kg)	3860	(122)	ND	(11.2)	ND	(12.2)	ND	(13.0)
SW8240 - Volatile Organics (µg/kg)								
1,1-Dichloroethene	ND	(120)	ND	(110)	.79 J	(120)	ND	(130)
Ethyl benzene	ND	(120)	ND	(110)	ND	(120)	ND	(130)
Methylene chloride	130 B@	(120)	260 B@	(110)	3.731 JB	(120)	190 B@	(130)
Tetrachloroethene	ND	(120)	ND	(110)	ND	(120)	ND	(130)
Toluene	8.5 J	(120)	9.4 J	(110)	.256 J	(120)	7.6 J	(130)
Xylenes	ND	(120)	ND	(110)	ND	(120)	ND	(130)

Table 4-79

(Continued)

Location	[illegible]				[illegible]			
Sample ID: Depth:	91J1UL1H037-009 0 - 2 ft		91J1UL1H037-010 10 - 12 ft		91J1UL1H037-011 25 - 27 ft		91J1UL1H037-012 25 - 27 ft	
Analyses	Result	(DL)	Result	(DL)	Result	(DL)	Result	(DL)
EPA 418.1 - TRPH (mg/kg)	16.0 @	(12.0)	ND	(12.3)	ND	(12.9)	ND	(14.1)
SW8240 - Volatile Organics (µg/kg)								
1,1-Dichloroethene	ND	(120)	ND	(130)	ND	(130)	ND	(140)
Ethyl benzene	ND	(120)	ND	(130)	ND	(130)	ND	(140)
Methylene chloride	530 B@	(120)	110 JB	(130)	96 JB	(130)	54 JB	(140)
Tetrachloroethene	ND	(120)	ND	(130)	ND	(130)	ND	(140)
Toluene	9.2 J	(120)	7.8 J	(130)	7 JB	(130)	6.9 JB	(140)
Xylenes	ND	(120)	ND	(130)	ND	(130)	ND	(140)

Table 4-79

(Continued)

Location	[illegible]		[illegible]	
Sample ID: Depth:	[illegible]		[illegible]	
Analyte	Result	(D.L.)	Result	(D.L.)
EPA 418.1 - TRPH (mg/kg)	48.2 @	(11.6)	22.3 @	(15.2)
SW8240 - Volatile Organics (µg/kg)				
1,1-Dichloroethene	ND	(120)	ND	(110)
Ethyl benzene	ND	(120)	ND	(110)
Methylene chloride	780	(120)	56 JB	(110)
Tetrachloroethene	ND	(120)	ND	(110)
Toluene	10 JB	(120)	ND	(110)
Xylenes	ND	(120)	ND	(110)

NOTE: Table presents only constituents detected in soil at this site.
ND = Not Detected, at the reported detection limit.
J = Detected below the detection limit.
B = Analyte detected in laboratory blank analysis, no blank subtraction performed.
@ = Measured result is less than five times the detection limit.

Table 4-80

Concentrations of Inorganic Analytes in Site 37 Groundwater Samples

[illegible] Location: Sample ID:	MW-37-01 37-01-01		MW-37-02 37-02-01		MW-37-03 37-03-01	
[illegible]	[illegible]	(PQL)	[illegible]	(PQL)	[illegible]	(PQL)
EPA 160.1 - Total Dissolved Solids (mg/L)	11000	(10)	14000	(10)	10000	(10)
EPA 300.0 - Chloride (mg/L)	3000	(26)	5300	(26)	2500	(26)
EPA 300.0 - Sulfate (mg/L)	4200	(5.0)	3400	(5.0)	4700	(5.0)
EPA 340.2 - Fluoride (mg/L)	1.5	(0.10)	1.3	(0.10)	1.6	(0.10)
EPA 353.1 - Nitrate-Nitrite (mg/L)	48	(1.1)	66	(1.1)	48	(1.1)
EPA 365.2 - Total Phosphorus (mg/L)	0.10	(0.020)	0.14	(0.020)	0.19	(0.020)
SW6010 - Metals (mg/L)						
Antimony	0.11 @	(0.10)	0.12 @	(0.10)	0.11 @	(0.10)
Cadmium	ND	(0.0050)	ND	(0.0050)	0.0055 @	(0.0050)
Chromium	ND	(0.010)	ND	(0.010)	0.011 @	(0.010)
Copper	0.032 Z@	(0.020)	ND Z	(0.020)	0.024 Z@	(0.020)
Nickel	ND	(0.020)	ND	(0.020)	0.029 @	(0.020)
Zinc	ND	(0.020)	ND	(0.020)	0.048 @	(0.020)
SW7060 - Arsenic (mg/L)	ND	(0.016)	ND	(0.016)	ND	(0.016)
SW7421 - Lead (mg/L)	ND	(0.0030)	ND	(0.0030)	ND	(0.0030)
SW7740 - Selenium (mg/L)	ND	(0.020)	ND	(0.020)	ND	(0.020)

Table 4-80

(Continued)

Location: Sample ID:	MW-37-04 37-04-01		MW-37-05 37-05-01		MW-37-06 37-06-01	
Analyses	Result	(DL)	Result	(DL)	Result	(DL)
EPA 160.1 - Total Dissolved Solids (mg/L)	13000	(10)	12000	(10)	17000	(10)
EPA 300.0 - Chloride (mg/L)	4900	(26)	3900	(26)	6800	(26)
EPA 300.0 - Sulfate (mg/L)	3100	(5.0)	4000	(5.0)	3700	(5.0)
EPA 340.2 - Fluoride (mg/L)	1.7	(0.10)	2.0	(0.10)	1.5	(0.10)
EPA 353.1 - Nitrate-Nitrite (mg/L)	75	(1.1)	75	(1.1)	74	(1.1)
EPA 365.2 - Total Phosphorus (mg/L)	0.19	(0.020)	0.32	(0.020)	0.26	(0.020)
SW6010 - Metals (mg/L)						
Antimony	0.12 @	(0.10)	ND	(0.40)	ND	(0.10)
Cadmium	ND	(0.0050)	ND	(0.020)	ND	(0.0050)
Chromium	ND	(0.010)	0.048 @	(0.040)	0.012 @	(0.010)
Copper	ND Z	(0.020)	0.28 @	(0.080)	ND	(0.020)
Nickel	ND	(0.020)	ND	(0.080)	0.028 @	(0.020)
Zinc	ND	(0.020)	0.12 @	(0.080)	0.030 @	(0.020)
SW7060 - Arsenic (mg/L)	ND	(0.016)	0.016 @	(0.016)	ND	(0.016)
SW7421 - Lead (mg/L)	ND	(0.0030)	0.011 @	(0.0030)	0.0044 @	(0.0030)
SW7740 - Selenium (mg/L)	0.016 @	(0.010)	ND	(0.010)	ND	(0.010)

NOTE: Table presents only constituents detected in groundwater at this site.
@ = Measured result is less than five times the detection limit.
ND = Not Detected, at the reported detection limit.
Z = SW6010, SW7421--Analyte detected in method blank.

Table 4-81

Concentrations of Organic Analytes in Site 37 Groundwater Samples

Location: Sample ID:	MW-37-01 37-01-01		MW-37-02 37-02-01		MW-37-03 37-03-01	
Analyte	Result	(DL)	Result	(DL)	Result	(DL)
SW8240 - Volatile Organics (μg/L)						
1,1,2,2-Tetrachloroethane	ND	(5.0)	ND	(5.0)	ND	(5.0)
Acetone	ND	(100)	ND	(100)	ND	(100)
Bromodichloromethane	2.3 J	(5.0)	ND	(5.0)	ND	(5.0)
Chloroform	7.4 @	(5.0)	1.9 J	(5.0)	6.3 @	(5.0)
Methylene chloride	18 B@	(5.0)	17 B@	(5.0)	1.6 JB	(5.0)
Location: Sample ID:	MW-37-04 37-04-01		MW-37-05 37-05-01		MW-37-06 37-06-01	
Analyte	Result	(DL)	Result	(DL)	Result	(DL)
SW8240 - Volatile Organics (μg/L)						
1,1,2,2-Tetrachloroethane	ND	(5.0)	ND	(5.0)	0.59 J	(5.0)
Acetone	ND	(100)	ND	(100)	6.0 J	(100)
Bromodichloromethane	1.2 J	(5.0)	ND	(5.0)	ND	(5.0)
Chloroform	3.4 J	(5.0)	5.0 @	(5.0)	1.3 J	(5.0)
Methylene chloride	9.1 B@	(5.0)	ND	(5.0)	11 B@	(5.0)

NOTE: Table presents only constituents detected in groundwater at this site.
ND = Not Detected, at the reported detection limit.
J = Detected below the detection limit.
@ = Measured result is less than five times the detection limit.
B = Analyte detected in laboratory blank analysis, no blank subtraction performed.

Table 4-82

Soil and Groundwater Analytes Detected Above Risk-Based Action Levels at Site 37

Analyte	Location ID	Result		Action Level
Soil Results (mg/kg)				
Beryllium	SB-37-01	0.78	@	0.2
Beryllium	SB-37-07	0.57	@	0.2
PCB-1260	HA-37-14	3.2	C	0.09
Groundwater Results (mg/L)				
Antimony	MW-37-01	0.11	@	0.01
Antimony	MW-37-02	0.12	@	0.01
Antimony	MW-37-03	0.11	@	0.01
Antimony	MW-37-04	0.12	@	0.01
Arsenic	MW-37-05	0.016	@	0.01
Cadmium	MW-37-03	0.0055	@	0.005
Chloroform	MW-37-01	0.0074	@	0.006
Chloroform	MW-37-03	0.0063	@	0.006
Fluoride	MW-37-05	2		2
Methylene chloride[a]	MW-37-01	0.018	B@	0.005
Methylene chloride[a]	MW-37-02	0.017	B@	0.005
Methylene chloride[a]	MW-37-04	0.0091	B@	0.005
Methylene chloride[a]	MW-37-06	0.011	B@	0.005

Note: Result units were changed to match action level units for this table.

@ = Measured result is less than five times the detection limit.
C = Presence and quantitation of analyte confirmed by second column analysis.
[a] Methylene chloride was determined to be a laboratory contaminant in a QA/QC review and is, therefore, not considered to be above the action level in samples from the site.
B = Analyte detected in laboratory blank analysis, no blank subtraction performed.

DRILLING LOG

HOLE NO. SB-37-01

F2402

1. COMPANY NAME	RADIAN CORPORATION
2. DRILLING SUBCONTRACTOR	SOUTHWEST ENG INC
SHEET 1 OF 2 SHEETS	
3. PROJECT	HOLLOMAN AFB RI/FS FOR 29 SITES
4. LOCATION	37
5. NAME OF DRILLER	ART VALTIERRA
6. MANUFACTURER'S DESIGNATION OF DRILL	HOLLOW-STEM AUGER
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT	BOREHOLE DIA.: 7.5"
8. HOLE LOCATION	688488.57(Y), 538891.40(X)
9. SURFACE ELEVATION	4070.22
10. DATE STARTED	26 SEP 91
11. DATE COMPLETED	26 SEP 91
12. OVERBURDEN THICKNESS	
15. DEPTH GROUNDWATER ENCOUNTERED	
13. DEPTH DRILLED INTO ROCK	
16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED	
14. TOTAL DEPTH OF HOLE	20 ft.
17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY)	

18. GEOTECHNICAL SAMPLES	DISTURBED	UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES

20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY %

22. DEPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR
			GROUT	ACD

a	DEPTH b	DESCRIPTION OF MATERIALS c	FIELD SCREENING RESULTS d	GEOTECH SAMPLE OR CORE BOX NO. e	ANALYTICAL SAMPLE NO. f	BLOW COUNTS g	REMARKS/RECOVERY h
		SILTY SAND: light brown (5YR 6/4), dry, poorly graded, crumbly, soft. (SM)	HS=0.0ppm			1,1,3,2	1.7/2.0 ft
	1						
	2	tan (10YR 8/2), caliche at 2).0 ft.					
	3		HS=0.0ppm		91JULH037-001	4,13,31,48	2.0/2.0 ft
	4	CLAYEY SILT: brown (5YR 5/6), firm/hard sample, gypsum crystals/spots, white spots, moist. (MH)					
	5		HS=0.0ppm			7,17,21,30	2.0/2.0 ft
	6						
	7		HS=0.0ppm			7,17,18,21	2.0/2.0 ft
	8	SILTY SAND: tan (10YR 8/2) to light brown orange (5YR 8/4), some caliche, dry, crumbly, poorly graded. (SM)					
	9						

DRILLING LOG

HOLE NO. SB-37-01

PROJECT HOLLOMAN AFB RI/FS

INSPECTOR ACD

SHEET 2 OF 2 SHEETS

a	DEPTH b	DESCRIPTION OF MATERIALS c	FIELD SCREENING RESULTS d	GEOTECH SAMPLE OR CORE BOX NO. e	ANALYTICAL SAMPLE NO. f	BLOW COUNTS g	REMARKS/RECOVERY h
			HS=0.0ppm		91JULH037 -002	9,50+	1.0/2.0 ft
	11	SAND: clean, brown and olive, mottled, hard (not really caliche), crumbly, dry to slightly moist. (SP)					
	12						
	13						
	14						
	15	CLAYEY SILT: brown (5YR 5/6), high plasticity, white spots/streaks, olive zone above sand. (MH)	HS=0.0ppm			4,5,17,27	
	16						
	17	SAND: clean, fine to very fine, almost white, moist. (SP)					
	18						
	19						
	20	SAND, as above: tan (5YR 8/4).				6,27,39, 50+	TD= 20.0 ft
	21						
	22						
	23						
	24						
	25						
	26						
	27						

PROJECT HOLLOMAN AFB RI/FS FOR 29 SITES

HOLE NO. SB-37-01

12402

DRILLING LOG

HOLE NO. SB-37-02

F2409

1. COMPANY NAME	RADIAN CORPORATION
2. DRILLING SUBCONTRACTOR	SOUTHWEST ENG INC
SHEET 1 OF 2 SHEETS	
3. PROJECT	HOLLOMAN AFB RI/FS FOR 29 SITES
4. LOCATION	37
5. NAME OF DRILLER	ART VARTIERRA
6. MANUFACTURER'S DESIGNATION OF DRILL	HOLLOW-STEM AUGER
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT	BOREHOLE DIA.: 7.5"
8. HOLE LOCATION	688436.70(Y), 539049.78(X)
9. SURFACE ELEVATION	4082.57
10. DATE STARTED	26 SEP 91
11. DATE COMPLETED	26 SEP 91
12. OVERBURDEN THICKNESS	
15. DEPTH GROUNDWATER ENCOUNTERED	
13. DEPTH DRILLED INTO ROCK	
16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED	
14. TOTAL DEPTH OF HOLE	25 ft.
17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY)	
18. GEOTECHNICAL SAMPLES	DISTURBED / UNDISTURBED
19. TOTAL NUMBER OF CORE BOXES	
20. SAMPLES FOR CHEMICAL ANALYSIS	VOC / METALS / OTHER (SPECIFY) / OTHER (SPECIFY) / OTHER (SPECIFY)
21. TOTAL CORE RECOVERY	%
22. DEPOSITION OF HOLE	BACKFILLED / MONITORING WELL / OTHER (SPECIFY): GROUT
23. SIGNATURE OF INSPECTOR	HTH

a	DEPTH b	DESCRIPTION OF MATERIALS c	FIELD SCREENING RESULTS d	GEOTECH SAMPLE OR CORE BOX NO. e	ANALYTICAL SAMPLE NO. f	BLOW COUNTS g	REMARKS/RECOVERY h
						1,5,2,9	no sample, no recovery
	1						
	2						
	3	SILT: very pale orange (10YR 8/2), low plasticity, dry, white specks. (ML)	HS=0.0ppm		91JULH037-003	10,22,22,32	8.0/2.0 ft
	4						
	5	SILT, as above. (ML)	HS=0.0ppm			30,33,29,24	1.7/2.0 ft
	6						
	7	SILT, as above: pale yellowish-brown (10YR 6/2). (ML)	HS=0.0ppm			28,25,26,17	1.8/2.0 ft
	8						
	9						

DRILLING LOG

HOLE NO. SB-37-02

PROJECT HOLLOMAN AFB RI/FS

INSPECTOR HTH

SHEET 2 OF 2 SHEETS

a	DEPTH b	DESCRIPTION OF MATERIALS c	FIELD SCREENING RESULTS d	GEOTECH SAMPLE OR CORE BOX NO. e	ANALYTICAL SAMPLE NO. f	BLOW COUNTS g	REMARKS/RECOVERY h
		SILT, as above. (ML)	HS=0.0ppm		91JULH037-004	17,9,16,11	1.7/2.0 ft
	11	SAND: light brown (5YR 6/4), fine to very fine grained, poorly graded, dry. (SP)					
	12						
	13						
	14						
	15	SAND: greyish-orange (10YR 7/4), coarse to fine grained, some small gravel, well graded, dry. (SP)	HS=0.0ppm			17,18,11,20	1.6/2.0 ft
	16	CLAY: moderate brown (5YR 4/4), medium to low plasticity, hard, gypsum crystals. (CL)					
	17						
	18						
	19						
	20	CLAY, as above.					
	21						
	22						
	23						
	24						
	25	CLAY: dark reddish-brown (10R 3/4), high plasticity, hard, moist. (CH)	HS=0.0ppm			19,20,31,50	1.5/2.0 ft
	26						
	27	no groundwater encountered. CME-55 can't drill through hard clay					TD= 27.0 ft

PROJECT HOLLOMAN AFB RI/FS FOR 29 SITES

HOLE NO. SB-37-02

DRILLING LOG

HOLE NO. SB-37-03

F2392

1. COMPANY NAME	RADIAN CORPORATION
2. DRILLING SUBCONTRACTOR	SOUTHWEST ENG INC
SHEET 1 OF 2 SHEETS	
3. PROJECT	HOLLOMAN AFB RI/FS FOR 29 SITES
4. LOCATION	37
5. NAME OF DRILLER	ART VALTIERRA
6. MANUFACTURER'S DESIGNATION OF DRILL	HOLLOW-STEM AUGER
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT	BOREHOLE DIA.: 7.5"
8. HOLE LOCATION	688957.31(Y), 539260.17(X)
9. SURFACE ELEVATION	4085.89
10. DATE STARTED	26 SEP 91
11. DATE COMPLETED	26 SEP 91
12. OVERBURDEN THICKNESS	
15. DEPTH GROUNDWATER ENCOUNTERED	
13. DEPTH DRILLED INTO ROCK	
16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED	
14. TOTAL DEPTH OF HOLE	17 ft.
17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY)	

18. GEOTECHNICAL SAMPLES	DISTURBED	UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES

20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY %

22. DEPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR
			GROUT	ACD

a	DEPTH b	DESCRIPTION OF MATERIALS c	FIELD SCREENING RESULTS d	GEOTECH SAMPLE OR CORE BOX NO. e	ANALYTICAL SAMPLE NO. f	BLOW COUNTS g	REMARKS/RECOVERY h
		SAND: greyish-orange (10YR 7/4), very fine, moist, loose, crumbly, clean, poorly graded. (SP)	HS=2.5ppm		91JULH037-005	10,12,10,9	2.0/2.0 ft
	1						
	2	brown/tan (10YR 6/6).	HS=0.0ppm			10,17,9,14	2.0/2.0 ft
	3	changes to a fine to very fine, tan (10YR 8/2) sand, hard (not quite caliche) sand.					
	4						
	5	changes to an orange-pink (5YR 8/4) color.	HS=0.0ppm			2,7,9,12	2.0/2.0 ft
	6						
	7		HS=0.0ppm		91JULH037-006	8,20,22,23	2.0/2.0 ft
	8						
	9						

DRILLING LOG

HOLE NO. SB-37-03

PROJECT HOLLOMAN AFB RI/FS

INSPECTOR ACD

SHEET 2 OF 2 SHEETS

a	DEPTH b	DESCRIPTION OF MATERIALS c	FIELD SCREENING RESULTS d	GEOTECH SAMPLE OR CORE BOX NO. e	ANALYTICAL SAMPLE NO. f	BLOW COUNTS g	REMARKS/RECOVERY h
			HS=0.0ppm			3,13,11,13	2.0/2.0 ft
	11	CLAYEY SILT: brown (5YR 5/6), firm to stiff, high plasticity, white spots or mottles, sandy gypsum crystals. (MH)					
	12						
	13						
	14						
	15					18,25,15, 16	2.0/2.0 ft
	16	SILT: tan (10YR 8/2), caliche, crumbly, hard. (ML)	HS=0.0ppm				
	17						TD= 17 ft
	18						
	19						
	20						
	21						
	22						
	23						
	24						
	25						
	26						
	27						

F2392

PROJECT HOLLOMAN AFB RI/FS FOR 29 SITES

HOLE NO. SB-37-03

DRILLING LOG

HOLE NO. SB-37-04

F2410

1. COMPANY NAME RADIAN CORPORATION	2. DRILLING SUBCONTRACTOR SOUTHWEST ENG INC
SHEET 1 OF 2 SHEETS	
3. PROJECT HOLLOMAN AFB RI/FS FOR 29 SITES	4. LOCATION 37
5. NAME OF DRILLER ART VALTIERRA	6. MANUFACTURER'S DESIGNATION OF DRILL HOLLOW-STEM AUGER
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: BOREHOLE DIA.: 7.5"	8. HOLE LOCATION 687361.22(Y), 538546.76(X)
	9. SURFACE ELEVATION 4078.51
	10. DATE STARTED 26 SEP 91 / 11. DATE COMPLETED 26 SEP 91
12. OVERBURDEN THICKNESS	15. DEPTH GROUNDWATER ENCOUNTERED 21 ft blg
13. DEPTH DRILLED INTO ROCK	16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED
14. TOTAL DEPTH OF HOLE 22 ft.	17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY)

18. GEOTECHNICAL SAMPLES	DISTURBED	UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES

20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY %

22. DEPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR
			GROUT	HTH

a	DEPTH b	DESCRIPTION OF MATERIALS c	FIELD SCREENING RESULTS d	GEOTECH SAMPLE OR CORE BOX NO. e	ANALYTICAL SAMPLE NO. f	BLOW COUNTS g	REMARKS/RECOVERY h
	1	SILT: very pale orange (10YR 8/2), low plasticity, dry, organic debris near top. (ML)	HS=0.0ppm			39,16,25	1.7/2.0 ft
	2, 3	SILT: greyish-orange (10YR 7/4), low plasticity, dry, some fine sand, caliche layers. (ML)	HS=0.0ppm			11,12,22, 32	1.9/2.0 ft
	5, 6	SILT, as above.	HS-0.0ppm		91JULH037 -007	20,37,29, 21	2.0/2.0 ft
	7, 8, 9	SAND: greyish-orange (10YR 7/4), silt and very fine grained ssilt and, poorly graded, dry, white specks, non-plastic. (SP)	HS=0.0ppm			17,37,31, 34	1.5/2.0 ft

DRILLING LOG

HOLE NO. SB-37-04

PROJECT HOLLOMAN AFB RI/FS

INSPECTOR HTH

SHEET 2 OF 2 SHEETS

a	DEPTH b	DESCRIPTION OF MATERIALS c	FIELD SCREENING RESULTS d	GEOTECH SAMPLE OR CORE BOX NO. e	ANALYTICAL SAMPLE NO. f	BLOW COUNTS g	REMARKS/RECOVERY h
		SAND: white (N9), very fine grained, poorly graded, dry. (SP)				37,50	0.3/2.0 ft no sample, no recovery
	11						
	12						
	13						
	14						
	15	SAND, as above. (SP)				50	no sample, no recovery
	16						
	17						
	18						
	19						
	20	CLAY: very dark red (5R 2/6), high plasticity, moist, some gypsum. (CH)			91JULH037 -008	8,12,13,25	sample 20-21 ft for analysis
	21	SAND: white (N9), very fine grained, poorly graded, wet, some silt and clay. (SP)					water at 21 ft bgl
	22						TD= 22.0 ft
	23						
	24						
	25						
	26						
	27						

PROJECT HOLLOMAN AFB RI/FS FOR 29 SITES

HOLE NO. SB-37-04

F2410

DRILLING LOG

HOLE NO. SB-37-05

12394

1. COMPANY NAME RADIAN CORPORATION	2. DRILLING SUBCONTRACTOR SOUTHWEST ENG INC
SHEET 1 OF 2 SHEETS	
3. PROJECT HOLLOMAN AFB RI/FS FOR 29 SITES	4. LOCATION 02
5. NAME OF DRILLER ALEX SANCHEZ	6. MANUFACTURER'S DESIGNATION OF DRILL HOLLOW-STEM AUGER
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: BOREHOLE DIA.: 7.5"	8. HOLE LOCATION 686248.02(Y), 538052.73(X)
	9. SURFACE ELEVATION 4076.36
	10. DATE STARTED 26 SEP 91 / 11. DATE COMPLETED 26 SEP 91
12. OVERBURDEN THICKNESS	15. DEPTH GROUNDWATER ENCOUNTERED
13. DEPTH DRILLED INTO ROCK	16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED
14. TOTAL DEPTH OF HOLE 17.0 ft.	17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY)

18. GEOTECHNICAL SAMPLES	DISTURBED	UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES

20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY %

22. DEPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR
			GROUT	ACD

a	DEPTH b	DESCRIPTION OF MATERIALS c	FIELD SCREENING RESULTS d	GEOTECH SAMPLE OR CORE BOX NO. e	ANALYTICAL SAMPLE NO. f	BLOW COUNTS g	REMARKS/RECOVERY h
	1, 2	SAND: tan/orange, clean, very fine, dry, crumbly, poorly graded, roots. (SP)	HS=0.0ppm		91JULH037-009	2,5,7,10	1.0/2.0 ft
	3, 4, 5, 6, 7	SILTY SAND: brown (5YR 6/4), tan mottles, crumbly, moist, slightly hard. (SM)	HS=0.0ppm			3,13,22,30	2.0/2.0 ft
			HS=0.0ppm				2.0/2.0 ft
	8, 9	SAND: tan and brown (5YR 6/4) zones, clean, fine to very fine, poorly graded, moist, crumbly. (SP)	HS=0.0ppm			5,19,21,26	2.0/2.0 ft

PROJECT HOLLOMAN AFB RI/FS FOR 29 SITES HOLE NO. SB-37-05

DRILLING LOG

HOLE NO. SB-37-05

F2394

PROJECT HOLLOMAN AFB RI/FS

INSPECTOR ACD

SHEET 2 OF 2 SHEETS

a	DEPTH b	DESCRIPTION OF MATERIALS c	FIELD SCREENING RESULTS d	GEOTECH SAMPLE OR CORE BOX NO. e	ANALYTICAL SAMPLE NO. f	BLOW COUNTS g	REMARKS/RECOVERY h
					91JULH037 -010		
	11	SAND: tan (10YR 8/2), very fine, hard (almost caliche), poorly graded, crumbly. (SP)	HS=0.0ppm			1,10,26,27	2.0/2.0 ft
	12						
	13						
	14						
	15	SAND: brown (5YR 6/4), clean, fine to very fine, poorly graded. (SP)	HS=0.0ppm			20,38,50, 16	2.0/2.0 ft not able to obtain sample
	16						
	17						TD= 17.0 ft
	18						
	19						
	20						
	21						
	22						
	23						
	24						
	25						
	26						
	27						

PROJECT HOLLOMAN AFB RI/FS FOR 29 SITES

HOLE NO. SB-37-05

DRILLING LOG

HOLE NO. SB-37-06

1. COMPANY NAME	RADIAN CORPORATION
2. DRILLING SUBCONTRACTOR	SOUTHWEST ENG INC
SHEET 1 OF 3 SHEETS	
3. PROJECT	HOLLOMAN AFB RI/FS FOR 29 SITES
4. LOCATION	37
5. NAME OF DRILLER	ART VALTIERRA
6. MANUFACTURER'S DESIGNATION OF DRILL	HOLLOW-STEM AUGER
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT	BOREHOLE DIA.: 7.5"
8. HOLE LOCATION	685990.06(Y), 538018.92(X)
9. SURFACE ELEVATION	4075.62
10. DATE STARTED	27 SEP 91
11. DATE COMPLETED	27 SEP 91
12. OVERBURDEN THICKNESS	
15. DEPTH GROUNDWATER ENCOUNTERED	34 ft bgl
13. DEPTH DRILLED INTO ROCK	
16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED	
14. TOTAL DEPTH OF HOLE	35 ft.
17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY)	
18. GEOTECHNICAL SAMPLES	DISTURBED / UNDISTURBED
19. TOTAL NUMBER OF CORE BOXES	
20. SAMPLES FOR CHEMICAL ANALYSIS	VOC / METALS / OTHER (SPECIFY) / OTHER (SPECIFY) / OTHER (SPECIFY)
21. TOTAL CORE RECOVERY	%
22. DEPOSITION OF HOLE	BACKFILLED / MONITORING WELL / OTHER (SPECIFY): GROUT
23. SIGNATURE OF INSPECTOR	HTH

a	DEPTH b	DESCRIPTION OF MATERIALS c	FIELD SCREENING RESULTS d	GEOTECH SAMPLE OR CORE BOX NO. e	ANALYTICAL SAMPLE NO. f	BLOW COUNTS g	REMARKS/RECOVERY h
	1	SILT: very pale orange (10YR 8/2), low plasticity, dry, very soft. (ML)	HS=0.0ppm			3,8,12,14	1.5/2.0 ft
	2	SILT: as above.	HS=0.0ppm		91JULH037-011	5,15,12,13	1.8/2.0 ft
	3						
	4						
	5	CLAYEY SILT: light brown (5YR 6/4), mottled with white gypsum sand, medium plasticity, dry, soft. (ML)	HS=0.0ppm				2.0/2.0 ft
	6						
	7	SAND: very pale orange (10YR 8/2), very fine grained, poorly graded, rust stains. (SP)				19,30,50	1.0/2.0 ft
	8						
	9						

DRILLING LOG

HOLE NO. SB-37-06

PROJECT HOLLOMAN AFB RI/FS

INSPECTOR HTH

SHEET 2 OF 3 SHEETS

a	DEPTH b	DESCRIPTION OF MATERIALS c	FIELD SCREENING RESULTS d	GEOTECH SAMPLE OR CORE BOX NO. e	ANALYTICAL SAMPLE NO. f	BLOW COUNTS g	REMARKS/RECOVERY h
		SAND: as above.	HS=0.0ppm			17,9,4,9	1.5/2.0 ft
	11						
		SILTY SAND: as above.					
	12						
	13						
	14						
	15	SILT: light brown (5YR 6/4) and very pale orange (10YR 8/2), low plasticity, dry, soft soft. (ML)	HS=0.0ppm			13,17,21, 23	
	16						
	17						
	18						
	19						
	20	SANDYR SILT, with clay: light brown (5YR 5/6), medium plasticity, moist, firm, sand increases with depth. (ML)	HS=0.0ppm			12,18,36, 50	
	21						
	22						
	23						
	24						
	25	SILTY SAND: light brown (5YR 5/6), very fine grained, poorly graded, non-plastic, moist, soft. (SM)	HS=0.0ppm		91JULH037 -012	13,15,25, 30	
	26						
	27						

DRILLING LOG

HOLE NO. SB-37-06

PROJECT HOLLOMAN AFB RI/FS

INSPECTOR HTH

SHEET 3 OF 3 SHEETS

a	DEPTH b	DESCRIPTION OF MATERIALS c	FIELD SCREENING RESULTS d	GEOTECH SAMPLE OR CORE BOX NO. e	ANALYTICAL SAMPLE NO. f	BLOW COUNTS g	REMARKS/RECOVERY h
	29						
	30	SILTY SAND, as above.	HS=0.0ppm			24,50	
	31						
	32						
	33						
	34						water at 34.0 ft bgl
	35	SILTY SAND: as above, wet.	HS=0.0ppm				
	36						
	37						TD= 37.0 ft
	38						
	39						
	40						
	41						
	42						
	43						
	44						
	45						

PROJECT HOLLOMAN AFB RI/FS FOR 29 SITES

HOLE NO. SB-37-06

DRILLING LOG

HOLE NO. MW-37-01

F2387

1. COMPANY NAME RADIAN CORPORATION	2. DRILLING SUBCONTRACTOR SOUTHWEST ENG INC
SHEET 1 OF 3 SHEETS	
3. PROJECT HOLLOMAN AFB RI/FS FOR 29 SITES	4. LOCATION -37
5. NAME OF DRILLER ART VALTIERRA	6. MANUFACTURER'S DESIGNATION OF DRILL HOLLOW-STEM AUGER
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: BOREHOLE DIA.: 7.5"	8. HOLE LOCATION 686025.10(Y), 537843.13(X)
	9. SURFACE ELEVATION 4076.08
	10. DATE STARTED 27 SEP 91 / 11. DATE COMPLETED 27 SEP 91
12. OVERBURDEN THICKNESS	15. DEPTH GROUNDWATER ENCOUNTERED 28.5 ft bgl
13. DEPTH DRILLED INTO ROCK	16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED 04 NOV 91 31.64 ft bgl
14. TOTAL DEPTH OF HOLE 36 ft.	17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY)

18. GEOTECHNICAL SAMPLES	DISTURBED	UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES
		X	

20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY %

22. DEPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR
		X		ACD

a	DEPTH b	DESCRIPTION OF MATERIALS c	FIELD SCREENING RESULTS d	GEOTECH SAMPLE OR CORE BOX NO. e	ANALYTICAL SAMPLE NO. f	BLOW COUNTS g	REMARKS/RECOVERY h
	1, 2	SILTY SAND: light brown, very fine, crumbly, moist, poorly graded. (SM)					4.0/5.0 ft
	3, 4	SANDY SILT: tan (10YR 8/2), some caliche, dry, crumbly, low plasticity. (ML)					
	5, 6, 7, 8, 9	SAND: orange-pink (5YR 8/4), clean, fine to very fine, loose, crumbly, poorly graded, homogeneous. (SP)					3.5/5.0 ft

DRILLING LOG

HOLE NO. MW-37-01

PROJECT HOLLOMAN AFB RI/FS

INSPECTOR ACD

SHEET 2 OF 3 SHEETS

a	DEPTH b	DESCRIPTION OF MATERIALS c	FIELD SCREENING RESULTS d	GEOTECH SAMPLE OR CORE BOX NO. e	ANALYTICAL SAMPLE NO. f	BLOW COUNTS g	REMARKS/RECOVERY h
	11	CLAYEY SILT: brown (5YR 5/6), meduim to high plasticity, white spots/mottles (gypsum crystals??), firm, moist, medium toughness. (MH)					4.5/5.0 ft
	12						
	13						
	14	SAND: brown (5YR 5/6), fine to very fine, clean. (SP)					
	15	SAND: tan (10YR 8/2), clean, moist, crumbly, fine to very fine, poorly graded, homogeneous, minor caliche. (SP)					3.0/5.0 ft
	16						
	17	changes to brown (5YR 6/4).					
	18						
	19						
	20	SILTY SAND: brown (5YR 5/6), moist, very fine, poorly graded, homogeneous, crumbly. (SM)					3.5/5.0 ft
	21						
	22						
	23	tan laminae.					
	24						
	25						4.0/5.0 ft
	26	fine to very fine, clean sand zone.					
	27						

DRILLING LOG

PROJECT: HOLLOMAN AFB RI/FS

INSPECTOR: ACD

HOLE NO.: MW-37-01

SHEET 3 OF 3 SHEETS

F2387

a	DEPTH b	DESCRIPTION OF MATERIALS c	FIELD SCREENING RESULTS d	GEOTECH SAMPLE OR CORE BOX NO. e	ANALYTICAL SAMPLE NO. f	BLOW COUNTS g	REMARKS/RECOVERY h
		wet at 28.5'					
	29						
	30						▽ -water at 29.64 ft 5.0/5.0 ft
	31						
	32						
	33			MW037-01-32.5-35.0'			
	34						
	35	CLAY: brown (5YR 4/4), high plasticity, sticky, low toughness, large gypsum crystals. (CH)					
	36						TD=36 ft
	37						
	38						
	39						
	40						
	41						
	42						
	43						
	44						
	45						

PROJECT: HOLLOMAN AFB RI/FS FOR 29 SITES

HOLE NO.: MW-37-01

DRILLING LOG

HOLE NO. MW-37-02

F2388

1. COMPANY NAME	RADIAN CORPORATION
2. DRILLING SUBCONTRACTOR	SOUTHWEST ENG INC
SHEET 1 OF 2 SHEETS	
3. PROJECT	HOLLOMAN AFB RI/FS FOR 29 SITES
4. LOCATION	37
5. NAME OF DRILLER	ART VALTIERRA
6. MANUFACTURER'S DESIGNATION OF DRILL	HOLLOW-STEM AUGER
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT	BOREHOLE DIA.: 7.5"
8. HOLE LOCATION	686330.24(Y), 537768.93(X)
9. SURFACE ELEVATION	4057.22
10. DATE STARTED	27 SEP 91
11. DATE COMPLETED	27 SEP 91
12. OVERBURDEN THICKNESS	
15. DEPTH GROUNDWATER ENCOUNTERED	~13 ft bgl
13. DEPTH DRILLED INTO ROCK	
16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED	04 NOV 91 14.54 ft bmp
14. TOTAL DEPTH OF HOLE	21.5 ft.
17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY)	

18. GEOTECHNICAL SAMPLES	DISTURBED	UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES
		X	

20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY %

22. DEPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR
		X		ACD

a	DEPTH b	DESCRIPTION OF MATERIALS c	FIELD SCREENING RESULTS d	GEOTECH SAMPLE OR CORE BOX NO. e	ANALYTICAL SAMPLE NO. f	BLOW COUNTS g	REMARKS/RECOVERY h
	1	SILTY SAND: orange-pink (5YR 8/4), loose, crumbly, dry, poorly graded, homogeneous. (SM)					3.0/5.0 ft
	2, 3, 4	SANDY SILT (silty sand?): brown (5YR 5/6), moist, homogeneous, loose, crumbly, low plasticity, mottled appearance. (ML)					
	5, 6, 7	SAND: brown (5YR 5/6), clean, very fine, loose, moist, crumbly, poorly graded, homogeneous. (SP)					3.5/4.0 ft
	8, 9	SAND: orange-pink (5YR 8/4), very fine to fine, moist, loose, crumbly, poorly graded, clean, homogeneous. (SP)					

DRILLING LOG

PROJECT HOLLOMAN AFB RI/FS

INSPECTOR ACD

HOLE NO. MW-37-02

SHEET 2 OF 2 SHEETS

F3388

a	DEPTH b	DESCRIPTION OF MATERIALS c	FIELD SCREENING RESULTS d	GEOTECH SAMPLE OR CORE BOX NO. e	ANALYTICAL SAMPLE NO. f	BLOW COUNTS g	REMARKS/RECOVERY h
		harder (not loose, but not caliche) at 10', moist					5.0/5.0 ft
	11						
	12						
	13	SAND: brown (5YR 5/6), fine to medium, loose, wet zone at 13 ft. (SP)					—water at 12.54 ft
	14	very fine to fine, clean, hard, caliche, homogeneous, poorly graded, wet.					
	15						5.0/5.0 ft
	16						
	17	SAND, as above: not as hard, very saturated.		MW037-02 17.5-20.0			
	18						
	19						
	20						
	21						
	22						TD=21.5 ft
	23						
	24						
	25						
	26						
	27						

PROJECT HOLLOMAN AFB RI/FS FOR 29 SITES

HOLE NO. MW-37-02

DRILLING LOG

HOLE NO. MW-37-03

1. COMPANY NAME	RADIAN CORPORATION
2. DRILLING SUBCONTRACTOR	SOUTHWEST ENG INC
SHEET 1 OF 3 SHEETS	
3. PROJECT	HOLLOMAN AFB RI/FS FOR 29 SITES
4. LOCATION	37
5. NAME OF DRILLER	ART VALTIERRA
6. MANUFACTURER'S DESIGNATION OF DRILL	HOLLOW-STEM AUGER
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT	BOREHOLE DIA.: 7.5"
8. HOLE LOCATION	687430.86(Y), 538441.26(X)
9. SURFACE ELEVATION	4077.62
10. DATE STARTED	27 SEP 91
11. DATE COMPLETED	27 SEP 91
12. OVERBURDEN THICKNESS	
15. DEPTH GROUNDWATER ENCOUNTERED	25.6 ft bgl
13. DEPTH DRILLED INTO ROCK	
16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED	04 NOV 91 28.60 ft bmp
14. TOTAL DEPTH OF HOLE	36 ft.
17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY)	

18. GEOTECHNICAL SAMPLES	DISTURBED	UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES

20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY %

22. DEPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR
		X		HTH

a	DEPTH b	DESCRIPTION OF MATERIALS c	FIELD SCREENING RESULTS d	GEOTECH SAMPLE OR CORE BOX NO. e	ANALYTICAL SAMPLE NO. f	BLOW COUNTS g	REMARKS/RECOVERY h
	1, 2, 3, 4, 5	SILT: very pale orange (10YR 8/2), low plasticity, dry, very soft. (ML)					cuttings
	6, 7	SILTY CLAY: moderate brown (5YR 4/4), medium plasticity, moist. (CL)	SC=0.0ppm				cuttings
	8, 9	SANDY CLAY: moderate brown (5YR 4/4), medium plasticity, dry, very fine sand in clay. (CL)	SC=0.0ppm				cuttings

DRILLING LOG

HOLE NO. MW-37-03

PROJECT HOLLOMAN AFB RI/FS

INSPECTOR HTH

SHEET 2 OF 3 SHEETS

a	DEPTH b	DESCRIPTION OF MATERIALS c	FIELD SCREENING RESULTS d	GEOTECH SAMPLE OR CORE BOX NO. e	ANALYTICAL SAMPLE NO. f	BLOW COUNTS g	REMARKS/RECOVERY h
	11						
	12	CLAYEY SILT: moderate brown (5YR 4/4), low plasticity, firm, dry, white spots. (ML)					
	13						
	14						
	15	SANDY CLAY: moderate brown (5YR 4/4), medium plasticity, dry, hard, very fine sand, gypsum crystals. (CL)	SC=0.0ppm				cuttings; very hard to drill.
	16						
	17						
	18						
	19						easier to drill at 19 ft
	20	SAND: very pale orange (10YR 8/2), fine to very fine grained, poorly graded, dry. (SP)	SC=0.0ppm			15,30,50	
	21						
	22						
	23						
	24						
	25	CLAY: moderate brown (5YR 4/4), high plasticity, moist, firm. (CL)	SC=0.0ppm			7,9,13,11	
	26						water at 25.6 ft bgl
	27						
							saturation ~27.5 ft

PROJECT HOLLOMAN AFB RI/FS FOR 29 SITES

HOLE NO. MW-37-03

F2417

DRILLING LOG

HOLE NO. MW-37-03

PROJECT HOLLOMAN AFB RI/FS

INSPECTOR HTH

SHEET 3 OF 3 SHEETS

a	DEPTH b	DESCRIPTION OF MATERIALS c	FIELD SCREENING RESULTS d	GEOTECH SAMPLE OR CORE BOX NO. e	ANALYTICAL SAMPLE NO. f	BLOW COUNTS g	REMARKS/RECOVERY h
	29						
	30	SILTY SAND: light brown (6YR 6/4), very fine grained, poorly graded, low plasticity, wet. (SP)	SC=0.0ppm			6,9,7,7	
	31	SILTY CLAY: light brown (6YR 6/4), high plasticity, firm, wet. (CH)					
	32						
	33						
	34						
	35						
	36						TD= 36.0 ft
	37						
	38						
	39						
	40						
	41						
	42						
	43						
	44						
	45						

F2412

DRILLING LOG

HOLE NO. MW-37-04

1. COMPANY NAME	RADIAN CORPORATION
2. DRILLING SUBCONTRACTOR	SOUTHWEST ENG INC
SHEET 1 OF 2 SHEETS	
3. PROJECT	HOLLOMAN AFB RI/FS FOR 29 SITES
4. LOCATION	37
5. NAME OF DRILLER	ART VALTIERRA
6. MANUFACTURER'S DESIGNATION OF DRILL	HOLLOW-STEM AUGER
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT	BOREHOLE DIA.: 7.5"
8. HOLE LOCATION	688500.66(Y), 538802.84(X)
9. SURFACE ELEVATION	4061.11
10. DATE STARTED	28 SEP 91
11. DATE COMPLETED	28 SEP 91
12. OVERBURDEN THICKNESS	
15. DEPTH GROUNDWATER ENCOUNTERED	~8.5 ft bgl
13. DEPTH DRILLED INTO ROCK	
16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED	04 NOV 91 16.14 ft bmp
14. TOTAL DEPTH OF HOLE	20 ft.
17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY)	

18. GEOTECHNICAL SAMPLES	DISTURBED	UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES

20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY %

22. DEPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR
		X		ACD

a	DEPTH b	DESCRIPTION OF MATERIALS c	FIELD SCREENING RESULTS d	GEOTECH SAMPLE OR CORE BOX NO. e	ANALYTICAL SAMPLE NO. f	BLOW COUNTS g	REMARKS/RECOVERY h
	1	SANDY SILT: brown (5YR 5/6) to (5YR 6/4), dry, crumbly, loose, low plasticity. (ML)					3.0/5.0 ft
	2	CLAYEY SILT: brown (5YR 4/4), white spots/mottles/gypsuspots/m crystals, high plasticity, firm to stiff, moist. (MH)					
	3						
	4						
	5						4.5/5.0 ft
	6						
	7						
	8						
	9	SILTY SAND: light (5YR 6/4) and moderate (5YR 4/4) brown, poorly graded, wet, loose, homogeneous, very fine grained. (SM)					

PROJECT HOLLOMAN AFB RI/FS FOR 29 SITES HOLE NO. MW-37-04

DRILLING LOG

HOLE NO. MW-37-04

PROJECT HOLLOMAN AFB RI/FS

INSPECTOR ACD

SHEET 2 OF 2 SHEETS

a	DEPTH b	DESCRIPTION OF MATERIALS c	FIELD SCREENING RESULTS d	GEOTECH SAMPLE OR CORE BOX NO. e	ANALYTICAL SAMPLE NO. f	BLOW COUNTS g	REMARKS/RECOVERY h
	11	SAND: greyish-orange (10YR 7/4) to light brown, clean, fine to very fine, wet, loose, homogeneous, poorly graded. (SP)					5.0/5.0 ft
	12						
	13						
	14						▽ water at 13.64 ft
	15						4.0/5.0 ft
	16	SAND: tan (10YR 8/2), clean, wet, very fine to fine (some medium) grained, homogeneous, loose, poorly graded. (SP)					
	17						
	18						
	19						
	20						TD=20 FT
	21						
	22						
	23						
	24						
	25						
	26						
	27						

PROJECT HOLLOMAN AFB RI/FS FOR 29 SITES

HOLE NO. MW-37-04

DRILLING LOG

HOLE NO. MW-37-05

1. COMPANY NAME	RADIAN CORPORATION
2. DRILLING SUBCONTRACTOR	SOUTHWEST ENG INC
SHEET 1 OF 3 SHEETS	
3. PROJECT	HOLLOMAN AFB RI/FS FOR 29 SITES
4. LOCATION	37
5. NAME OF DRILLER	ART VALTIERRA
6. MANUFACTURER'S DESIGNATION OF DRILL	HOLLOW-STEM AUGER
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT	BOREHOLE DIA.: 7.5"
8. HOLE LOCATION	688445.46(Y), 538940.94
9. SURFACE ELEVATION	4081.14
10. DATE STARTED	28 AUG 91
11. DATE COMPLETED	28 AUG 91
12. OVERBURDEN THICKNESS	
15. DEPTH GROUNDWATER ENCOUNTERED	~33 ft bgl
13. DEPTH DRILLED INTO ROCK	
16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED	04 NOV 91 35.04 ft bmp
14. TOTAL DEPTH OF HOLE	42 ft.
17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY)	

18. GEOTECHNICAL SAMPLES	DISTURBED	UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES
		X	

20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY %

22. DEPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR
		X		ACD

a	DEPTH b	DESCRIPTION OF MATERIALS c	FIELD SCREENING RESULTS d	GEOTECH SAMPLE OR CORE BOX NO. e	ANALYTICAL SAMPLE NO. f	BLOW COUNTS g	REMARKS/RECOVERY h
	1, 2, 3, 4	SANDY SILT: tan to grey-orange (10YR 8/6), dry, loose, crumbly, low plasticity. (ML)					3.0/5.0 ft
		caliche at ~2.5'					
	5, 6	SAND: orange-pink (5YR 8/4), clean, fine to very fine, poorly graded, moist, loose, crumbly. (SP)					3.0/5.0 ft
	7	tan/orange (10YR 8/2), caliche layer.					
	8, 9	CLAYEY SILT: brown (5YR 5/6), white spots/mottles/gypsum, high plasticity, firm to stiff, moist. (MH)					

PROJECT HOLLOMAN AFB RI/FS FOR 29 SITES HOLE NO. MW-37-05

DRILLING LOG

PROJECT HOLLOMAN AFB RI/FS

INSPECTOR ACD

HOLE NO. MW-37-05

SHEET 2 OF 3 SHEETS

a	DEPTH b	DESCRIPTION OF MATERIALS c	FIELD SCREENING RESULTS d	GEOTECH SAMPLE OR CORE BOX NO. e	ANALYTICAL SAMPLE NO. f	BLOW COUNTS g	REMARKS/RECOVERY h
		changes to a hard, sandy, clayey silt.					5.0/5.0 ft
	11						
	12						
	13	SANDY SILT: brown (5YR 5/6), dry, low plasticity, loose, crumbly, some interbedded MH zones. (ML)					
	14						
	15	CLAYEY SILT: high plasticity, same as 7.5-13 ft. (MH)					5.0/5.0 ft
	16						
	17						
	18						
	19						
	20	some sandy zones present.					5.0/5.0 ft
	21						
	22						
	23						
	24						
	25						
	26	SAND: tan (10YR 8/2) to light brown (5YR 6/4) zones, clean, slightly silty, poorly graded, very fine to fine grained, moist to wet, loose crumbly, homogeneous. (SP)					3.5/5.0 ft
	27						

DRILLING LOG

PROJECT HOLLOMAN AFB RI/FS

INSPECTOR ACD

HOLE NO. MW-37-05

SHEET 3 OF 3 SHEETS

F2330

a	DEPTH b	DESCRIPTION OF MATERIALS c	FIELD SCREENING RESULTS d	GEOTECH SAMPLE OR CORE BOX NO. e	ANALYTICAL SAMPLE NO. f	BLOW COUNTS g	REMARKS/RECOVERY h
	29						
	30						
	31						
	32						▽ water at 31.84 ft
	33			MW-037-005 32.5-35.0			
	34						
	35	interbedded sands and clayey silts: yellowish-red (5YR 5/6)					3.0/5.0 ft
	36						
	37	SAND: tan (10YR 8/2), clean, fine to very fine, homogeneous, poorly graded, wet. (SP)					
	38						
	39						
	40	hard, caliche.					very slow drilling
	41						
	42						TD=42.0 ft
	43						
	44						
	45						

PROJECT HOLLOMAN AFB RI/FS FOR 29 SITES

HOLE NO. MW-37-05

DRILLING LOG

HOLE NO. MW-37-06

F2391

1. COMPANY NAME	RADIAN CORPORATION
2. DRILLING SUBCONTRACTOR	SOUTHWEST ENG INC
SHEET 1 OF 3 SHEETS	
3. PROJECT	HOLLOMAN AFB RI/FS FOR 29 SITES
4. LOCATION	37
5. NAME OF DRILLER	ART VALTIERRA
6. MANUFACTURER'S DESIGNATION OF DRILL	HOLLOW-STEM AUGER
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT	BOREHOLE DIA.: 7.5"
8. HOLE LOCATION	688953.52(Y), 539149.29(X)
9. SURFACE ELEVATION	4084.13
10. DATE STARTED	28 AUG 91
11. DATE COMPLETED	28 AUG 91
12. OVERBURDEN THICKNESS	
15. DEPTH GROUNDWATER ENCOUNTERED	~40 ft bgl
13. DEPTH DRILLED INTO ROCK	
16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED	04 NOV 91 35.82 ft bmp
14. TOTAL DEPTH OF HOLE	45 ft.
17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY)	

18. GEOTECHNICAL SAMPLES	DISTURBED	UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES

20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY %

22. DEPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR
		X		ACD

a	DEPTH b	DESCRIPTION OF MATERIALS c	FIELD SCREENING RESULTS d	GEOTECH SAMPLE OR CORE BOX NO. e	ANALYTICAL SAMPLE NO. f	BLOW COUNTS g	REMARKS/RECOVERY h
	1	SILTY SAND: orange-pink (5YR 8/4), dry, loose, crumbly, poorly graded. (SM)					3.5/5.0 ft
	2, 3, 4, 5	SILT: tan (10YR 8/2) and light brown/tan, hard, caliche, dry, crumbly, low plasticity. (ML)					
	6	SAND: tan (10YR 8/2) to yellow-tan, clean, dry, loose, fine to very fine grained, poorly graded, yellow-brown stains. (SP)					4.0/5.0 ft
	7, 8, 9	SILT: red brown to brown (5YR 5/6), clayey (7-8 ft), high plasticity, white spots/mottles, sandy, low to medium plasticity (8-9 ft), firm hard, almost a silty sand (?). (MH)					

DRILLING LOG

PROJECT HOLLOMAN AFB RI/FS

INSPECTOR ACD

HOLE NO. MW-37-06

SHEET 2 OF 3 SHEETS

a	DEPTH b	DESCRIPTION OF MATERIALS c	FIELD SCREENING RESULTS d	GEOTECH SAMPLE OR CORE BOX NO. e	ANALYTICAL SAMPLE NO. f	BLOW COUNTS g	REMARKS/RECOVERY h
	11						4.5/5.0 ft
	12	SILT: tan (10YR 8/2) and brown (5YR 6/4), some caliche, low plasticity, moist, soft, sandy. (ML)					
	13						
	14						
	15	SAND: grey-orange (10YR 7/4), clean poorly graded, homogeneous, moist, loose, some hard zones, very fine. (SP)					4.5/5.0 ft
	16						
	17	changes to pale orange (10YR 8/2).					
	18	CLAYEY, SANDY SILT: brown (5YR 5/6), gypsum crystals, medium plasticity. (MH)					
	19	SANDY, CLAYEY SILT: grey-orange (10YR 7/4), firm to hard, low plasticity. (ML)					
	20	CLAYEY SILT: brown (5YR 5/6), dry, loose, sticky when wet, low plasticity. (ML)					4.0/5.0 ft
	21						
	22	changes to grey-orange (10YR 7/4), harder.					
	23	SAND: brown (5YR 5/6), loose, moist, fine to very fine, clean. (SP)					
		CLAYEY SILT: brown (5YR 5/6), high plasticity, white spots (gypsum crystals?), firm sample, moist. (MH)					
	24						
	25	SILTY SAND: olive, very fine, poorly graded, loose, some thin caliche/hard zones, moist. (SM)					3.5/4.0 ft
	26						
	27						
		changes to a tan (10YR 8/2)					

DRILLING LOG

PROJECT	INSPECTOR	HOLE NO.	SHEET
HOLLOMAN AFB RI/FS	ACD	MW-37-06	3 OF 3 SHEETS

F2391

a	DEPTH b	DESCRIPTION OF MATERIALS c	FIELD SCREENING RESULTS d	GEOTECH SAMPLE OR CORE BOX NO. e	ANALYTICAL SAMPLE NO. f	BLOW COUNTS g	REMARKS/RECOVERY h
	29						
	30						4.0/5.0 ft
	31						
	32	caliche zones some interbedded brown laminae					
	33						▽
	34	SAND: tan (10YR 8/2), clean, wet, fine to very fine grained, poorly graded. (SP)					—water at 33.32 ft
	35	SILTY SAND: olive, poorly graded. (SM)					5.0/5.0 ft
	36	SILTY SAND: light brown (5YR 6/4), some caliche, moist (wet?), homogeneous, poorly graded, hard. (SM)					
	37						
	38						
	39						
	40	SILT: brown (5YR 4/4), moist to wet, loose, no caliche, firm, medium to low plasticity. (MH)					
	41						
	42	CLAYEY SILT: high plasticity.					
	43	SAND: clean, light brown (5YR 6/4), clean, very fine to medium, wet, homogeneous, poorly graded. (SP)					
	44						
	45						TD=45.0 ft

ELEVATION GROUND WATER			PROJECT HOLLOMAN AFB RI/FS
DATE INSTALLED 27 SEPT 91	STARTED	COMPLETED	LOCATION (Coordinates or Station) 37
ELEVATION TOP OF CASING 4077.22			SIGNATURE OF INSPECTOR/INSTALLER ACD
DRILLING METHOD HOLLOW STEM AUGER			WELL NO. (as shown on drawing: title and file number) MW-37-01

MONITORING WELL CONSTRUCTION DIAGRAM

(ALL MEASUREMENTS FROM GROUND SURFACE)

PROTECTIVE CASING

TYPE OF PROTECTIVE CASING: Steel Lockbox

TOP OF WELL

PROTECTIVE POSTS

CASING DIAMETER: 2 in.

TYPE OF PIPE JOINTS: Flush Threaded

TYPE OF BLANK CASING: PVC

BACKFILL/GROUT MIX ETC. Type I Portland Cement

TOP OF SEAL

TYPE OF SEAL: Bentonite Pellets

TOP OF FILTERPACK

TOP OF SCREEN

FILTER PACK

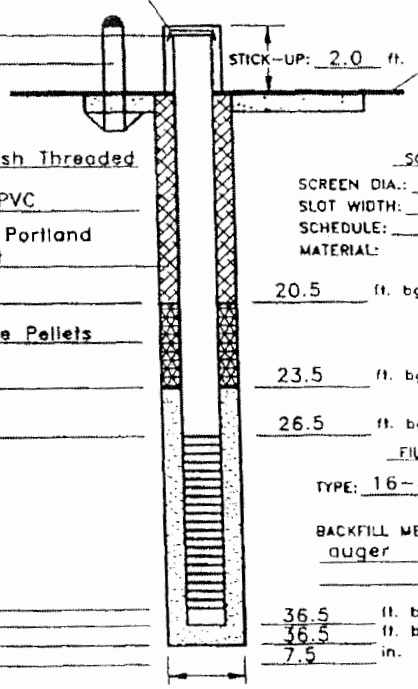
BOTTOM OF WELL

BOTTOM OF BORING

BORING DIAMETER

28.5 ft. LENGTH OF SOLID PIPE

9.5 ft. WELL SCREEN LENGTH



STICK-UP: 2.0 ft.

GROUND SURFACE

CONCRETE PAD MIN. 4.0" THICKNESS

SCREEN INFORMATION

SCREEN DIA.: 2 in.

SLOT WIDTH: 0.010 in.

SCHEDULE: 40

MATERIAL: ☒ PVC ☐ STAINLESS STEEL ☐ OTHER (DESCRIBE)

20.5 ft. bgl

23.5 ft. bgl

26.5 ft. bgl

FILTERPACK MATERIAL

TYPE: 16-40 Colorado Silica Sand

BACKFILL METHOD: Tremie through auger

36.5 ft. bgl

36.5 ft. bgl

7.5 in.

WELL DEVELOPMENT

METHOD: See Well Development Record

TIME SPENT DEVELOPING:

VOLUME OF WATER REMOVED:

VOLUME OF WATER ADDED:

DESCRIPTION OF PREDEVELOPMENT WATER:

DESCRIPTION OF POST DEVELOPMENT WATER:

WATER LEVEL SUMMARY

WATER LEVEL MEASUREMENTS

DATE/TIME/LEVEL 4 NOV 91/1437/31.64 ft. bmp

DEPTH FROM TOP CASING AFTER DEVELOPMENT:

01738D

ELEVATION GROUND WATER			PROJECT HOLLOMAN AFB RI/FS
DATE INSTALLED 27 SEPT 91	STARTED	COMPLETED	LOCATION (Coordinates or Station) 37
ELEVATION TOP OF CASING 4058.43			SIGNATURE OF INSPECTOR/INSTALLER ACD
DRILLING METHOD HOLLOW STEM AUGER			WELL NO. (as shown on drawing: title and file number) MW-37-02

MONITORING WELL CONSTRUCTION DIAGRAM

(ALL MEASUREMENTS FROM GROUND SURFACE)

PROTECTIVE CASING

TYPE OF PROTECTIVE CASING: Steel Lockbox

TOP OF WELL

PROTECTIVE POSTS

CASING DIAMETER: 2 in.

TYPE OF PIPE JOINTS: Flush Threaded

TYPE OF BLANK CASING: PVC

BACKFILL/GROUT MIX ETC. Type I Portland Cement

TOP OF SEAL

TYPE OF SEAL: Bentonite Pellets

TOP OF FILTERPACK

TOP OF SCREEN

FILTER PACK

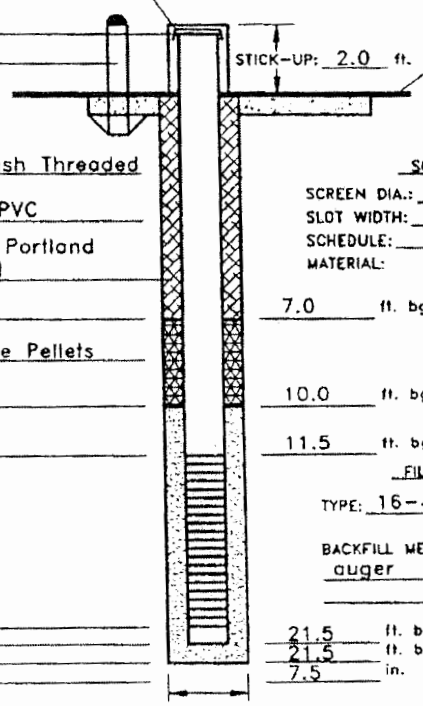
BOTTOM OF WELL

BOTTOM OF BORING

BORING DIAMETER

13.5 ft. LENGTH OF SOLID PIPE

9.5 ft. WELL SCREEN LENGTH



STICK-UP: 2.0 ft.

GROUND SURFACE

CONCRETE PAD MIN. 4.0" THICKNESS

SCREEN INFORMATION

SCREEN DIA.: 2 in.

SLOT WIDTH: 0.010 in.

SCHEDULE: 40

MATERIAL: ☒ PVC ☐ STAINLESS STEEL ☐ OTHER (DESCRIBE)

7.0 ft. bgl

10.0 ft. bgl

11.5 ft. bgl

FILTERPACK MATERIAL

TYPE: 16-40 Colorado Silica Sand

BACKFILL METHOD: Tremie through auger

21.5 ft. bgl

21.5 ft. bgl

7.5 in.

WELL DEVELOPMENT

METHOD: See Well Development Record

TIME SPENT DEVELOPING:

VOLUME OF WATER REMOVED:

VOLUME OF WATER ADDED:

DESCRIPTION OF PREDEVELOPMENT WATER:

DESCRIPTION OF POST DEVELOPMENT WATER:

WATER LEVEL SUMMARY

WATER LEVEL MEASUREMENTS

DATE/TIME/LEVEL 4 NOV 91/1443/14.54 ft. bmp

DEPTH FROM TOP CASING AFTER DEVELOPMENT:

D1738E

ELEVATION GROUND WATER			PROJECT HOLLOMAN AFB RI/FS
DATE INSTALLED 27 SEPT 91	STARTED	COMPLETED	LOCATION (Coordinates or Station) 37
ELEVATION TOP OF CASING 4079.66			SIGNATURE OF INSPECTOR/INSTALLER HTH
DRILLING METHOD HOLLOW STEM AUGER			WELL NO. (as shown on drawing: title and file number) MW-37-03

MONITORING WELL CONSTRUCTION DIAGRAM

(ALL MEASUREMENTS FROM GROUND SURFACE)

PROTECTIVE CASING

TYPE OF PROTECTIVE CASING: Steel Lockbox

TOP OF WELL

PROTECTIVE POSTS

CASING DIAMETER: 2 in.

TYPE OF PIPE JOINTS: Flush Threaded

TYPE OF BLANK CASING: PVC

BACKFILL/GROUT MIX ETC. Type I Portland Cement

TOP OF SEAL

TYPE OF SEAL: 1/4" Bentonite

TOP OF FILTERPACK

TOP OF SCREEN

FILTER PACK

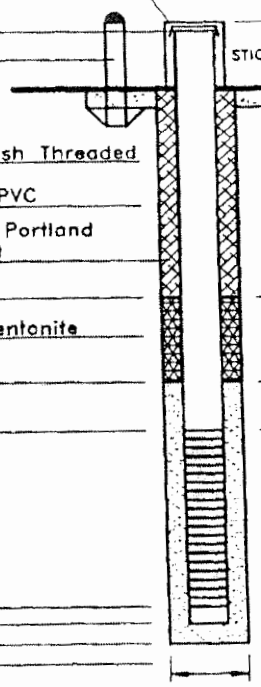
BOTTOM OF WELL

BOTTOM OF BORING

BORING DIAMETER

27.4 ft. LENGTH OF SOLID PIPE

9.5 ft. WELL SCREEN LENGTH



STICK-UP: 3.0 ft.

GROUND SURFACE

CONCRETE PAD MIN. 4.0 THICKNESS

SCREEN INFORMATION

SCREEN DIA.: 2 in.

SLOT WIDTH: 0.010 in.

SCHEDULE: 40

MATERIAL: ☒ PVC ☐ STAINLESS STEEL ☐ OTHER (DESCRIBE)

20.1 ft. bgl

23.1 ft. bgl

25.4 ft. bgl

FILTERPACK MATERIAL

TYPE: 16-40 Colorado Silica Sand

BACKFILL METHOD: Tremie through auger

34.3 ft. bgl

36.0 ft. bgl

7.5 in.

WELL DEVELOPMENT

METHOD: See well development record

TIME SPENT DEVELOPING:

VOLUME OF WATER REMOVED:

VOLUME OF WATER ADDED:

DESCRIPTION OF PREDEVELOPMENT WATER:

DESCRIPTION OF POST DEVELOPMENT WATER:

WATER LEVEL SUMMARY

WATER LEVEL MEASUREMENTS

DATE/TIME/LEVEL 27 SEP 91/1600/26.3 ft bgl

17 OCT 91/1500/28.64 ft bmp

04 NOV 91/1505/28.60 ft bmp

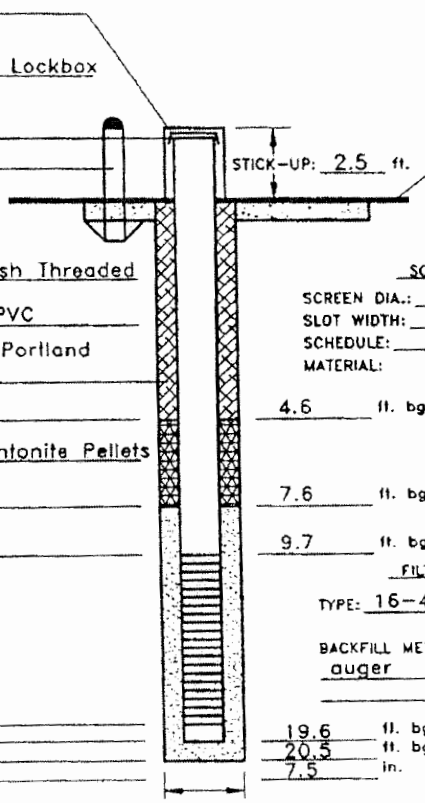
DEPTH FROM TOP CASING AFTER DEVELOPMENT:

F2304

ELEVATION GROUND WATER			PROJECT HOLLOMAN AFB RI/FS
DATE INSTALLED 28 SEPT 91	STARTED 1400	COMPLETED 1500	LOCATION (Coordinates or Station) 37
ELEVATION TOP OF CASING 4063.53			SIGNATURE OF INSPECTOR/INSTALLER HTH
DRILLING METHOD HOLLOW STEM AUGER			WELL NO. (as shown on drawing: title and file number) MW-37-04

MONITORING WELL CONSTRUCTION DIAGRAM

(ALL MEASUREMENTS FROM GROUND SURFACE)



PROTECTIVE CASING

TYPE OF PROTECTIVE CASING: Steel Lockbox

TOP OF WELL

PROTECTIVE POSTS

CASING DIAMETER: 2 in.

TYPE OF PIPE JOINTS: Flush Threaded

TYPE OF BLANK CASING: PVC

BACKFILL/GROUT MIX ETC. Type I Portland Cement

TOP OF SEAL

TYPE OF SEAL: 1/4" Bentonite Pellets

TOP OF FILTERPACK

TOP OF SCREEN

FILTER PACK

BOTTOM OF WELL

BOTTOM OF BORING

BORING DIAMETER

12.1 ft. LENGTH OF SOLID PIPE

9.5 ft. WELL SCREEN LENGTH

STICK-UP: 2.5 ft.

GROUND SURFACE

CONCRETE PAD MIN. 4.0" THICKNESS

SCREEN INFORMATION

SCREEN DIA.: 2 in.

SLOT WIDTH: 0.010 in.

SCHEDULE: 40

MATERIAL: ☒ PVC ☐ STAINLESS STEEL

4.6 ft. bgl ☐ OTHER (DESCRIBE)

7.6 ft. bgl

9.7 ft. bgl

FILTERPACK MATERIAL

TYPE: 16-40 Colorado Silica Sand

BACKFILL METHOD: Tremie through auger

19.6 ft. bgl

20.5 ft. bgl

7.5 in.

WELL DEVELOPMENT

METHOD: See well development record

TIME SPENT DEVELOPING:

VOLUME OF WATER REMOVED:

VOLUME OF WATER ADDED:

DESCRIPTION OF PREDEVELOPMENT WATER:

DESCRIPTION OF POST DEVELOPMENT WATER:

WATER LEVEL SUMMARY

WATER LEVEL MEASUREMENTS

DATE/TIME/LEVEL 28 SEP 91/1600/13.3 ft bgl

19 OCT 91/0840/16.09 ft bmp

04 NOV 91/1515/16.14 ft bmp

DEPTH FROM TOP CASING AFTER DEVELOPMENT:

F2305

ELEVATION GROUND WATER			PROJECT HOLLOMAN AFB RI/FS
DATE INSTALLED 29 SEPT 91	STARTED 1600	COMPLETED 1800	LOCATION (Coordinates or Station) 37
ELEVATION TOP OF CASING 4083.09			SIGNATURE OF INSPECTOR/INSTALLER HTH
DRILLING METHOD HOLLOW STEM AUGER			WELL NO. (as shown on drawing: title and file number) MW-37-05

MONITORING WELL CONSTRUCTION DIAGRAM

(ALL MEASUREMENTS FROM GROUND SURFACE)

PROTECTIVE CASING

TYPE OF PROTECTIVE CASING: Steel Lockbox

TOP OF WELL

PROTECTIVE POSTS

CASING DIAMETER: 2 in.

TYPE OF PIPE JOINTS: Flush Threaded

TYPE OF BLANK CASING: PVC

BACKFILL/GROUT MIX ETC. Type I Portland Cement

TOP OF SEAL

TYPE OF SEAL: 1/4" Bentonite Pellets

TOP OF FILTERPACK

TOP OF SCREEN

FILTER PACK

BOTTOM OF WELL

BOTTOM OF BORING

BORING DIAMETER

LENGTH OF SOLID PIPE: 3.2 ft.

WELL SCREEN LENGTH: 9.5 ft.

STICK-UP: 3.2 ft.

GROUND SURFACE

CONCRETE PAD MIN. 4.0 THICKNESS

SCREEN INFORMATION

SCREEN DIA.: 2 in.

SLOT WIDTH: 0.010 in.

SCHEDULE: 40

MATERIAL: ☒ PVC ☐ STAINLESS STEEL

26.2 ft. bgl ☐ OTHER (DESCRIBE)

29.2 ft. bgl

31.1 ft. bgl

FILTERPACK MATERIAL

TYPE: 16-40 Colorado Silica Sand

BACKFILL METHOD: Tremie through auger

41.0 ft. bgl

42.0 ft. bgl

7.5 in.

WELL DEVELOPMENT

METHOD: See Well Development Record

TIME SPENT DEVELOPING:

VOLUME OF WATER REMOVED:

VOLUME OF WATER ADDED:

DESCRIPTION OF PREDEVELOPMENT WATER:

DESCRIPTION OF POST DEVELOPMENT WATER:

WATER LEVEL SUMMARY

WATER LEVEL MEASUREMENTS

DATE/TIME/LEVEL 19 OCT 91/0840/35.04 ft. bmp

4 NOV 91/1458/35.04 ft. bmp

DEPTH FROM TOP CASING AFTER DEVELOPMENT:

D1736M

ELEVATION GROUND WATER			PROJECT HOLLOMAN AFB RI/FS
DATE INSTALLED 29 SEPT 91	STARTED	COMPLETED	LOCATION (Coordinates or Station) 37
ELEVATION TOP OF CASING 4085.29			SIGNATURE OF INSPECTOR/INSTALLER ACD
DRILLING METHOD HOLLOW STEM AUGER			WELL NO. (as shown on drawing: title and file number) MW-37-06

MONITORING WELL CONSTRUCTION DIAGRAM

(ALL MEASUREMENTS FROM GROUND SURFACE)

PROTECTIVE CASING

TYPE OF PROTECTIVE CASING: Steel Lockbox

TOP OF WELL

PROTECTIVE POSTS

CASING DIAMETER: 2 in.

TYPE OF PIPE JOINTS: Flush Threaded

TYPE OF BLANK CASING: PVC

BACKFILL/GROUT MIX ETC. Type I Portland Cement

TOP OF SEAL

TYPE OF SEAL: Bentonite Pellets

TOP OF FILTERPACK

TOP OF SCREEN

FILTER PACK

BOTTOM OF WELL

BOTTOM OF BORING

BORING DIAMETER

LENGTH OF SOLID PIPE: 34.6 ft.

WELL SCREEN LENGTH: 9.5 ft.

STICK-UP: 2.5 ft.

GROUND SURFACE

CONCRETE PAD MIN. 4.0" THICKNESS

SCREEN INFORMATION

SCREEN DIA.: 2 in.

SLOT WIDTH: 0.010 in.

SCHEDULE: 40

MATERIAL: ☒ PVC ☐ STAINLESS STEEL ☐ OTHER (DESCRIBE)

27.0 ft. bgl

30.0 ft. bgl

32.0 ft. bgl

FILTERPACK MATERIAL

TYPE: 16-40 Colorado Silica Sand

BACKFILL METHOD: Tremie through auger

42.0 ft. bgl

45.0 ft. bgl

7.5 in.

WELL DEVELOPMENT

METHOD: See Well Development Record

TIME SPENT DEVELOPING:

VOLUME OF WATER REMOVED:

VOLUME OF WATER ADDED:

DESCRIPTION OF PREDEVELOPMENT WATER:

DESCRIPTION OF POST DEVELOPMENT WATER:

WATER LEVEL SUMMARY

WATER LEVEL MEASUREMENTS

DATE/TIME/LEVEL 4 NOV 91/1452/35.82 ft. bmp

DEPTH FROM TOP CASING AFTER DEVELOPMENT:

01738F

APPENDIX B

SITE-SPECIFIC ADDENDUM TO THE BASEWIDE HEALTH AND SAFETY PLAN

SITE-SPECIFIC ADDENDUM
TO THE BASEWIDE HEALTH AND SAFETY PLAN

ACCELERATED CORRECTIVE MEASURES
MULTIPLE SITES
HOLLOMAN AFB, NEW MEXICO

Prepared for:

49 CES/CEV
Holloman Air Force Base
New Mexico

Under Contract to:

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

Contract No. DACA45-03-D-0023
Task Order No. 021

Prepared by:

Bhate Environmental Associates, Inc.
1608 13th Avenue South, Suite 300
Birmingham, Alabama 35205

Bhate Project No. 9050361.03

November 2006

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SITE-SPECIFIC ADDENDUM
TO THE BASEWIDE HEALTH AND SAFETY PLAN
ACCELERATED CORRECTIVE MEASURES
MULTIPLE SITES
HOLLOMAN AFB, NEW MEXICO

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ACRONYMS AND ABBREVIATIONS

ACM	Accelerated Corrective Measures
AF Fm	Air Force Form
AHA	Activity Hazard Analysis
ANSI	American National Standards Institute
Bhate	Bhate Environmental Associates, Inc.
CES/CEV	Civil Engineering Squadron/Combat Engineer Vehicle
CFR	Code of Federal Regulations
CHMM	Certified Hazardous Materials Manager
CIH	Certified Industrial Hygienist
CPR	Cardiopulmonary Resuscitation
DPT	Direct push technology
HAFB	Holloman Air Force Base
HASP	Health and Safety Plan
HSM	Health and Safety Manager
mg/m^3	Milligrams per cubic meter
mR	Milliroentgen
mrem	Millirem
MSDS	Material Safety Data Sheet
MSPH	Master of Science in Public Health
NIOSH	National Institute for Occupational Safety and Health
NMED	New Mexico Environment Department
PCBs	Polychlorinated Biphenyls
PCS	Petroleum contaminated soil
PEL	Permissible exposure limit
P.G.	Professional Geologist
PID	Photoionization Detector
PPE	Personal protective equipment
ppm	Parts per million
RCRA	Resource Conservation and Recovery Act
SPF	Sun protection factor
SSA	Site-Specific Addendum
SSLs	Soil Screening Levels
SSHO	Site Safety and Health Officer
SVOCs	Semi-volatile organic compounds
USACE	U.S. Army Corps of Engineers
VOC	Volatile organic compound

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1 PROJECT SAFETY COORDINATION

The Bhate personnel who are responsible for safety and health issues during the implementation of the work plan are identified in Table 1-1. The respective personnel shall have reviewed and approved this Site-Specific Addendum to the Basewide Health and Safety Plan (HASP) submitted by Bhate Environmental Associates, Inc., (Bhate) for implementation on this scope of work prior to the start of field operations. The requirements of this site-specific addendum are applicable to Bhate employees, their subcontractors, and site visitors.

Table 1-1. Project Team Members with Project Health and Safety Responsibilities

Title	Name	Telephone
Site Manager	Mr. John Hymer	505-491-9171
Program Manager	Mr. Frank Gardner, P.G.	303-386-6454
Project Manager	Mr. Jim Moore, P.G.	303-929-4840
Health and Safety Director	Mr. Brian Muller, MSPH, CIH, CHMM	205-918-4032
Site Safety and Health Officer	Mr. Dave Rizzuto	505-430-3965

P.G. = Professional Geologist
CIH = Certified Industrial Hygienist
CHMM = Certified Hazardous Materials Manager
MSPH = Master of Science in Public Health

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2 PROJECT BACKGROUND AND SCOPE

Since 1983, the 11 Sites (OT-03, OT-20, OT-32, OT-35, OT-38, OT-45, SS-06, SS-12, SS-18 RW-42, and OT-37) addressed in the Accelerated Corrective Measures (ACM) Work Plan at Holloman Air Force Base (HAFB) in Alamogordo, New Mexico have been the subject of a series of environmental investigations to evaluate the soil and groundwater conditions and determine the various site-specific sources of volatile organic compounds (VOCs), semi-volatile organic compounds (SVOCs), petroleum hydrocarbons, metals, polychlorinated biphenyls (PCBs), pesticides and herbicides, and radionuclide contamination. The historical characterization data and chronology of previous investigations for these 11 sites is presented in Section 2 of the ACM Work Plan. The ACM Work Plan will serve as the primary document for the additional site investigations and excavation of petroleum contaminated soil (PCS) and hazardous constituents including sludge grit, PCBs, pesticides, and herbicides at several sites.

Review of historical data collected at SS-06 and OT-35 indicates that these sites have been sufficiently characterized during previous investigations. Under separate cover and pending New Mexico Environment Department (NMED) approval, HAFB will submit a Statement of Basis requesting no further action for Sites SS-06 and OT-35. Additionally, it has been determined that due to the small size of the OT-03 source area, additional characterization would not be required. The ACM approach for OT-03 will consist of removing the contaminated soil until site risk-based closure goals are met as determined by confirmation sampling.

The objective of the additional characterizations at the eight remaining sites (OT-20, OT-32, OT-38, OT-45, SS-12, SS-18, RW-42, and OT-37) is to fill in the data gaps to completely identify and define the presumed PCS and/or hazardous constituent source areas as outlined in Section 3 of the ACM Work Plan. Once the source areas have been delineated, the primary objective of this ACM is to remove, through excavation, and properly dispose of the PCS and/or hazardous constituent source areas that exceed the NMED Soil Screening Levels (SSLs). Groundwater conditions surrounding the various source areas will also be evaluated as described in the ACM Work Plan. During this process, required data will be collected to support risk based evaluations of these sites based on guidance from the NMED. The ultimate objective is to achieve approval for site closure(s) in accordance with the HAFB Resource Conservation Recovery Act (RCRA) permit (number NM6572124422).

Based on the historical site characterizations, the source areas at OT-03, OT-20, OT-37, and OT-45 contain various hazardous constituents above NMED SSLs. Based on the historical data, these source areas will be excavated for disposal as presented in Sections 4 and 5 of the ACM Work Plan. Source area excavations will be also conducted at sites OT-32, OT-38, SS-12, SS-18, and RW-42 if the results of the planned additional investigations indicate that excavation and removal of contaminated soil is required. In the event that source area removal is required at these five sites, an addendum to the ACM Work Plan and Site-Specific HASP Addendum will be submitted to NMED for approval prior to excavation.

The anticipated investigation and excavation activities for this ACM project include:

- Mobilization and demobilization of equipment;

- Direct push technology (DPT) soil boring, subsurface soil sampling, monitoring well installation, and groundwater sampling;
- Soil excavation and loading;
- Confirmation soil sampling and screening;
- Excavated soils placement and land-farm maintenance, as applicable; and,
- Backfill excavation with clean soil.

3 HAZARD ASSESSMENT AND CONTROLS

3.1 Task Hazard(s) Summary

The potential health and safety hazards of this task are summarized below in Table 3-1. The potential for encountering these hazards is ranked (high, moderate, or low) based on the work to be performed and the hazard control measures to be used.

Table 3-1. Task Hazards Summary

Summary	Hazard potential [High, Moderate, or Low]	Description of potential hazards
_√_ **Safety** (i.e. Walking and working surfaces, heavy equipment, traffic, falls, excavations, power and hand tools, materials handling, confined spaces, electrical safety, etc.)	• Moderate All tasks and their control measures are addressed in Task Specific Activity Hazard Analyses (AHAs) in Attachment A	• Walking and surfaces • Heavy equipment and vehicular traffic • Materials handling • Slips, trips, and falls • Excavation
_√_ **Utilities**	• Low	• Buried • Overhead • Building Although these hazards should not be associated with this particular scope of work, it is necessary to verify that the hazards can be controlled.
_√_ **Chemical**	• Moderate	• VOCs: benzene, toluene, ethylbenzene, and xylenes (see Attachment B) • PCBs: Aroclor 1254 and Aroclor 1260 • Herbicides: Dicamba • Pesticides: Heptachlor • Metals: Chromium
_√_ **Physical**	• Moderate	• Thermal stressors • Equipment noise
_√_ **Biological** (i.e. Plants, animals, insects, spiders, infectious waste)	• Low	• Insect stings and bites • Poisonous snakes/reptiles (Potential for contact should be minimal)
_√_ **Radiological** (i.e. exposure to low levels of ionizing radiation due to potential presence of medical tracers such as C-14, tritium, and I-125)	• Low	• Potential exposure to Beta and possibly Alpha radiation • Applicable only at sites OT-32 and RW-42.

3.2 Hazard Control Measures

General safe work practices and control measures are identified and summarized in the *Basewide HASP* (Bhate, December 2003) and are consistent with the practices described in the *U.S. Army Corps of Engineers Safety and Health Requirements Manual, EM 385-1-1, November 2003*. In addition, the implementation of tasks associated with the ACM Work Plan may involve working in two areas potentially contaminated with radionuclides and therefore the guidance described in *Radiation Protection Manual, U.S. Army Corps of Engineers, EM 385-1-80, May 1997* was also considered in the assessment of hazards and their mitigation. Additional task-specific hazards and control measures are identified for non-routine tasks as part of the Activity Hazard Analysis (AHA) process. AHAs have been developed for each of the following activities and are included in Attachment A:

- General site activities/mobilization and demobilization
- Soil boring, subsurface soil sampling, monitoring well installation, groundwater sampling
- Soil excavation and loading
- Soils placement/land-farm maintenance and backfilling excavation with clean soil
- Soil confirmation sampling and screening
- Investigation of two sites (OT-32 and RW-42) that are potentially contaminated with medical tracers such as C-14, tritium, and I-125

3.3 Written Safety Procedures and Programs

Table 3-2 provides a summary of the existing safety procedures and programs that will be used for this task. Copies of applicable procedures and programs are included in the *Basewide HASP*, as indicated.

Table 3-2. Written Safety Procedures and Programs

Reference Procedure or Program	Applicable Section(s)
Bhate Hazard Communication Program	All (Refer to Basewide HASP)
Bhate Respiratory Protection Program	All (Refer to Basewide HASP)
Bhate Hearing Conservation Program	All (Refer to Basewide HASP)
USACE Safety and Health Requirements Manual, EM 385-1-1, November 2003	Section 25 (Excavations)
U.S. Army Corps of Engineers Radiation Protection Manual	Sections that Guide on Radiation Protection

3.4 Permits

Before site activities can begin, there are several pre-construction documents and approval requirements to be met, including Air Force Form (AF Fm) 332 approval, Base dig permit with utility clearances, site security measures, and facility manager notification of the intended operations. Bhate will coordinate project requests for Base installation support services through the 49th Civil Engineering Squadron/Combat Engineer Vehicle (CES/CEV). Pertinent to the start of activities, a pre-construction meeting and site walk-through will be conducted with the U.S. Army Corps of Engineers (USACE) Resident Engineer, HAFB personnel, and Bhate Site Manager, to inspect site conditions for site/equipment access, equipment staging, and decontamination area(s), potential site hazards, and emergency evacuation routes. Also reviewed at this time will be project procedures in accordance with the schedule and planned activities.

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4 PERSONAL PROTECTIVE EQUIPMENT

The following personal protective equipment (PPE) as presented in Table 4-1 will be used for the identified activities based on the best available information about the work requirements and anticipated hazards.

Table 4-1. Personal Protective Equipment by Activity

Activity	Head/Face	Foot	Hands	Respiratory	Clothing
Mobilization / Demobilization	Hard Hat (for overhead hazards), Safety Glasses[1] with rigid side shields	Steel toed boots	Leather gloves as needed	None[3, 4]	Minimum of long pants and shirts with a minimum 4-inch sleeve
General Site Labor	Hard Hat (for overhead hazards), Safety Glasses[1] with rigid side shields	Steel toed boots	Leather gloves as needed	None[3, 4]	Minimum of long pants and shirts with a minimum 4-inch sleeve
Equipment Operation (Drilling, Landfarm Soil Placement, and Excavation Equipment)	Hard Hat[2] (for overhead hazards), Safety Glasses[1] with rigid side shields	Steel toed boots Boot covers for entering and exiting equipment	Leather gloves as needed	None[3, 4] Air Purifying Respirator with Organic vapor cartridges and P100 pre-filters based on monitoring	Minimum of long pants and shirts with a minimum 4-inch sleeve
Equipment Decontamination	Hard Hat[2] (for overhead hazards), Safety Glasses[1] with rigid side shields	Steel toed boots Boot covers	Chemical resistant gloves	None[3, 4] Air Purifying Respirator with Organic vapor cartridges and P100 pre-filters based on monitoring	Minimum of long pants and shirts with a minimum 4-inch sleeve Tyvek coveralls may be worn as recommended by the SSHO[5]
Soil/Groundwater Sampling and Confirmation Soil Sampling/Soil Screening	Hard Hat (for overhead hazards), Safety Glasses[1] with rigid side shields	Steel toed boots	Chemical resistant gloves	None[3, 4] Air Purifying Respirator with Organic vapor cartridges and P100 pre-filters based on monitoring	Minimum of long pants and shirts with a minimum 4-inch sleeve Tyvek coveralls may be worn as recommended by the SSHO
Supervision of work	Hard Hat (for overhead hazards), Safety Glasses[1] with rigid side shields	Steel toed boots	Leather gloves as needed	None[3, 4]	Minimum of long pants and shirts with a minimum 4-inch sleeve

Notes:

[1] Safety Glasses with rigid side shields approved by American National Standards Institute (ANSI) Z-87 required at all times.

[2] Hard hats are not required inside fully enclosed equipment cabs.

[3] Voluntary use of respirators is authorized for comfort from nuisance dusts and odors, provided they are issued and used in accordance with established respiratory protection program procedures.

[4] Cartridge change out will occur at the following conditions:

- Damage to cartridge
- Cartridge is wet, restriction in breathing, unusual odors
- Cartridge is visibly clogged with dust, restriction in breathing
- After 40 hours of use with no continuous exposures over the established Permissible Exposure Limits (PELs)
- Changes that may be otherwise identified in 29 Code of Federal Regulations (CFR) §1910.120.

[5] SSHO = Site Safety and Health Officer

The following qualified person certifies that the selection of PPE is based on best available information about the work requirements and anticipated hazards.

Printed name:	**Signature:**	**Date:**
Brian S. Muller, MSPH, CIH, CHMM **Bhate Health and Safety Director**		

5 SITE MONITORING

Site monitoring will be conducted using direct-reading instruments primarily in the workers' breathing zone. To the extent feasible, site operations will be conducted and modified as needed to ensure that personnel are situated upwind of the soil boring/well installation and excavation activities. Initial upwind background and work-zone readings will be obtained before the initiation of activities. Readings of breathing zones (unless location is otherwise specified) will be taken periodically during all activities. The Site Safety and Health Officer (SSHO) has the authority to modify the level of protection required for work at these sites as well as halt operations as deemed necessary to control personal exposures. Monitoring results will be recorded on an Atmospheric Monitoring Log Field Health and Safety form maintained by the SSHO. Monitoring, calibrating, and maintaining instruments are the responsibility of the SSHO. Table 5-1 summarizes the site monitoring parameters and action levels applicable for direct reading exposure monitoring.

Table 5-1. Direct Reading Exposure Monitoring

Activity(s)	Compound / Instrument	Action Level(s) and Frequency	Actions
Soil boring and well installation	Total VOCs / Photoionization Detector (PID)	0 - 9 parts per million (ppm) Every 15 minutes during intrusive activities	Continue work in required PPE and continue monitoring.
		= 10 ppm (sustained for more than 5 minutes)	Cease Work and ensure personnel are upwind, notify the Site Manager. SSHO may upgrade PPE to Level C respiratory protection with organic vapor cartridge, as necessary.
	Radionuclides / Beta-Gamma direct radiation reading field instrument such as a Geiger-Muller detector on a survey meter that provides readings in milliroentgen (mR)/hour (only at Sites OT-32 and RW-42)	100 millirem (mrem) annual Total Effective Dose Equivalent, whole body	Establish site background with the direct reading instrument. Cease work and leave the area if radiation levels exceed 0.5 mR/hour.

Table 5-1 (Continued). Direct Reading Exposure Monitoring

Activity(s)	Compound / Instrument	Action Level(s) and Frequency	Actions
Excavation Soil Placement at and Maintenance of Land-farm Confirmation Soil Sampling and Screening	Total VOCs / PID	0 - 9 ppm Every 15 minutes during intrusive activities	Continue work in required PPE and continue monitoring.
		= 10 ppm (sustained for more than 5 minutes)	Cease work and ensure personnel are upwind, notify the Site Manager. SSHO may upgrade PPE to Level C respiratory protection with organic vapor cartridge, as necessary. **Monitor for benzene**. If benzene is detected follow response actions outlined for benzene.
	Benzene / By colorimetric tube or similar (where indicted by PID readings)	No detection up to 0.2 ppm	Continue work activities in required protective equipment.
		> 0.2 ppm	Cease work, exit the area to upwind location and notify the Site Manager.
	Particulates / Personal DataRam or similar particulate monitor	=1.5 milligrams per cubic meter of air (mg/m^3) particulates (average) not to exceed 5.0 mg/m^3 5 minute monitoring periods as necessary if visible dust is present	Stop work and increase dust suppression.

6 SITE CONTROL

6.1 Site Activities

Site-specific site control measures will be used to control access to the work area. Tables 6-1 and 6-2 summarize the site control requirements applicable for both general work areas and work areas with potentially contaminated soils, respectively.

Table 6-1. Site Control for General Work Area(s)

Location	Site Control Procedure (discuss important elements such as signs, barricades, fencing, briefings, sign-in/out logs, etc.)
General Work Area	Due to the location of the project sites, access will be coordinated with the Site Manager and HAFB Operations. Access will be made via a specified route.

Table 6-2. Site Control for Potentially Contaminated Area(s)

Location	Site Control Procedure (discuss important elements such as signs, barricades, briefings, qualifications, required supplies and equipment, sign-in/out logs, etc.)
Support Zone	Located outside of contaminated areas, access will be from clean areas or from the Exclusion Zone through the Contamination Reduction Zone.
Contamination Reduction Zone	The Contamination Reduction Zone will be demarcated with caution tape or temporary construction fencing. Decontamination stations will be located here.
Exclusion Zone	Exclusion Zone work areas will be clearly demarcated with caution tape or temporary construction fencing. All access to this area will require the use of a sign-in/out log.

6.2 Decontamination

Required decontamination procedures are described below in Table 6-3.

Table 6-3. Decontamination Procedures by Location

Type of decontamination	Decontamination Methods
Personnel decontamination	Personnel will be required to thoroughly wash hands and face prior to eating, drinking, or smoking. Disposable PPE will be collected for proper disposal. Additional decontamination procedures will be developed by the SSHO as needed.
Equipment decontamination	Work efforts will be made to minimize equipment contact with contaminated materials. Prior to leaving the work area(s) and land-farm following placement of contaminated soils, equipment (tires, excavator/loader buckets, hand tools) will be dry decontaminated. Soils from the dry decontamination process will be disposed with the excavated materials. Decontamination tools may include brooms and shovels.

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7 COMMUNICATIONS

Cellular telephones will be available to summon emergency services as required. Refer to Sections 10, 11, and 12 of this Site-Specific Addendum (SSA) to the HASP for site specific guidance on emergency situations and appropriate actions. Site communication amongst workers shall be a combination of verbal and line of sight hand communications. Some common hand communication signals include the following:

- Hand gripping throat: Can't breath
- Grip partner's wrist or both hands at waist: Leave area immediately
- Hands on top of head: Need assistance
- Thumbs up: OK, I'm all right, I understand
- Thumbs down: No, negative

Cellular telephone use is not permitted while operating equipment.

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8 MEDICAL SURVEILLANCE AND TRAINING

The medical surveillance and training requirements for Bhate's on-site personnel working on the soil boring, soil sampling, well installation, groundwater sampling, and soil excavation activities will follow the requirements outlined in the Basewide HASP Sections 7.4 and 5, respectively.

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9 HAZARDOUS CHEMICALS

Hazardous chemicals (as defined in 29 CFR §1910.1200) to be brought or used on-site are identified below. This chemical inventory and associated Material Safety Data Sheet (MSDSs) will be maintained by the SSHO.

Table 9-1. Hazardous Chemicals Brought On-Site

Chemical Name	Amount	Location	Purpose
Assorted fuels, lubricants, coolants, etc. necessary for equipment operation	No storage planned. Quantities limited to immediate use requirements of on-site equipment.	No storage planned. Materials to be brought on-site by vendor's maintenance vehicle.	Equipment Servicing and Operation

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10 EMERGENCY ACTION AND RESPONSE

Personnel responsible for coordinating emergency response actions during soil boring, well installation, soil and groundwater sampling, and source area excavation activities are identified below in Table 10-1. A map showing directions to the authorized medical facility are included in Section 12.

Table 10-1. Emergency Coordinator and Alternate

Responsibility	Name	Phone Number(s)
Task Emergency Coordinator	Mr. John Hymer	Office (505) 679-2100 Cell (505) 491-9171
Alternate Emergency Coordinator	Mr. Dave Rizzuto	Office (505) 679-2100 Cell (505) 430-3965

If an emergency situation develops which requires evacuation of the work area, the evacuation procedures in Table 10-2 shall be followed.

Table 10-2. Evacuation Procedures

Evacuation Step	Methods and comments:
Notify affected workers	Use of site communication methods as applicable
Evacuate to safe location	Assemble at the primary evacuation site (support area outside of the exclusion zone)
Assemble and account for workers	Emergency Coordinator shall account for personnel using site Sign in/Sign out sheet
Notify Fire and Emergency Services	Notification as needed
Complete incident report	Follow the Incident Reporting and Investigation Procedure

Table 10-3 summarizes potential emergency situations and response actions that are applicable.

Table 10-3. Potential Emergency Situations

In case of	Response actions
Injury or illness	Treat injury with applicable First Aid. All work related injuries beyond first aid will result in notification of Emergency Services and notification of the employee supervisor. Any employee requiring advanced medical treatment will be accompanied by a knowledgeable company employee that can answer potential questions on job duties and hazards. Make notifications in accordance with the Incident Reporting and Investigation Procedure (found in Section 10.2.2 of the *Basewide Health and Safety Plan*, Bhate, December, 2003).
Chemical exposure	First Aid shall be provided such as but not limited to: move victim to fresh air, remove contaminated clothing, flush affected skin with water, and seek medical attention.
Fire or explosion	Notify emergency services immediately. All personnel shall evacuate the immediate area of the fire and move to an upwind location. Personnel shall not engage in fire fighting activities use of fire extinguisher) unless trained to do so and only in the incipient stages of fire.
Adverse weather	Tornados, lightning, or other threatening weather conditions will result in an immediate shut down of operations and evacuation of personnel. Lightning proximity will be determined by measuring the time interval between the visually observed lightning flash and the subsequent sound of thunder. An interval less than 30 seconds will prompt the shut down. Operations will be shut down for the period of the storm passing plus an additional 20 minutes.
Material spill or release	Vehicles and equipment will be maintained and inspected so as to prevent fluid leaks. Should any vehicle fluid leaks occur, the equipment will be taken out of service to make necessary repairs and any contaminated material will be cleaned-up and disposed of properly. Spill kits will be available to facilitate prompt containment and clean-up of spills. Notification will be made in accordance with the Incident Reporting and Investigation Procedure. Storage areas will be designed to have secondary containment as required, and work plans will be executed to accommodate stormwater runoff and minimize the potential for contamination spread.

11 EMERGENCY CONTACTS

In the event of an emergency, the following contacts should be made, as appropriate:

HAFB Emergency Number (using HAFB phone system).....9-911
Operators will assist with Medical, Fire, and Police emergencies

HAFB Security Force.....(505) 572-5037

HAFB Fire Protection.....(505) 572-1117

HAFB Hospital – 49th Medical Group (Main switchboard).....(505) 572-2778

Civilian Hospital (Alamogordo) Gerald Champion Regional Medical Center.....(505) 439-6100

After initial contacts have been made and the situation has stabilized, notify the Site Manager SSHO, Senior Project Manager, and/or Health and Safety Manager (HSM), as appropriate.

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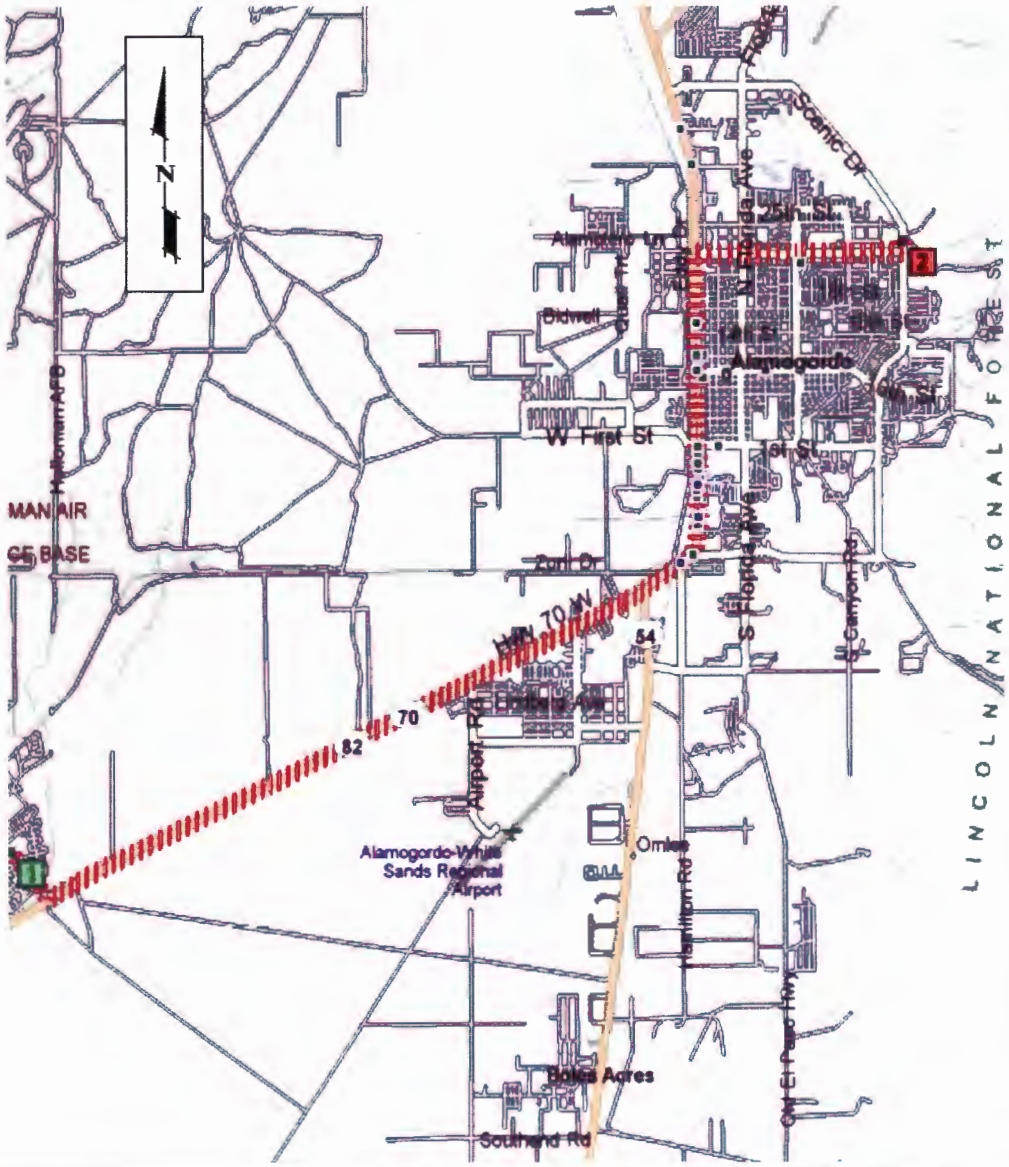
12 HOSPITAL DIRECTIONS

In the event of a true medical emergency ("life or limb"), HAFB Emergency Services should be used. Notification of any injury must be made to HAFB Emergency Services. Bhate personnel and subcontractors should not transport injured personnel to the HAFB Hospital without prior authorization from HAFB Emergency Services.

Other injuries should be treated as necessary at Gerald Champion Regional Medical Center at 2669 Scenic Drive, Alamogordo, NM 88330. From HAFB, exit the Main Gate and proceed east on US-70 onto US-54, continue north on US-54 to Indian Wells Road, turn right heading east to Scenic Drive, and turn left on Scenic proceed to the medical center. A map to this hospital is presented as Figure 12-1.

Figure 12-1. Hospital Route Map



bhate associates ENGINEERING, SCIENCE AND CONSTRUCTION	HOSPITAL ROUTE MAP Holloman Air Force Base to Gerald Champion Regional Hospital Source: Microsoft Expedia Street Maps	Holloman Air Force Base SSA to the HASP Figure 12-1
	Not to Scale / Date September 2006	

ATTACHMENT A

ACTIVITY HAZARD ANALYSES (AHAS)

Activity Hazard Analysis (AHA) – 01

Task: Accelerated Corrective Measures General Site Activities: All Sites	**Bhate Project Number:** 9050361
Minimum Personal Protective Equipment (PPE): Level D PPE (Long pants, shirts with minimum 4" sleeve, steel toe boots, safety glasses, hard hat for overhead hazards, leather work gloves, and hearing protection, as required)	**Location:** Holloman Air Force Base, New Mexico
	Analysis Approved by: Brian Muller, CIH — **Date:** November 2006

Activity	Potential Hazards	Recommended Controls
General Site Activities including Mobilization / Demobilization and Site Preparation Note: Each workday shall begin with a mandatory daily safety meeting for all on-site workers	Slips, trips, or falls on walking and working surfaces	• Determine the best access route prior to transporting equipment and tools • Continuously inspect the work area for slip, trip, and fall hazards • Pay attention; ensure safe and secure footing • Maintain clean work areas by following good housekeeping procedures • Be alert for uneven and variable terrain • Wear slip resistant footwear when walking/working on slippery surfaces or slopes
	Site Traffic	• Be aware of potential vehicle traffic while on site • Follow posted warnings and rules for travel around site • Wear high visibility apparel.
	Eye injury	• Use approved safety glasses with rigid side shields
	Overhead hazards	• Personnel will be required to wear hard hats that meet ANSI Standard Z89.1 in all areas with overhead hazards
	Cuts, punctures, and abrasions	• Wear leather work gloves when handling materials or using tools
	Dropped objects	• Steel toe boots meeting ANSI Standard Z41 will be worn
	Thermal Stressors (i.e. heat stress, cold stress)	• Employees will have appropriate clothing for variable weather • Use of long sleeves or application of sunscreen with a high sun protection factor (SPF) on exposed skin encouraged • Employees will take breaks and drink plenty of fluids to prevent heat stress • Warming breaks will be permitted as necessary to prevent cold stress
	Back Injury from Materials Handling	• Use proper lifting techniques • Loads greater than 50 pounds require assistance or mechanical equipment • Prior to lifting, check the load for jagged or sharp edges • Avoid torso twisting motions while handling or moving loads

AHA – 01 (Continued)

Activity	Potential Hazards	Recommended Controls
General Site Activities including Mobilization/ Demobilization and Site Preparation (continued)	Inclement weather (Thunderstorms and tornadoes)	• Halt activities immediately and take cover during thunderstorm or tornado warnings, shelter in a building if possible, stay away from windows • If outdoors, stay close to the ground • Listen to radio or television announcements for pending weather information • Do not try to outrun a tornado on foot or in a vehicle
	Biological hazards (spiders, snakes, etc.)	• Workers will inspect the work area carefully and avoid placing hands and feet into concealed areas • Look in direction of travel for biological hazards to avoid
Safety Equipment Used	**Inspection Requirements**	**Training Requirements**
Level D PPE First Aid Kit Fire Extinguisher	Informal daily work area inspections to be conducted by the SSHO and formal inspections to be conducted on a weekly basis	Site personnel have read and understand the SSA to the HASP Site personnel possess all of the required training as specified in the SSA to the HASP Site personnel received site specific safety indoctrination At least two individuals on-site will have current cardiopulmonary resuscitation (CPR) and First Aid training.

Activity Hazard Analysis (AHA) – 02

Task: Additional Investigation Requirements for OT-20, OT-32, OT-37, OT-38, OT-45, SS-12, SS-18 (non-radiological sites)	**Bhate Project Number:** 9050361
Minimum Personal Protective Equipment (PPE): Level D PPE (Long pants, shirts with minimum 4" sleeve, steel toe boots, safety glasses, hard hat for overhead hazards, leather work gloves, and hearing protection, as required)	**Location:** Holloman Air Force Base, New Mexico
	Analysis Approved by: Brian Muller, CIH — **Date:** November 2006

Activity	Potential Hazards	Recommended Controls
Soil Boring and Sampling Hazards and recommended controls from AHA – 01 apply	Drill Rig Hazards Including but not limited to: Flying debris, falling objects, noise, hydraulic failures, unguarded machinery, equipment rollover, movement of large, heavy drilling tools, etc.	• Drill rig is to be operated and maintained by qualified operators • A Drill Rig Inspection Checklist should be completed daily to ensure that the rig is operating properly • The inspection will include fittings, cables, pins, connections, lubrication points, controls, emergency stops, etc. • To the extent possible, the terrain should be level and the condition of the ground such that unexpected movement of the rig is unlikely • Stabilize the rig prior to boring • Wear required PPE (hard hat, safety glasses, work gloves, ear muffs or plugs, steel toe work boots), ensure loose clothing is secured • Maintain good housekeeping on and around drill rig
	Overhead/buried utilities	• Conduct a utility locate to identify the location of underground utilities in boring locations and complete any required dig permits • Overhead utilities should be considered live until determined otherwise • Maintain a minimum distance of 15 feet from overhead utilities • All underground utilities must be clearly marked before beginning work • No borings shall be made within a 4 foot "Buffer Zone" of any utility marking
	Exposure to soil contaminants	• To the extent feasible, limit contact with subsurface materials • Wear required PPE when conducting intrusive activities • SSHO shall conduct breathing zone monitoring for VOCs with a PID in accordance with requirements for site monitoring • SSHO may require an upgrade in PPE or modification to work based on monitoring results • Use appropriate decontamination methods

AHA – 02 (Continued)

Activity	Potential Hazards	Recommended Controls
Monitoring Well Installation	Pinch points	• Utilize appropriate PPE (leather gloves) when handling well casings and tools
	Dust	• Use care when installing well materials (sand, bentonite, Portland cement) into monitoring well to prevent dust generation • Position body in an upwind location
Well Development / Groundwater depth measurement / Groundwater sampling	Exposure to groundwater contaminants	• Position body upwind from monitoring well prior to opening cap • Wear appropriate PPE including chemical resistant gloves and Tyvek coveralls to minimize potential contact with groundwater, as appropriate • Conduct work activities in a manner that minimizes potential contact with groundwater • Collect all PPE and disposable sampling equipment and dispose of properly • Wash hands and face prior to eating, drinking, or smoking
Safety Equipment Used	**Inspection Requirements**	**Training Requirements**
Level D PPE First Aid Kit Fire Extinguisher	Informal daily work area inspections to be conducted by the SSHO and formal inspections to be conducted on a weekly basis	Site personnel have read and understand the SSA to the HASP Site personnel possess all of the required training as specified in the SSA to the HASP Site personnel received site specific safety indoctrination At least two individuals on-site will have current CPR and First Aid training.

Activity Hazard Analysis (AHA) – 03

Task: Excavation and Soil Loading for Source Removal at Sites OT-03, OT-20, OT-37, and OT-45	**Bhate Project Number:** 9050361	
Minimum Personal Protective Equipment (PPE): Level D PPE (Long pants, shirts with minimum 4" sleeve, steel toe boots, safety glasses, hard hat for overhead hazards, leather work gloves, and hearing protection, as required)	**Location:** Holloman Air Force Base, New Mexico	
	Analysis Approved by: Brian Muller, CIH	**Date:** November 2006

Activity	Potential Hazard(s)	Recommended Controls
Excavation and Confirmation Soil Sampling Hazards and recommended controls from AHA – 01 apply	Overhead/buried utilities	• Completion of an HAFB Excavation Permit is required prior to the start of excavation activities • Overhead utilities should be considered live until determined otherwise • Maintain a minimum distance of 15 feet from overhead utilities • All underground utilities must be clearly marked before beginning work
	Heavy equipment operation	• Access to the work area shall be coordinated with the Site Manager • Equipment (including trucks) shall be inspected and documented at the beginning of each shift • Equipment will be operated and maintained by qualified operators • Maintain awareness of vehicle movement in work area • Employees to wear highly visible orange or yellow vests while working around heavy mobile equipment • Exercise caution when approaching heavy equipment • Equipment will be equipped with functioning back-up alarms, signal lamps, and alerting horns • Operators are required to use seat belts • Signs, barricades, flagmen, and/or other traffic control devices will be used to control traffic in the work area • Buckets and attachments shall be placed on the ground if operator not at controls or if ground personnel approach • Key will be removed from the ignition if operator leaves the immediate area

Activity Hazard Analysis (AHA) – 03 (Continued)

Activity	Potential Hazard(s)	Recommended Controls
Excavation and Confirmation Soil Sampling (continued) Hazards and recommended controls from AHA – 01 apply	Excavation Safety	• Ensure equipment is placed so as to not contribute to a cave-in situation • When vehicles and machinery are operated adjacent to excavations, stop logs or barricades will be utilized to prevent vehicles from entering the excavation or trench • All utilities will be located and cleared prior to initiating digging • No personnel will be allowed to enter the excavation unless the excavation has been properly inspected, shoring and means of egress installed as necessary, all heavy equipment has been moved away from the affected edges, and any spoils have been removed from the edge • Do not place spoil piles closer than 2 feet from the edge of the excavation • Barriers will be provided to prevent personnel from inadvertently falling into an excavation • Atmospheric testing shall be done prior to employees entering excavations 4-feet or greater in depth to ensure safe levels of oxygen, lower explosion limit, and toxic gases
	Exposure to soil contaminants	• Utilize appropriate PPE and decontamination procedures • Conduct work activities in a manner that minimizes potential contact with excavated materials
Soils Loading Hazards and Controls associated with Excavation apply	Falling materials and flying debris striking personnel	• Loading equipment must have cab protection, functioning back-up alarms, signal lamps, and alerting horns • Operators are required to use seat belts • Ground personnel are not permitted to approach equipment in motion or while materials being handled • Maintain clear radius of machine • Operator must minimize the amount of materials spilled on the exterior of trucks during loading operations

Activity Hazard Analysis (AHA) – 03 (Continued)

Activity	Potential Hazard(s)	Recommended Controls
Soils Loading Hazards and Controls associated with Excavation apply	Dust	• Adequate dust suppression with water should be utilized to minimize visible dust emissions • If visible dust is prevalent, utilize personal dust monitor to evaluate
	Striking heavy equipment and operators	• Only experienced personnel will operate equipment • Equipment will be operated with cab doors and windows closed
	Overloading capacity	• Load charts of all equipment will be reviewed and followed
Equipment Used	**Inspection Requirements**	**Training Requirements**
Level D PPE First Aid Kits Portable Eyewash Fire Extinguishers Heavy Equipment (Loader, Excavator, Haul Trucks)	Weekly inspections will be performed on fire extinguishers Weekly inspections will be performed on first aid kits Portable eye wash will be inspected weekly Daily inspections of open excavations and trenches will be conducted Informal daily and formal weekly safety inspections will be conducted	Personnel have read and understand the work plan and AHA Site specific briefing At least two individuals on-site will have current CPR and First Aid training.

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Activity Hazard Analysis (AHA) – 04

Task: Soils Placement/Land-farm Maintenance and Backfilling Excavation with Clean Soil for Sites OT-03, OT-20, OT-37, and OT-45	**Bhate Project Number:** 9050361	
Minimum Personal Protective Equipment (PPE): Level D PPE (Long pants, shirts with minimum 4" sleeve, steel toe boots, safety glasses, hard hat for overhead hazards, leather work gloves, and hearing protection, as required)	**Location:** Holloman Air Force Base, New Mexico	
	Analysis Approved by: Brian Muller, CIH	**Date:** November 2006

Activity	Potential Hazard(s)	Recommended Controls
Soil Placement and Land-farm Maintenance Backfilling Excavation with Clean Soil	Exposure to soil contaminants	• Utilize appropriate PPE and decontamination procedures • Conduct work activities in a manner that minimizes potential contact with excavated materials • Utilize placement method that minimizes haul truck traffic through contaminated material
Hazards and recommended controls from AHA – 01 and AHA-03 apply	Heavy equipment operation	• Haul truck drivers should wait for signal from equipment operator to enter the land-farm soil placement area • Only experienced personnel will operate equipment • Ground personnel are not permitted to approach equipment in motion or while materials being handled • Maintain clear radius of machine • Equipment will be equipped with functioning back-up alarms, signal lamps and alerting horns • Operators are required to use seat belts • Signs, barricades, flagmen, and/or other traffic control devices will be used to control traffic in the work area • Only necessary personnel will be permitted in the delineated land-farm area

Activity Hazard Analysis (AHA) – 04 (Continued)

Equipment Used	Inspection Requirements	Training Requirements
Level D PPE First Aid Kits Portable Eyewash Fire Extinguishers Heavy Equipment (Tractor, Haul Trucks)	Weekly inspections will be performed on fire extinguishers Weekly inspections will be performed on first aid kits Portable eye wash will be inspected weekly Excavations and trenches will be inspected daily Informal daily and formal weekly safety inspections to be conducted	Personnel have read and understand the work plan and AHA Site specific briefing At least two individuals on-site will have current CPR and First Aid training.

Activity Hazard Analysis (AHA) – 05

Task: Additional Investigation Requirements for OT-32 and RW-42 (sites with potential radioactive contamination [tritium] in source areas)	**Bhate Project Number:** 9050361	
Minimum Personal Protective Equipment (PPE): Level D PPE (Long pants, shirts with minimum 4" sleeve, steel toe boots, safety glasses, hard hat for overhead hazards, leather work gloves, and hearing protection, as required)	**Location:** Holloman Air Force Base, New Mexico	
	Analysis Approved by: Brian Muller, CIH	**Date:** November 2006

Activity	Potential Hazards	Recommended Controls
Soil Boring and Sampling Hazards and recommended controls from AHA – 01 and AHA - 02 apply	Exposure to ionizing radiation above background levels during soil boring and sampling	• Measure background radiation levels next to the site. • Perform initial site entry by a certified radiation technician and survey the site with direct reading radiation instrument • If site levels are at background levels then proceed with site sampling tasks • If levels exceed background but are <0.5 mR/hour then upgrade PPE and setup site ingress and egress controls as per advice from the radiation technician and SSHO to prevent personnel exposure and spread of loose contamination • If levels exceed 0.5 mR/hour then cease work

Equipment Used	Inspection Requirements	Training Requirements
Level D PPE First Aid Kit Fire Extinguisher	Informal daily work area inspections to be conducted by the SSHO and formal inspections to be conducted on a weekly basis	Site personnel have read and understand the SSA to the HASP Site personnel possess all of the required training as specified in the SSA to the HASP Site personnel received site specific safety indoctrination At least two individuals on-site will have current CPR and First Aid training.

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ATTACHMENT B
PRIMARY CONTAMINANTS OF CONCERN

Properties of the Primary Contaminants of Concern

Contaminant	PEL	TLV	Route(s) of Exposure	Signs and Symptoms of Exposure		Target Organs	IP (eV)	Specific Gravity (g/ml)	VP (mm Hg)	Flash Point (°F)	LEL %	UEL %
				Acute	Chronic							
Benzene	1 ppm	0.5 ppm	Inhalation Ingestion Contact Absorption	Irritation of eyes, skin, nose, and throat, headache, dizziness, nausea, staggered gait, fatigue	Cancer (leukemia), adverse reproductive effects (female fertility, birth defects)	Eyes, skin, respiratory system, blood, central nervous system, bone marrow	9.24	0.88	75	12	1.2	7.8
Toluene	200 ppm (750 mg/m^3)	50 ppm (188 mg/m^3)	Inhalation Ingestion Contact Absorption	Irritation of eyes, skin, nose, drowsiness, fatigue, weakness, confusion, headache, nausea, dilated pupils	Liver and kidney damage	Eyes, skin, respiratory system, CNS, liver, kidneys	8.82	0.87	21	40	1.1	7.1
Ethylbenzene	100 ppm (435 mg/m^3)	100 ppm (434 mg/m^3)	Inhalation Ingestion Contact Absorption	Irritation of eyes, and skin, may also cause conjunctivitis (eyes)	CNS depression, pulmonary aspiration	CNS, eyes, skin, respiratory system	8.76	0.87	7	55	0.8	6.7
Xylenes (o-, m-, p- isomers)	100 ppm	100 ppm	Inhalation Ingestion Contact Absorption	Irritation of eyes, skin, nose	Permanent brain and nervous system damage	CNS, liver, and urinary system/kidneys	21	0.864	8	76	1.0	7.0
Radionuclides	As Low As Reasonably Achievable	2 rems per year averaged over 5 years for radiation workers (ACGIH)	Direct contact	Radiation sickness	Cancer	Skin	NA	NA	NA	NA	NA	NA
Aroclor 1254	NA	0.5 mg/m^3	Inhalation Ingestion Contact Absorption	Skin lesions, dark pigmentation of the exposed pores	Eye disorders, kidney disorders and allergies	Skin and kidneys	NA	0.88	NA	295	0.9	7
Aroclor 1260	NA	5 mg/m^3	Inhalation Ingestion Contact Absorption	Skin lesions, dark pigmentation of the exposed pores	Eye disorders, kidney disorders and allergies	Skin and kidneys	NA	0.88	NA	295	0.9	7
Dicamba	NA	NA	Inhalation Contact Absorption	Skin irritation	NA	NA	NA	NA	0.00375	390	NA	NA

Properties of the Primary Contaminants of Concern (Continued)

Contaminant	PEL	TLV	Route(s) of Exposure	Signs and Symptoms of Exposure		Target Organs	IP (eV)	Specific Gravity (g/ml)	VP (mm Hg)	Flash Point (°F)	LEL %	UEL %
				Acute	Chronic							
Heptachlor	NA	0.5 mg/m^3	Inhalation Ingestion Contact Absorption	Lethargy, tremors and stomach cramps	Cancer	CNS, liver, and gastrointestinal tract	NA	NA	NA	NA	NA	NA
Chromium	0.5 mg/m^3	0.5 mg/m^3	Inhalation Ingestion Contact Absorption	Caustic to skin and mucous membranes	Cancer	Lung, kidney, and liver	NA	2.7	NA	NA	NA	NA

Notes:

PEL = Permissible Exposure Limit
TLV = Threshold Limit Value
IP = Ionization Potential
eV = Electron volt
VP = Vapor Pressure
mm Hg = Millimeters of mercury
°F = Degrees Fahrenheit
LEL = Lower Explosive Limit
UEL = Upper Explosive Limit
% = Percent
ppm = Parts per million
mg/m^3 = Milligrams per cubic meter of air
CNS = Central Nervous System
NA = Not Applicable
g/ml = Grams per milliliter
rems = Millirem
ACGIH = American Conference of Governmental Industrial Hygienists

APPENDIX C

QUALITY ASSURANCE PROJECT PLAN ADDENDUM

QUALITY ASSURANCE PROJECT PLAN ADDENDUM

ACCELERATED CORRECTIVE MEASURES
MULTIPLE SITES
HOLLOMAN AFB, NM

Prepared for:

49 CES/CEV
Holloman Air Force Base
New Mexico

Under Contract To:

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

Contract No. DACA45-03-D-0023
Task Order No. 021

November 2006

Prepared by:

Bhate Environmental Associates, Inc.
1608 13th Avenue South, Suite 300
Birmingham, Alabama 35205

Bhate Project No. 9050361.03

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QUALITY ASSURANCE PROJECT PLAN ADDENDUM

ACCELERATED CORRECTIVE MEASURES
MULTIPLE SITES
HOLLOMAN AFB, NM

REVIEW SHEET

COMMITMENT TO IMPLEMENT THIS QUALITY ASSURANCE PROJECT PLAN ADDENDUM		
Michael D'Auben		
Project Chemist	Signature	Date
Jim Moore, P.G.		
Project Manager	Signature	Date
John Hymer		
Site Manager	Signature	Date

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QUALITY ASSURANCE PROJECT PLAN ADDENDUM

ACCELERATD CORRECTIVE MEASURES
MULTIPLE SITES
HOLLOMAN AIR FORCE BASE, NM

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4-2	Summary of Laboratory QC Limits

LIST OF ACRONYMS

ACM	Accelerated Corrective Measures
AFB	Air Force Base
AFCEE	Air Force Center for Environmental Excellence
AOC	Areas of Concern
Bhate	Bhate Environmental Associates, Inc.
EDD	Electronic data deliverable
ERPIMS	Environmental Resources Program Information Management System
HAFB	Holloman Air Force Base
LCL	Lower Control Limit
LCS	Laboratory Control Sample
mg/kg	Milligrams per kilogram
mg/L	Milligrams per liter
MS	Matrix Spike
MSD	Matrix Spike Duplicate
NELAC	National Environmental Laboratory Accreditation Conference
PCS	Petroleum Contaminated Soil
pCi/L	Pico Curies per Liter
pCi/g	Pico Curies per gram
QA	Quality Assurance
QAM	Quality Assurance Manual
QAPP	Quality Assurance Project Plan
QC	Quality Control
RCRA	Resource Conservation and Recovery Act
RPD	Relative Percent Difference
SOPs	Standard Operating Procedures
STL	Severn Trent Laboratories, Inc.
SVOC	Semi-volatile Organic Compounds
SWMU	Solid Waste Management Unit
TAL	Target Analyte List
UCL	Upper Control Limit
µg/kg	Micrograms per kilogram
µg/L	Micrograms per liter
USACE	United States Army Corps of Engineers
USEPA	United States Environmental Protection Agency
VOC	Volatile Organic Compound

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PREFACE

This Quality Assurance Project Plan Addendum (QAPP Addendum) has been developed to assure that sample collection, analyses, and evaluations are legally and scientifically defensible for the *Accelerated Corrective Measures Work Plan, Soil Remediation at Multiple Sites, Holloman Air Force Base, NM* (Bhate, September 2006) (ACM Work Plan). This document is an addendum to the *Basewide Quality Assurance Project Plan, Holloman Air Force Base, New Mexico* (Bhate, November 2003) (Basewide QAPP) and must be used in conjunction with that document. This document contains the site specific information for the work at the sites outlined in the ACM Work Plan.

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1 INTRODUCTION

Bhate Environmental Associates, Inc., (Bhate) has been retained by the U.S. Army Corps of Engineers (USACE), under contract DACA45-03-D-0023, Task Order No. 021, to conduct Accelerated Corrective Measures (ACMs) at several of the Solid Waste Management Units (SWMUs) and Areas of Concern (AOCs) at Holloman Air Force Base (HAFB), New Mexico. This document provides a QAPP Addendum that will serve as the primary analytical quality assurance (QA) document for the additional investigations and excavation of petroleum contaminated soil (PCS) and hazardous constituents including sludge grit and radionuclides at 11 previously investigated sites.

Several of the site will require additional investigations to fill in data gaps to completely identify and define the presumed PCS and/or hazardous constituent source areas. Once the source areas have been delineated, the primary objective of the ACM is to remove, through excavation, and properly dispose the PCS and/or hazardous constituent source areas. Groundwater conditions surrounding the various source areas will also be evaluated as described in the ACM Work Plan. See the Basewide QAPP (Bhate, 2003) and Soil Remediation at Multiple Sites Work Plan (Bhate, November 2006) for additional information on HAFB and the 11 sites included in this project.

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2 PROJECT LABORATORY

The primary analytical laboratory for this project will be Severn Trent Laboratories, Inc. of Denver, Colorado (STL).

Severn Trent Laboratories - Denver
4955 Yarrow Street
Arvada, CO 80002
Phone: 303-736-0134
Fax: 303-431-7171

The laboratory personnel who will be involved with this project include:

Ms. Debra Henderer, STL-Denver Customer Service Manager

Mr. Michael Schmitt, STL-Denver Quality Assurance Officer

STL is certified by the National Environmental Laboratory Accreditation Conference (NELAC) and validated by USACE and has extensive previous experience in working on USACE and Air Force Center for Environmental Excellence (AFCEE) projects. The STL Quality Assurance Manual (QAM) and Standard Operating Procedures (SOPs) have been reviewed by Bhate and found to meet all the requirements for this project. The QAM and SOPs are available for further review if required.

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3 DATA CATEGORIES

The data use determines the required levels of data quality. The two levels of data quality established by the USACE are screening and definitive. Under this QAPP Addendum, the data to be generated under each level in these investigations are presented in Table 3-1 (Screening) and Table 3-2 (Definitive). The screening data will be generated in the field using field instruments. The definitive data generated by the laboratory will be presented with limited data deliverables (i.e. Level II data packages), using a 21 day turn-around-time for soil and groundwater samples collected during the additional investigations. All additional investigative definitive data produced by the laboratory will also be presented in an Environmental Resources Program Information Management System (ERPIMS) format electronic data deliverable (EDD).

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4 DATA QUALITY ASSURANCE AND QUALITY CONTROL

The general data quality assurance (QA) and quality control (QC) requirements for HAFB are presented in the Basewide QAPP. The field QC requirements for the additional investigations to be conducted are presented in Tables 4-1A through 4-1H. The project specific laboratory QC limits are listed in Table 4-2.

All final definitive data will be reviewed and validated by a Bhate Senior Chemist based on the logic and guidelines of the United States Environmental Protection Agency (USEPA) National Functional Guidelines for Data Validation and the site specific laboratory QC limits presented in this QAPP Addendum.

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5 REFERENCES

Bhate, November 2003. *Final Basewide Quality Assurance Project Plan, Holloman Air Force Base, New Mexico.*

Bhate, November 2006. *Accelerated Corrective Measures Work Plan, Multiple Sites, Holloman Air Force Base, NM.*

United States Environmental Protection Agency, October 2004. *USEPA Contract Laboratory Program National Functional Guidelines for Inorganic Data Review.*

United States Environmental Protection Agency, October 1999. *USEPA Contract Laboratory Program National Functional Guidelines for Organic Data Review.*

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TABLES

Table 3-1
Summary of Screening Data

Parameter	Matrix	Testing Method
pH	Water	Multi-parameter sonde and a flow-through cell
Conductivity	Water	Multi-parameter sonde and a flow-through cell
Turbidity	Water	Multi-parameter sonde and a flow-through cell
Temperature	Water	Multi-parameter sonde and a flow-through cell
Volatile Headspace	Soil	Organic Vapor Analyzer (Flame Ionization Detector)

Table 3-2
Summary of Definitive Data

Parameter	Matrix	Preparation Method	Analytical Method
Chlorinated Herbicides	Soil	USEPA Method 3510C	USEPA Method 8151A
Hexavalent Chromium (Cr(VI))	Soil	USEPA Method 7196A	USEPA Method 7196A
Organochlorine Pesticides	Soil	USEPA Method 3510C	USEPA Method 8081A
Perchlorates	Soil	USEPA Method 6860	USEPA Method 6860
Polychlorinated Biphenyls (PCBs)	Soil	USEPA Method 3550B	USEPA Method 8082
RCRA Metals	Soil	USEPA Method 3550B	USEPA Methods 6010B and 7471A
Semi-volatile Organic Compounds (SVOCs)	Soil	USEPA Method 3550B	USEPA Method 8270C
Total Petroleum Hydrocarbons (TPH)	Soil	USEPA Method 5030B and 3550B	USEPA Method 8015M
Target Analyte List (TAL) Metals	Soil	USEPA Method 3050B	USEPA Methods 6010B and 7471A
Tritium (^3H)	Soil	USEPA Method EPA 906.0M	USEPA Method EPA 906.0M
Volatile Organic Compounds (VOCs)	Soil	USEPA Method 5035B	USEPA Method 8260B
Chlorinated Herbicides	Groundwater	USEPA Method 3510C	USEPA Method 8151A
Organochlorine Pesticides	Groundwater	USEPA Method 3510C	USEPA Method 8081A
Perchlorates	Groundwater	USEPA Method 6860	USEPA Method 6860
PCBs	Groundwater	USEPA Method 3510C	USEPA Method 8082
RCRA Metals	Groundwater	USEPA Method 3010A and 7470A	USEPA Methods 6010B and 7470A
SVOCs	Groundwater	USEPA Method 3520C	USEPA Method 8270C
Total Dissolved Solids (TDS)	Groundwater	USEPA Method 160.1	USEPA Method 160.1
TPH	Groundwater	USEPA Method 3510C	USEPA Method 8015M
Target Analyte List (TAL) Metals	Groundwater	USEPA Method 3010A and 7470A	USEPA Methods 6010B and 7470A
^3H	Groundwater	USEPA Method EPA 906.0M	USEPA Method EPA 906.0M
VOCs	Groundwater	USEPA Method 5030B	USEPA Method 8260B

Notes:
USEPA = United States Environmental Protection Agency
RCRA = Resource Conservation and Recovery Act

Table 4-1A
Summary of Additional Investigation Field QC Samples
OT-20 Sewage Lagoons Disposal Trenches

Matrix	Analysis	Number of Field Samples	Equipment Blanks	Trip Blanks*	Field Duplicates	Field Splits	MS/MSD	Total
Soil	Herbicides by EPA Method 8151A	21	0	0	3	0	2	26
	PCBs by EPA Method 8082	21	0	0	3	0	2	26
	Pesticides by EPA Method 8081A	21	0	0	3	0	2	26
	RCRA Metals by EPA Method 6010B/7471A	21	0	0	3	0	2	26
	SVOCs by EPA Method 8270C	21	0	0	3	0	2	26
	TPH by EPA Method 8015M	21	0	0	3	0	2	26
	VOCs by EPA Method 8260B	21	0	5	3	0	2	31
Groundwater	Herbicides by EPA Method 8151A	3	0	0	1	0	1	5
	PCBs by EPA Method 8082	3	0	0	1	0	1	5
	Pesticides by EPA Method 8081A	3	0	0	1	0	1	5
	RCRA Metals by EPA Method 6010B/7470A	3	0	0	1	0	1	5
	SVOCs by EPA Method 8270C	3	0	0	1	0	1	5
	Total Dissolved Solids by EPA Method 160.1	3	0	0	1	0	1	5
	VOCs by EPA Method 8260B	3	0	1	1	0	1	6

Notes:
*Estimated, one trip blank will accompany every shipment of volatile samples
EPA = Environmental Protection Agency
PCBs = Polychlorinated biphenyls
RCRA = Resource Conservation and Recovery Act
SVOCs = Semi-volatile Organic Compounds
TPH = Total Petroleum Hydrocarbons
VOCs = Volatile Organic Compounds
MS/MSD = Matrix Spike/Matrix Spike Duplicate

Table 4-1B
Summary of Additional Investigation Field QC Samples
OT-32 Collapsed Former Primate Research Area Sewers

Matrix	Analysis	Number of Field Samples	Equipment Blanks	Trip Blanks*	Field Duplicates	Field Splits	MS/MSD	Total
	SVOCs by EPA Method 8270C	24	0	0	3	0	2	29
	TAL Metals by EPA Method 6010B/7471A	24	0	0	3	0	2	29
	TPH by EPA Method 8015M	24	0	0	3	0	2	29
	Tritium by EPA Method 906.0M	24	0	0	3	0	2	29
	VOCs by EPA Method 8260B	24	0	5	3	0	2	34
Groundwater	SVOCs by EPA Method 8270C	12	0	0	2	0	1	15
	TAL Metals by EPA Method 6010B/7470A	12	0	0	2	0	1	15
	Total Dissolved Solids by EPA Method 160.1	12	0	0	2	0	1	15
	Tritium by EPA Method 906.0M	12	0	0	2	0	1	15
	VOCs by EPA Method 8260B	12	0	3	2	0	1	18

Notes:
*Estimated, one trip blank will accompany every shipment of volatile samples
EPA = Environmental Protection Agency
SVOCs = Semi-volatile Organic Compounds
TAL = Target Analyte List
TPH = Total Petroleum Hydrocarbons
VOCs = Volatile Organic Compounds
MS/MSD = Matrix Spike/Matrix Spike Duplicate

Table 4-1C
Summary of Additional Investigation Field QC Samples
OT-38 Test Sled Maintenance Area

Matrix	Analysis	Number of Field Samples	Equipment Blanks	Trip Blanks*	Field Duplicates	Field Splits	MS/MSD	Total
Soil	PCBs by EPA Method 8082	15	0	0	2	0	1	18
	RCRA Metals by EPA Method 6010B/7471A	15	0	0	2	0	1	18
	SVOCs by EPA Method 8270C	15	0	0	2	0	1	18
	TPH by EPA Method 8015M	15	0	0	2	0	1	18
	VOCs by EPA Method 8260B	15	0	3	2	0	1	21
Groundwater	PCBs by EPA Method 8082	3	0	0	1	0	1	5
	Perchlorates by EPA Method 6860	3	0	0	1	0	1	5
	RCRA Metals by EPA Method 6010B/7470A	3	0	0	1	0	1	5
	SVOCs by EPA Method 8270C	3	0	0	1	0	1	5
	Total Dissolved Solids by EPA Method 160.1	3	0	0	1	0	1	5
	VOCs by EPA Method 8260B	3	0	1	1	0	1	6

Notes:
*Estimated, one trip blank will accompany every shipment of volatile samples
EPA = Environmental Protection Agency
PCBs = Polychlorinated biphenyls
RCRA = Resource Conservation and Recovery Act
SVOCs = Semi-volatile Organic Compounds
TPH = Total Petroleum Hydrocarbons
VOCs = Volatile Organic Compounds
MS/MSD = Matrix Spike/Matrix Spike Duplicate

Table 4-1D
Summary of Additional Investigation Field QC Samples
OT-45 Old AGE Refueling Station

Matrix	Analysis	Number of Field Samples	Equipment Blanks	Trip Blanks*	Field Duplicates	Field Splits	MS/MSD	Total
Soil	SVOCs by EPA Method 8270C	15	0	0	2	0	1	18
	TPH by EPA Method 8015M	15	0	0	2	0	1	18
	VOCs by EPA Method 8260B	15	0	3	2	0	1	21
Groundwater	SVOCs by EPA Method 8270C	5	0	0	1	0	1	7
	Total Dissolved Solids by EPA Method 160.1	5	0	0	1	0	1	7
	VOCs by EPA Method 8260B	5	0	1	1	0	1	8

Notes:
*Estimated, one trip blank will accompany every shipment of volatile samples
EPA = Environmental Protection Agency
SVOCs = Semi-volatile Organic Compounds
TPH = Total Petroleum Hydrocarbons
VOCs = Volatile Organic Compounds
MS/MSD = Matrix Spike/Matrix Spike Duplicate

Table 4-1E
Summary of Additional Investigation Field QC Samples
SS-12 Northeast Fuel Line Spill Site

Matrix	Analysis	Number of Field Samples	Equipment Blanks	Trip Blanks*	Field Duplicates	Field Splits	MS/MSD	Total
Soil	RCRA Metals by EPA Method 6010B/7471A	15	0	0	0	0	1	16
	SVOCs by EPA Method 8270C	15	0	0	0	0	1	16
	TPHs by EPA Method 8015M	15	0	0	0	0	1	16
	VOCs by EPA Method 8260B	15	0	3	0	0	1	19
Groundwater	RCRA Metals by EPA Method 6010B/7470A	3	0	0	0	0	1	4
	SVOCs by EPA Method 8270C	3	0	0	0	0	1	4
	Total Dissolved Solids by EPA Method 160.1	3	0	0	0	0	1	4
	VOCs by EPA Method 8260B	3	0	1	0	0	1	5

Notes:
*Estimated, one trip blank will accompany every shipment of volatile samples
EPA = Environmental Protection Agency
RCRA = Resource Conservation and Recovery Act
SVOCs = Semi-volatile Organic Compounds
TPH = Total Petroleum Hydrocarbons
VOCs = Volatile Organic Compounds
MS/MSD = Matrix Spike/Matrix Spike Duplicate

Table 4-1F
Summary of Additional Investigation Field QC Samples
SS-18 Chromic Acid Spill Site

Matrix	Analysis	Number of Field Samples	Equipment Blanks	Trip Blanks*	Field Duplicates	Field Splits	MS/MSD	Total
Soil	Hexavalent Chromium by EPA Method 7196A	6	0	0	1	0	1	8
	TAL Metals by EPA Method 6010B/7471A	6	0	0	1	0	1	8
	SVOCs by EPA Method 8270C	6	0	0	1	0	1	8
	TPH by EPA Method 8015M	6	0	0	1	0	1	8
	VOCs by EPA Method 8260B	6	0	2	1	0	1	10
Groundwater	TAL Metals by EPA Method 6010B/7470A	4	0	0	1	0	1	6
	SVOCs by EPA Method 8270C	4	0	0	1	0	1	6
	Total Dissolved Solids by EPA Method 160.1	4	0	0	1	0	1	6
	VOCs by EPA Method 8260B	4	0	1	1	0	1	7

Notes:
*Estimated, one trip blank will accompany every shipment of volatile samples
EPA = Environmental Protection Agency
SVOCs = Semi-volatile Organic Compounds
TAL = Target Analyte List
TPH = Total Petroleum Hydrocarbons
VOCs = Volatile Organic Compounds
MS/MSD = Matrix Spike/Matrix Spike Duplicate

Table 4-1G
Summary of Additional Investigation Field QC Samples
RW-42 Radioactive Waste Burial Site

Matrix	Analysis	Number of Field Samples	Equipment Blanks	Trip Blanks*	Field Duplicates	Field Splits	MS/MSD	Total
Soil	SVOCs by EPA Method 8270C	12	0	0	2	0	1	15
	TAL Metals by EPA Method 6010B/7471A	12	0	0	2	0	1	15
	TPH by EPA Method 8015M	12	0	0	2	0	1	15
	Tritium by EPA Method 906.0M	12	0	0	2	0	1	15
	VOCs by EPA Method 8260B	12	0	3	2	0	1	18
Groundwater	SVOCs by EPA Method 8270C	3	0	0	1	0	1	5
	TAL Metals by EPA Method 6010B/7470A	3	0	0	1	0	1	5
	Total Dissolved Solids by EPA Method 160.1	3	0	0	1	0	1	5
	Tritium by EPA Method 906.0M	3	0	0	1	0	1	5
	VOCs by EPA Method 8260B	3	0	1	1	0	1	6

Notes:
*Estimated, one trip blank will accompany every shipment of volatile samples
EPA = Environmental Protection Agency
SVOCs = Semi-volatile Organic Compounds
TAL = Target Analyte List
TPH = Total Petroleum Hydrocarbons
VOCs = Volatile Organic Compounds
MS/MSD = Matrix Spike/Matrix Spike Duplicate

Table 4-1H
Summary of Additional Investigation Field QC Samples
OT-37 Early Missile Test Site

Matrix	Analysis	Number of Field Samples	Equipment Blanks	Trip Blanks*	Field Duplicates	Field Splits	MS/MSD	Total
Soil	PCBs by EPA Method 8082	32	0	0	4	0	2	38
	Perchlorates by EPA Method 6860	16	0	0	2	0	1	19
	RCRA Metals by EPA Method 6010B/7471A	16	0	0	2	0	1	19
	SVOCs by EPA Method 8270C	16	0	0	2	0	1	19
	TPH by EPA Method 8015M	32	0	0	4	0	2	38
	VOCs by EPA Method 8260B	16	0	4	2	0	1	23
Groundwater	PCBs by EPA Method 8082	10	0	0	1	0	1	12
	Perchlorates by EPA Method 6860	10	0	0	1	0	1	12
	RCRA Metals by EPA Method 6010B/7470A	10	0	0	1	0	1	12
	SVOCs by EPA Method 8270C	10	0	0	1	0	1	12
	Total Dissolved Solids by EPA Method 160.1	10	0	0	1	0	1	12
	VOCs by EPA Method 8260B	10	0	2	1	0	1	14

Notes:
*Estimated, one trip blank will accompany every shipment of volatile samples
EPA = Environmental Protection Agency
PCBs = Polychlorinated biphenyls
RCRA = Resource Conservation and Recovery Act
SVOCs = Semi-volatile Organic Compounds
TPH = Total Petroleum Hydrocarbons
VOCs = Volatile Organic Compounds

Table 4-2
Summary of Laboratory QC Limits

Parameter	RL		LCS				Matrix Spike Water			Matrix Spike Soil		
			Water		Soil		MS Recovery		MSD	MS Recovery		MSD
	Water	Soil	LCL	UCL	LCL	UCL	LCL	UCL	RPD	LCL	UCL	RPD
VOCs by EPA Method 8260B	µg/L	µg/kg	%	%	%	%	%	%	%	%	%	%
Acetone	10	20	48	130	45	184	48	130	41	45	184	28
Benzene	1	5	77	118	76	116	77	118	20	76	116	20
Bromobenzene	1	5	75	115	74	114	75	115	20	74	114	22
Bromochloromethane	1	5	78	118	77	117	78	118	20	77	117	21
Bromodichloromethane	1	5	78	118	74	125	78	118	20	74	125	20
Bromoform	1	5	74	121	75	115	74	121	21	75	115	20
Bromomethane	2	10	42	154	40	149	42	154	24	40	149	22
2-Butanone (MEK)	6	20	57	120	58	150	57	120	32	58	150	32
n-Butylbenzene	1	5	76	117	66	130	76	117	21	66	130	22
sec-Butylbenzene	1	5	80	120	79	128	80	120	21	79	128	22
tert-Butylbenzene	1	5	76	116	77	124	76	116	21	77	124	20
Carbon tetrachloride	1	5	80	120	69	147	80	120	21	69	147	20
Chlorobenzene	1	5	78	118	74	114	78	118	20	74	114	20
Dibromochloromethane	1	5	76	116	74	114	76	116	20	74	114	22
Chloroethane	2	10	51	133	51	155	51	133	25	51	155	20
Chloroform	1	10	78	118	77	125	78	118	20	77	125	25
Chloromethane	2	10	46	142	47	148	46	142	24	47	148	22
2-Chlorotoluene	1	5	76	116	80	120	76	116	20	80	120	20
4-Chlorotoluene	1	5	78	118	77	117	78	118	20	77	117	28
1,2-Dibromo-3-chloropropane	5	10	65	117	60	120	65	117	22	60	120	20
1,2-Dibromoethane (EDB)	1	5	77	117	75	115	77	117	20	75	115	20
Dibromomethane	1	5	77	117	77	117	77	117	20	77	117	20
1,2-Dichlorobenzene	1	5	76	116	72	112	76	116	20	72	112	20
1,3-Dichlorobenzne	1	5	75	115	74	114	75	115	20	74	114	20
1,4-Dichlorobenzene	1	5	77	117	73	113	77	117	23	73	113	22
Dichlorodifluoromethane	2	10	56	140	42	178	56	140	24	42	178	28
1,1-Dichloroethane	1	5	77	117	74	114	77	117	21	74	114	20
1,2-Dichloroethane	1	5	74	120	62	142	74	120	20	62	142	20
cis-1,2-Dichloroethylene	1	2.5	75	115	75	115	75	115	20	75	115	20
trans-1,2-Dichloroethylene	1	2.5	80	120	82	127	80	120	24	82	127	20
1,1-Dichloroethylene	1	5	68	133	82	143	68	133	20	82	143	20
1,2-Dichloroethane (total)	1	5	78	118	80	120	78	118	20	80	120	20
1,2-Dichloropropane	1	5	76	116	74	114	76	116	20	74	114	20
1,3-Dichloropropane	1	5	75	115	72	112	75	115	20	72	112	20
2,3-Dichloropropane	5	5	72	128	64	144	72	128	24	64	144	20
cis-1,3-Dichloropropene	1	5	76	116	77	117	76	116	20	77	117	20
trans-1,3-Dichloropropene	1	5	72	117	71	120	72	117	20	71	120	20
1,1-Dichloropropene	1	5	75	115	76	123	75	115	21	76	123	20
Ethylbenzene	1	5	78	118	78	118	78	118	26	78	118	20
Hexachlorobutadiene	1	5	73	123	69	125	73	123	25	69	125	25

Table 4-2
Summary of Laboratory QC Limits

Parameter	RL		LCS				Matrix Spike Water			Matrix Spike Soil		
			Water		Soil		MS Recovery		MSD	MS Recovery		MSD
	Water	Soil	LCL	UCL	LCL	UCL	LCL	UCL	RPD	LCL	UCL	RPD
2-Hexanone	5	20	57	121	58	136	57	121	25	58	136	29
Isopropylbenzene	1	5	71	111	71	111	71	111	20	71	111	20
Methyl chloride	1	5	71	119	76	116	71	119	20	76	116	21
4-Methyl-2-pentanone	5	20	65	118	62	130	65	118	22	62	130	25
Methyl tert butyl ether	5	20	58	116	69	129	58	116	21	69	129	20
Naphthalene	5	5	62	121	65	113	62	121	32	65	113	38
n-Propylbenzene	1	5	76	116	79	120	76	116	20	79	120	22
Styrene	1	5	77	117	77	117	77	117	20	77	117	20
1,1,1,2-Tetrachloroethane	1	5	77	117	76	116	77	117	20	76	116	20
1,1,2,2-Tetrachloroethane	1	5	73	119	68	119	73	119	20	68	119	21
Tetrachloroethylene	1	5	77	117	71	111	77	117	20	71	111	20
Toluene	1	5	73	120	72	113	73	120	20	72	113	20
1,2,3-Trichlorobenzene	1	5	66	123	69	113	66	123	29	69	113	31
1,2,4-Trichlorobenzene	1	5	73	121	73	116	73	121	25	73	116	26
1,1,1-Trichloroethane	1	5	78	118	67	143	78	118	20	67	143	20
1,1,2-Trichloroethane	1	5	76	116	69	109	76	116	21	69	109	20
Trichloroethylene	1	5	78	122	78	118	78	122	20	78	118	20
Trichlorofluoromethane	2	10	63	135	50	155	63	135	20	50	155	33
1,2,3-Trichloropropane	1	5	72	120	72	122	72	120	23	72	122	21
1,2,4-Trimethylbenzene	1	5	77	117	78	126	77	117	20	78	126	20
1,3,5-Trimethylbenzene	1	5	77	117	77	125	77	117	20	77	125	21
Vinyl chloride	1	5	49	136	45	148	49	136	24	45	148	24
m-Xylene & p-Xylene	2	2.5	78	118	77	117	78	118	20	77	117	20
o-Xylene	1	2.5	77	117	77	117	77	117	20	77	117	20
Xylenes, Total	2	5	77	117	77	117	77	117	20	77	117	20
4-Bromofluorobenzene (surr)	--	--	78	118	76	127	--	--	--	--	--	--
1,2-Dichloroethane-D4 (surr)	--	--	70	127	58	140	--	--	--	--	--	--
Toluene-D8 (surr)	--	--	83	125	80	126	--	--	--	--	--	--
Dibromofluoromethane (surr)	--	--	77	119	75	121	--	--	--	--	--	--
SVOCs by EPA Method 8270C	**µg/L**	**µg/kg**	**%**	**%**	**%**	**%**	**%**	**%**	**%**	**%**	**%**	**%**
Acenaphthene	10	330	53	120	52	120	53	120	30	52	120	30
Acenaphthylene	10	330	54	120	53	120	54	120	30	53	120	30
Anthracene	10	330	56	120	57	120	56	120	30	57	120	30
Benzo(a)anthracene	10	660	54	120	55	120	54	120	30	55	120	30
Benzo(b)fluoranthene	10	660	57	120	52	120	57	120	30	52	120	44
Benzo(k)fluoranthene	10	660	52	120	54	120	52	120	30	54	120	30
Benzo(g,h,i)perylene	10	660	53	120	50	120	53	120	30	50	120	31
Benzo(a)pyrene	10	660	53	120	54	120	53	120	30	54	120	30
bis(2-Chloroethoxy)methane	10	330	52	120	49	120	52	120	30	49	120	30
bis(2-Chloroethyl)ether	10	660	49	120	48	120	49	120	30	48	120	30

Table 4-2
Summary of Laboratory QC Limits

Parameter	RL		LCS				Matrix Spike Water			Matrix Spike Soil		
			Water		Soil		MS Recovery		MSD	MS Recovery		MSD
	Water	Soil	LCL	UCL	LCL	UCL	LCL	UCL	RPD	LCL	UCL	RPD
bis(2-Chloroisopropyl)ether	10	660	37	120	47	120	37	120	30	47	120	30
bis(2-Ethylhexyl)phthalate	10	660	48	120	51	120	48	120	30	51	120	30
4-Bromophenyl phenyl ether	10	660	52	120	53	120	52	120	30	53	120	30
Butyl benzyl phthalate	20	660	55	120	49	120	55	120	30	49	120	30
Caprolactam	20	1,600	48	120	49	120	48	120	30	49	120	30
Carbazole	10	330	--	--	54	120	--	--	--	54	120	30
4-Chloroaniline	20	1,300	52	120	28	120	52	120	30	28	120	30
4-Chloro-3-methyl phenol	20	1,300	63	120	57	120	63	120	30	57	120	30
2-Chloronaphthalene	10	330	47	120	53	120	47	120	30	53	120	30
2-Chlorophenol	10	660	57	120	53	120	57	120	30	53	120	30
4-Chlorophenyl phenyl ether	10	660	56	120	55	120	56	120	30	55	120	30
Chrysene	10	660	56	120	55	120	56	120	30	55	120	35
Dibenz(a,h)anthracene	10	660	54	120	55	120	54	120	30	55	120	30
Dibenzofuran	10	660	58	120	56	120	58	120	30	56	120	30
Di-n-butyl phthalate	20	660	52	120	57	120	52	120	30	57	120	30
3,3'-Dichlorobenzidine	20	1,300	29	120	34	120	29	120	30	34	120	30
2,4-Dichlorophenol	10	660	59	120	53	120	59	120	30	53	120	30
Diethyl phthalate	20	660	61	120	57	120	61	120	30	57	120	30
2,4-Dimethylphenol	10	660	41	120	53	120	41	120	30	53	120	30
Dimethyl phthalate	20	660	61	120	57	120	61	120	30	57	120	30
4,6-Dinitro-2-methylphenol	60	3,300	37	126	30	120	37	126	30	30	120	30
2,4-Dinitrophenol	60	3,300	30	136	15	120	30	136	30	15	120	34
2,4-Dinitrotoluene	20	660	51	120	53	120	51	120	30	53	120	30
2,6-Dinitrotoluene	20	660	42	125	53	120	42	125	30	53	120	30
Di-n-octyl phthalate	20	660	47	120	54	120	47	120	30	54	120	30
Fluoranthene	20	660	49	120	55	120	49	120	30	55	120	30
Fluorene	10	660	57	120	55	120	57	120	30	55	120	30
Hexachlorobenzene	10	660	53	120	51	120	53	120	30	51	120	30
Hexachlorobutadiene	10	660	40	120	48	120	40	120	30	48	120	30
Hexachlorocyclopentadiene	10	660	10	120	35	120	10	120	30	35	120	30
Hexachloroethane	10	660	36	120	46	120	36	120	30	46	120	30
Indeno(1,2,3-cd)pyrene	10	660	56	120	54	120	56	120	30	54	120	30
2-Methylnaphthalene	10	660	54	120	55	120	54	120	30	55	120	30
2-Methylphenol	10	660	50	120	51	120	50	120	30	51	120	30
4-Methylphenol	20	660	54	120	53	120	54	120	30	53	120	30
Naphthalene	10	660	46	120	50	120	46	120	30	50	120	30
2-Nitroaniline	50	3,300	44	120	50	120	44	120	30	50	120	30
3-Nitroaniline	50	3,300	49	120	35	120	49	120	30	35	120	30
4-Nitroaniline	50	3,300	39	120	44	120	39	120	30	44	120	30
Nitrobenzene	20	660	41	120	49	120	41	120	30	49	120	30
2-Nitrophenol	20	660	51	120	53	120	51	120	30	53	120	30

Table 4-2
Summary of Laboratory QC Limits

Parameter	RL		LCS				Matrix Spike Water			Matrix Spike Soil		
			Water		Soil		MS Recovery		MSD	MS Recovery		MSD
	Water	Soil	LCL	UCL	LCL	UCL	LCL	UCL	RPD	LCL	UCL	RPD
4-Nitrophenol	50	3,300	49	120	41	120	49	120	30	41	120	30
N-Nitrosodiphenylamine	10	660	58	120	55	120	58	120	30	55	120	36
n-Nitrosodi-n-propylamine	20	660	46	120	51	120	46	120	30	51	120	30
Pentachlorophenol	60	3,300	52	120	30	120	52	120	30	30	120	30
Phenanthrene	10	660	57	120	58	120	57	120	30	58	120	30
Phenol	10	660	52	120	54	120	52	120	30	54	120	30
Pyrene	10	660	56	120	50	120	56	120	30	50	120	38
2,4,5-Trichlorophenol	20	660	--	--	56	120	--	--	--	56	120	30
2,4,6-Trichlorophenol	20	660	52	120	50	120	52	120	30	50	120	30
2-Fluorobiphenyl (surr)	--	--	49	120	--	--	--	--	--	--	--	--
2-Fluorophenol (surr)	--	--	51	120	--	--	--	--	--	--	--	--
2,4,6-Tribromophenol (surr)	--	--	57	120	--	--	--	--	--	--	--	--
Nitrobenzene-d5 (surr)	--	--	48	120	--	--	--	--	--	--	--	--
Phenol-d5 (surr)	--	--	51	120	--	--	--	--	--	--	--	--
Terphenyl-d14 (surr)	--	--	61	120	--	--	--	--	--	--	--	--
Organochlorine Pesticides by EPA Method 8081A	**µg/L**	**µg/kg**	**%**	**%**	**%**	**%**	**%**	**%**	**%**	**%**	**%**	**%**
Aldrin	0.05	1.7	45	115	72	112	45	115	33	72	112	50
alpha-BHC	0.05	1.7	72	115	62	110	72	115	50	62	110	17
beta-BHC	0.05	1.7	70	118	63	114	70	118	50	63	114	17
delta-BHC	0.05	1.7	57	104	59	105	57	104	50	59	105	19
gamma-BHC (Lindane)	0.05	1.7	71	118	66	116	71	118	26	66	116	24
alpha-Chlordane	0.05	1.7	74	114	72	112	74	114	50	72	112	18
gamma-Chlordane	0.05	1.7	72	112	71	114	72	112	50	71	114	21
4,4'-DDD	0.05	1.7	76	117	70	118	76	117	50	70	118	20
4,4'-DDE	0.05	1.7	72	112	74	117	72	112	50	74	117	15
4,4'-DDT	0.05	1.7	58	119	63	122	58	119	25	63	122	29
Dieldrin	0.05	1.7	74	118	74	119	74	118	22	74	119	25
Endosulfan-I	0.05	1.7	75	115	72	113	75	115	50	72	113	26
Endosulfan-II	0.05	1.7	75	118	74	117	75	118	50	74	117	20
Endosulfan sulfate	0.05	1.7	69	117	71	126	69	117	50	71	126	22
Endrin	0.05	1.7	71	115	71	114	71	115	39	71	114	30
Endrin aldehyde	0.05	1.7	73	113	64	104	73	113	50	64	104	90
Endrin ketone	0.05	1.7	71	121	74	120	71	121	50	74	120	20
Heptachlor	0.05	1.7	52	115	71	117	52	115	27	71	117	18
Heptachlor epoxide	0.05	1.7	74	114	73	113	74	114	50	73	113	18
Methoxychlor	0.1	3.3	62	116	66	117	62	116	50	66	117	23
Toxaphene	2.5	170	83	142	51	139	83	142	29	51	139	23
Tetrachloro-m-xylene (surr)	--	--	57	122	72	117	--	--	--	--	--	--
Decachlorobiphenyl (surr)	--	--	38	116	68	120	--	--	--	--	--	--

Table 4-2
Summary of Laboratory QC Limits

Parameter	RL		LCS				Matrix Spike Water			Matrix Spike Soil		
			Water		Soil		MS Recovery		MSD	MS Recovery		MSD
	Water	Soil	LCL	UCL	LCL	UCL	LCL	UCL	RPD	LCL	UCL	RPD
PCBs by EPA Method 8082	µg/L	mg/kg	%	%	%	%	%	%	%	%	%	%
Aroclor 1016	1.0	10	61	125	71	118	53	130	30	71	118	36
Aroclor 1221	1.0	10	--	--	--	--	--	--	--	--	--	--
Aroclor 1232	1.0	10	--	--	--	--	--	--	--	--	--	--
Aroclor 1242	1.0	10	--	--	--	--	--	--	--	--	--	--
Aroclor 1248	1.0	10	--	--	--	--	--	--	--	--	--	--
Aroclor 1254	1.0	10	--	--	--	--	--	--	--	--	--	--
Aroclor 1260	1.0	10	63	129	65	123	58	150	30	65	123	36
Decachlorobiphenyl (surr)	1.0	--	29	143	68	125	--	--	--	--	--	--
Tetrachloro-m-xylene (surr)	--	--	41	117	67	129	--	--	--	--	--	--
Chlorinated Herbicides by EPA Method 8151A	µg/L	µg/kg	%	%	%	%	%	%	%	%	%	%
2,4-D	4.0	80	15	140	32	97	15	140	30	32	97	40
Dalapon	2.0	40	51	141	11	87	51	141	30	11	87	50
2,4-DB	4.0	80	63	148	51	108	63	148	30	51	108	50
Dicamba	2.0	40	53	153	11	87	53	153	30	11	87	50
Dichloroprop	4.0	80	39	136	78	180	39	136	30	78	180	50
Dinoseb	0.6	12	10	142	5	166	10	142	30	5	166	50
MCPA	400	8,000	50	150	54	135	50	150	30	54	135	50
MCPP	400	8,000	67	141	65	135	67	141	30	65	135	50
2,4,5-TP (Silvex)	1.0	20	45	165	48	119	45	165	30	48	119	40
2,3,5-T	1.0	20	29	168	24	98	29	168	30	24	98	40
DCAA (surr)	--	--	39	135	31	105	--	--	--	--	--	--
Perchlorate by EPA Method 6860	µg/L	µg/kg	%	%	%	%	%	%	%	%	%	%
Perchlorate	0.10	1.00	69	138	58	146	52	141	20	37	170	20
Metals by EPA Method 6010B/7470A/7471A	µg/L	mg/kg	%	%	%	%	%	%	%	%	%	%
Aluminum	100	10	87	111	82	116	83	119	25	50	200	30
Antimony	10	1.5	88	108	82	102	81	124	25	20	200	30
Arsenic	15	2	88	109	85	104	84	124	25	76	111	30
Barium	10	1	92	112	87	112	85	120	25	52	159	30
Beryllium	5	0.5	89	113	84	114	79	121	25	72	105	30
Cadmium	5	0.5	88	111	87	107	82	119	25	40	130	30
Calcium	200	20	90	111	82	114	48	153	25	43	165	30
Chromium	10	1.5	90	113	84	114	73	135	25	70	200	30
Cobalt	10	1	89	111	87	108	82	119	25	72	106	30
Copper	15	2	86	112	88	109	82	129	25	37	187	30
Iron	100	15	89	116	87	124	52	155	25	70	200	30
Lead	9	0.8	89	109	86	107	89	121	25	70	200	30
Magnesium	200	20	92	113	90	110	62	146	25	64	145	30
Manganese	10	1	90	110	88	109	79	121	25	40	200	30

Table 4-2
Summary of Laboratory QC Limits

Parameter	RL		LCS				Matrix Spike Water			Matrix Spike Soil		
			Water		Soil		MS Recovery		MSD	MS Recovery		MSD
	Water	Soil	LCL	UCL	LCL	UCL	LCL	UCL	RPD	LCL	UCL	RPD
Mercury	0.2	0.033	88	111	88	111	88	111	10	88	111	30
Nickel	40	4	89	111	87	108	84	120	25	61	126	30
Potassium	3000	300	89	114	89	109	76	132	25	56	172	30
Selenium	15	1.3	90	110	83	103	71	140	25	76	104	30
Silver	10	1	86	120	87	114	75	141	25	75	141	30
Sodium	1000	500	90	117	90	112	70	203	25	78	111	30
Thallium	15	1.20	88	108	84	106	90	116	25	78	101	30
Vanadium	10	2	91	111	88	108	85	120	25	50	169	30
Zinc	20	3	84	111	76	114	60	137	25	70	200	30
Hexavalent Chromium by EPA Method 7196A	**µg/L**	**mg/kg**	**%**	**%**	**%**	**%**	**%**	**%**	**%**	**%**	**%**	**%**
Cr (VI)	--	0.10	--	--	85	115	--	--	--	30	150	19
Tritium by EPA Method 906.0	**pCi/L**	**pCi/g**	**%**	**%**	**%**	**%**	**%**	**%**	**%**	**%**	**%**	**%**
Tritium	500	1.00	79	108	84	103	43	150	40	67	127	40
Total Petroleum Hydrocarbons (TPH) by EPA Method 8015M	**µg/L**	**mg/kg**	**%**	**%**	**%**	**%**	**%**	**%**	**%**	**%**	**%**	**%**
TPH-GRO (C6-C10)	25	1.2	79	149	85	153	79	149	27	85	153	30
aaa-Trifluorotoluene (surr)	--	--	82	110	77	123	--	--	--	--	--	--
TPH (C10-C22)	250	4.0	115	31	56	115	50	115	31	56	115	30
TPH (>C22-C36)	1000	4.0	115	31	56	115	50	115	31	56	115	30
o-Terphenyll (surr)	--	--	50	115	49	115	--	--	--	--	--	--
Total Dissolved Solids by EPA Method 160.1	**mg/L**	**mg/kg**	**%**	**%**	**%**	**%**	**%**	**%**	**%**	**%**	**%**	**%**
Total Dissolved Solids	10	--	86	106	--	--	86	106	20	--	--	--

Notes:
µg/kg = Micrograms per kilogram
µg/L = Micrograms per liter
EPA = United States Environmental Protection Agency
LCL = Lower Control Limit
LCS = Laboratory Control Sample
mg/kg = Milligrams per kilogram
mg/L = Milligrams per liter
MS = Matrix Spike
MSD = Matrix Spike Duplicate
pCi/g = picocurie per gram
pCi/L = picocurie per liter
RL = Reporting Limit
RPD = Relative Percent Difference
UCL = Upper Control Limit
VOCs = Volatile Organic Compounds
SVOCs = Semi-volatile Organic Compounds
PCBs = Polychlorinated biphenyls
GRO - Gasoline range organics

APPENDIX D

UFGS SECTION 02111 *EXCAVATION AND HANDLING OF CONTAMINATED MATERIAL*, SEPTEMBER 2003

GUIDE SPECIFICATION FOR CONSTRUCTION

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DIVISION 02 - SITE CONSTRUCTION

SECTION 02111

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09/03

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GUIDE SPECIFICATION FOR CONSTRUCTION

SECTION 02111

EXCAVATION AND HANDLING OF CONTAMINATED MATERIAL
09/03

NOTE: This guide specification covers the requirements for excavation, handling, and temporary storage of contaminated material.

Comments and suggestions on this guide specification are welcome and should be directed to the technical proponent of the specification. A listing of technical proponents, including their organization designation and telephone number, is on the Internet.

Recommended changes to a UFGS should be submitted as a Criteria Change Request (CCR).

Use of electronic communication is encouraged.

Brackets are used in the text to indicate designer choices or locations where text must be supplied by the designer.

PART 1 GENERAL

NOTE: The following information should be shown on the project drawings:

a. Overall site plan, borrow areas, stockpile areas, storage areas, security requirements, special shoring requirements, boring logs, and access routes.

b. Individual site plans of each area of contamination with site features such as buildings, roads, utilities, topography, trees, shrubs, surface conditions, etc.

c. Limits of pavement removal, fence removal, and the location of ancillary equipment to be removed.

All specific chemical testing procedures (including air emissions analysis) should be addressed in the Sampling and Analysis Plan required by Section 01450 CHEMICAL DATA QUALITY CONTROL.

When applicable, the use of onsite field screening or field analysis (supported at a prescribed frequency by fixed laboratory analysis) should be encouraged to avoid prolonged delays or equipment downtime. Details on the appropriate application and use of field analyses can be found in Appendix H of EM 200-1-3.

****

1.1 REFERENCES

****

NOTE: Issue (date) of references included in project specifications need not be more current than provided by the latest guide specification. Use of SpecsIntact automated reference checking is recommended for projects based on older guide specifications.

****

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ASTM INTERNATIONAL (ASTM)

ASTM D 1556	(2000) Density and Unit Weight of Soil in Place by the Sand-Cone Method
ASTM D 1557	(2002) Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/cu. ft. (2,700 kN-m/cu.m.))
ASTM D 2167	(1994; R 2001) Density and Unit Weight of Soil in Place by the Rubber Balloon Method
ASTM D 2487	(2000) Soils for Engineering Purposes (Unified Soil Classification System)
ASTM D 2922	(2001) Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth)
ASTM D 422	(1963; R 2002) Particle-Size Analysis of Soils
ASTM D 5434	(1997; R 2003) Field Logging of Subsurface Explorations of Soil and Rock
ASTM D 698	(2000a) Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/cu. ft. (600 kN-m/cu. m.))

U.S. ARMY CORPS OF ENGINEERS (USACE)

EM 385-1-1	(2003) Safety and Health Requirements Manual

U.S. NATIONAL APCHIVES AND RECORDS ADMINISTRATION (NARA)

29 CFR 1926	Safety and Health Regulations for Construction
40 CFR 302	Designation, Reportable Quantities, and Notification

1.2 MEASUREMENT AND PAYMENT

****
NOTE: These paragraphs should be deleted if the work is in one lump-sum contract price. Coordinate requirements of these paragraphs with the bidding schedule.
****

1.2.1 Measurement

****
NOTE: Modify this paragraph if the method of payment will be on a weight basis.
****

Measurement for excavation and on-site transportation shall be based on the actual number of cubic meters yards of contaminated material in-place prior to excavation. Determination of the volume of contaminated material excavated shall be based on cross-sectional volume determination reflecting the differential between the original elevations of the top of the contaminated material and the final elevations after removal of the contaminated material. Measurement for backfilling of excavated areas shall be based on in-place cubic meters yards of compacted fill. Measurement for construction of stockpile areas shall be based on the number of square meters yards of stockpile liner constructed.

1.2.2 Payment

1.2.2.1 Excavation and Transportation

Compensation for excavation and onsite transportation of contaminated material will be paid as a unit cost. This unit cost shall include any other items incidental to excavation and handling not defined as having a specific unit cost.

1.2.2.2 Backfilling

Compensation for backfill soil, transportation of backfill, backfill soil conditioning, backfilling, compaction, and geotechnical testing will be paid as a single unit cost.

1.2.2.3 Stockpiling

Compensation for construction of stockpile areas will be paid for as a unit cost. This unit cost shall include all aspects of grading, preparation, handling, placement, maintenance, removal, treatment, and disposal of stockpile cover materials and liner materials and all other items incidental to construction of stockpiles.

1.3 SUBMITTALS

****

NOTE: Submittals must be limited to those necessary for adequate quality control. The importance of an item in the project should be one of the primary factors in determining if a submittal for the item should be required.

A "G" following a submittal item indicates that the submittal requires Government approval. Some submittals are already marked with a "G". Only delete an existing "G" if the submittal item is not complex and can be reviewed through the Contractor's Quality Control system. Only add a "G" if the submittal is sufficiently important or complex in context of the project.

For submittals requiring Government approval on Army projects, a code of up to three characters within the submittal tags may be used following the "G" designation to indicate the approving authority. Codes for Army projects using the Resident Management System (RMS) are: "AE" for Architect-Engineer; "DO" for District Office (Engineering Division or other organization in the District Office); "AO" for Area Office; "RO" for Resident Office; and "PO" for Project Office. Codes following the "G" typically are not used for Navy projects.

Submittal items not designated with a "G" are considered as being for information only for Army projects and for Contractor Quality Control approval for Navy projects.

****

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are [for Contractor Quality Control approval.] [for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government.] The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Surveys; G, [_____]

Separate cross-sections of each area before and after excavation and after backfilling.

SD-03 Product Data

Work Plan; G, [_____]

Work Plan within [30] [_____] calender days after notice to proceed. No work at the site, with the exception of site inspections and surveys, shall be performed until the Work Plan is approved. The Contractor shall allow [30] [_____] calender days

in the schedule for the Government's review. No adjustment for time or money will be made if resubmittals of the Work Plan are required due to deficiencies in the plan. At a minimum, the Work Plan shall include:

a. Schedule of activities.

b. Method of excavation and equipment to be used.

c. Shoring or side-wall slopes proposed.

d. Dewatering plan.

e. Storage methods and locations for liquid and solid contaminated material.

f. Borrow sources and haul routes.

g. Decontamination procedures.

h. Spill contingency plan.

Closure Report; G, [_____]

[_____] copies of the Closure Report within [14] [_____] calender days of work completion at the site.

SD-06 Test Reports

Backfill; G, [_____]
Surveys; G, [_____]
Confirmation Sampling and Analysis; G, [_____]
Sampling of Stored Material; G, [_____]
Sampling Liquid; G, [_____]
Compaction; G, [_____]

Test results.

1.4 SURVEYS

Surveys shall be performed immediately prior to and after excavation of contaminated material to determine the volume of contaminated material removed. Surveys shall also be performed immediately after backfill of each excavation. The Contractor shall provide cross-sections on [7.6] [_____] meter [25] [_____] foot intervals and at break points for all excavated areas. Locations of confirmation samples shall also be surveyed and shown on the drawings. Surveys shall be performed in accordance with Section: [_____].

1.5 REGULATORY REQUIREMENTS

1.5.1 Permits and Licenses

****
NOTE: Include additional site specific requirements in this paragraph.
****

The Contractor shall obtain required federal, state, and local permits for

excavation and storage of contaminated material. Permits shall be obtained at no additional cost to the Government.

1.5.2 Air Emissions

****

NOTE: An air pathway analysis should be performed during design to determine what air monitoring and controls are required. Guidance on air pathway analyses is provided in EP 1110-1-21 Air Pathway Analysis for the Design of Hazardous, Toxic, and Radioactive Waste (HTRW) Remedial Action Projects. Specify perimeter air monitoring requirements in Section 01355 ENVIRONMENTAL PROTECTION.

****

Air emissions shall be monitored and controlled in accordance with Section 01355.

1.6 DESCRIPTION OF WORK

****

NOTE: Include any pertinent information regarding project/site conditions in this paragraph, the appendices to the specifications, or on the drawings.

If oversize material such as debris and foundations are present, the specification should describe treatment, handling, and disposal requirements for this material. Measurement and payment procedures should also be described for this material.

If clean soil overlies the contaminated material, the specification should describe how this material will be measured, removed, stored, and tested to verify they are clean.

****

The work shall consist of excavation and temporary storage of approximately [_____] cubic meters yards of contaminated material. Approximate locations of contaminated material are shown on the drawings. Characterization data on the nature and extent of the contaminated material is shown in Appendix [_____]. Subsurface conditions are shown [on the drawings] [in Appendix [_____]]. The Contractor shall submit a Work Plan as specified in the Submittals paragraph. The Contracting Officer shall be notified within [24] [_____] hours, and before excavation, if contaminated material is discovered that has not been previously identified or if other discrepancies between data provided and actual field conditions are discovered. Backfill material is [not available onsite] [available onsite and typically consists of [_____]]. Ground water is approximately [_____] meters feet below pre-excavation ground surface.

1.7 CHEMICAL TESTING

Required sampling and chemical analysis shall be conducted in accordance with Section 01450A CHEMICAL DATA QUALITY CONTROL.

1.8 SCHEDULING

The Contractor shall notify the Contracting Officer [_____] calender days prior to the start of excavation of contaminated material. The [Contracting Officer will] [Contractor shall] be responsible for contacting regulatory agencies in accordance with the applicable reporting requirements.

PART 2 PRODUCTS

2.1 BACKFILL

****

NOTE: If contaminated material removal is part of a larger project and a backfilling specification is needed for the project as a whole, refer to another specification such as Section 02315 EXCAVATION, FILLING AND BACKFILLING FOR BUILDINGS for Buildings, for backfill requirements and delete the following paragraphs.

In many cases, the degree of engineering control of the materials used as backfill may not need to be as stringent as described in this paragraph. In other cases, such as under pavements, special compaction and material requirements may apply and the specification will need to be revised to address these special requirements or another specification section should be referenced.

Backfill and topsoil brought in from offsite is usually tested to verify the material is clean. Quality assurance samples taken by the Government may also be prudent to verify the seller's claims by analyzing for target analytes. Backfill is commonly tested for the site specific contaminants being cleaned up and/or is based on suspicion of contamination at the site from which the backfill is originating.

At some sites, previously contaminated material which has been removed from the excavation is reused as backfill following treatment to remove the contaminant of concern.

****

Backfill material shall be obtained from [the location indicated on the drawings] [offsite sources approved by the Contracting Officer]. Backfill shall be classified in accordance with ASTM D 2487 as GW, GP, GM, GC, SW, SP, SM, SC, ML, MH, CL, or CH and shall be free from roots and other organic matter, trash, debris, snow, ice or frozen materials. Backfill material shall be tested for the parameters listed below at a frequency of once per [3000] [_____] cubic meters yards. A minimum of one set of classification tests shall be performed per borrow source. [One] [_____] backfill sample per borrow source shall also be collected and tested for the chemical parameters listed below.

Physical Parameter	Criteria	Test Method
Grain Size	[_____]	ASTM D 422
Compaction	[_____]	ASTM D 698
[_____]	[_____]	[_____]

Chemical Parameter	Test Frequency	Criteria
[_____]	[_____]	[_____]

Backfill shall not be used until borrow source chemical and physical test results have been submitted and approved.

2.2 SPILL RESPONSE MATERIALS

The Contractor shall provide appropriate spill response materials including, but not limited to the following: containers, adsorbents, shovels, and personal protective equipment. Spill response materials shall be available at all times when contaminated materials/wastes are being handled or transported. Spill response materials shall be compatible with the type of materials and contaminants being handled.

PART 3 EXECUTION

3.1 EXISTING STRUCTURES AND UTILITIES

No excavation shall be performed until site utilities have been field located. The Contractor shall take the necessary precautions to ensure no damage occurs to existing structures and utilities. Damage to existing structures and utilities resulting from the Contractor's operations shall be repaired at no additional cost to the Government. Utilities encountered that were not previously shown or otherwise located shall not be disturbed without approval from the Contracting Officer.

3.2 CLEARING

****

NOTE: Grubbing is typically not required at sites where contaminated soil is being excavated for treatment and/or disposal. Typically, vegetation that is cut off above a certain height is defined as clean and any stumps and brush below this height are defined as contaminated.

****

Clearing shall be performed to the limits shown on the drawings in accordance with Section 02231 CLEARING AND GRUBBING.

3.3 CONTAMINATED MATERIAL REMOVAL

****

NOTE: Excavations should be marked and secured in accordance with the requirements specified in Section 01351 SAFETY, HEALTH, AND EMERGENCY RESPONSE (HTRW/UST).

****

3.3.2 Excavation

****

NOTE: For large excavations, more than one excavation log may be required.

****

Areas of contamination shall be excavated to the depth and extent shown on the drawings and not more than [60] [_____] mm [0.2] [_____] feet beyond the depth and extent shown on the drawings unless directed by the Contracting Officer. Excavation shall be performed in a manner that will limit spills and the potential for contaminated material to be mixed with uncontaminated material. An excavation log describing visible signs of contamination encountered shall be maintained for each area of excavation. Excavation logs shall be prepared in accordance with ASTM D 5434.

3.3.3 Shoring

If workers must enter the excavation, it shall be evaluated, shored, sloped or braced as required by EM 385-1-1 and 29 CFR 1926 section 650.

3.3.4 Dewatering

****

NOTE: Dewatering can significantly increase the cost of a project involving the excavation of contaminated material and should be carefully considered during design. TM 5-818-5 Dewatering and Groundwater Control provides guidance on the design of dewatering systems.

If water from dewatering operations will be allowed to discharge on or into the ground, an NPDES permit for dewatering is required. Reference the permits paragraph of Section 01355 ENVIRONMENTAL PROTECTION for permit requirements.

****

Surface water shall be diverted to prevent entry into the excavation. [Dewatering shall be limited to that necessary to assure adequate access, a safe excavation, prevent the spread of contamination, and to ensure that compaction requirements can be met.] [No dewatering shall be performed without prior approval of the Contracting Officer.]

3.4 CONFIRMATION SAMPLING AND ANALYSIS

****

NOTE: Confirmation samples and analyses are used to verify cleanup criteria have been met. These test results should be of relatively high quality. For this reason, the designer should consider the regulatory requirements, the complexity of the monitoring needed, and quantitative Data Quality Objectives in determining the analytical methods specified.

The number of confirmation samples must be based on the size of the excavation and regulatory requirements. For small excavations, a minimum of

one sample should be taken from near the center of the excavation (or where there is the highest potential for contamination). Additional samples may be oriented symmetrically relative to the center sample and the limits of the excavation.

Many military facilities have base-wide sampling and analysis plans which have been approved by the applicable regulatory agencies. These plans may specify the number of confirmation samples which must be taken.

For larger excavations, EPA 230/02-89-042 Methods of Evaluation and Attainment of Cleanup Standards provides guidance on the design of statistically based sampling intervals.

With regulator approval, confirmation sampling and analysis may be accomplished using an averaging technique for comparison to cleanup criteria. This is based on the fact that most soil risk exposure scenarios do not model contamination as existing in discrete hot spots but as a more disperse phenomenon. Two ways to accomplish this averaging technique are to take discrete samples and average the data or by compositing sample material before analysis. A composite sample typically consists of 4 to 6 samples which are mixed together. One sample is then obtained from the composite sample for analysis. EM 200-1-3 provides guidance on compositing samples. Composite samples are not applicable to volatile organic contaminants because the compositing process will result in volatilization of contaminants. If composite samples are required, Section 01450 CHEMICAL DATA QUALITY CONTROL should be edited by a qualified chemist to describe procedures for compositing samples.

Confirmation sampling at a site with radioactive contamination in surface soils or on building surfaces will be performed in accordance with the Multi-Agency Radiation Survey and Site Investigation Manual (MARSSIM), NUREG-1575, EPA 402-R-97-016. This manual is a guide for confirmation survey design (planning) and for data evaluation. Its primary purpose is to acquire legally defensible data concerning the post excavation residual radioactivity at the site to demonstrate that the site meets release criteria.

****

The Contracting Officer shall be present to inspect the removal of contaminated material from each site. After all material suspected of being contaminated has been removed, the excavation shall be examined for evidence of contamination. If the excavation appears to be free of contamination, field analysis shall be used to determine the presence of [_____] contamination using [a real time vapor monitoring instrument] [immunoassay field kits] [_____]. Excavation of additional material shall

be as directed by the Contracting Officer. After all suspected contaminated material is removed, confirmation samples shall be collected and analyzed for the following contaminants:

Chemical Parameter	Action Level
[_____]	[_____]

Samples shall be collected at a frequency of one per [_____] square meters yards from the bottom [and each of the side walls] or as directed by the Contracting Officer. A minimum of one sample shall be collected from the bottom [and each side wall] of the excavation. Based on test results, the Contractor shall propose any additional excavation which may be required to remove material which is contaminated above action levels. Additional excavation shall be subject to approval by the Contracting Officer. Locations of samples shall be marked in the field and documented on the as-built drawings.

3.5 CONTAMINATED MATERIAL STORAGE

****

NOTE: For CERCLA sites, permits are not required to store hazardous waste in a stockpile. However, storage structures and conditions must be in compliance the Applicable, Relevant, and Appropriate Regulations (ARARs). For RCRA sites, permits are required to store hazardous waste in a stockpile. However, for RCRA sites, hazardous waste can be stored in a drum or roll-off unit for up to 90 days without a permit.

For temporary storage of more than 90 days, dual containment of hazardous liquid and some hazardous solids may be required. Containment system requirements are described in 40 CFR 264.175. For stock piles that meet the definition of a waste pile, see 40 CFR 264.250.

To provide secondary containment, tanks and roll-off units are sometimes stored on lined areas similar in design to what is described in paragraph Stockpiles.

****

Material shall be placed in temporary storage [immediately after excavation] [after treatment while awaiting test results]. The following paragraphs describe acceptable methods of material storage. Storage units shall be in good condition and constructed of materials that are compatible with the material or liquid to be stored. If multiple storage units are required, each unit shall be clearly labeled with an identification number and a written log shall be kept to track the source of contaminated material in each temporary storage unit.

3.5.1 Stockpiles

****

NOTE: Check state regulations to determine the minimum requirements for stockpiles and modify this paragraph accordingly. For contaminated material with high moisture content, the subgrade for the

stockpile must be sloped and a sump should be provided.

Scrim reinforced geomembranes are commonly specified for stockpile covers and liners. Due to their higher strength properties, scrim reinforced geomembranes can generally be thinner than non-reinforced geomembranes.

For post treatment stockpiles, chemical testing is usually required to determine if material is contaminated or clean. Maximum stockpile size should be based on the required frequency of chemical testing. For example, if chemical tests are required at a frequency of one per 1,000 cubic meters (cubic yards), then stockpiles should be no greater than 1,000 cubic meters (cubic yards) in size.

****

Stockpiles shall be constructed to isolate stored contaminated material from the environment. The maximum stockpile size shall be [_____] cubic meters. yards. Stockpiles shall be constructed to include:

a. [A chemically resistant geomembrane liner free of holes and other damage. Non-reinforced geomembrane liners shall have a minimum thickness of [0.5] [_____] mm. [20] [_____] mils. Scrim reinforced geomembrane liners shall have a minimum weight of 20 kg/100 square meters. 40 lbs. per 1000 square feet. The ground surface on which the geomembrane is to be placed shall be free of rocks greater than 12 mm 0.5 inches in diameter and any other object which could damage the membrane.] [Pavement shall be used as the liner system. Pavement shall be constructed in accordance with Section [_____]].

b. Geomembrane cover free of holes or other damage to prevent precipitation from entering the stockpile. Non-reinforced geomembrane covers shall have a minimum thickness of 0.25 mm. 10 mils. Scrim reinforced geomembrane covers shall have a minimum weight of 13 kg/100 square meters 26 lbs. per 1000 square feet. The cover material shall be extended over the berms and anchored or ballasted to prevent it from being removed or damaged by wind.

c. Berms surrounding the stockpile, a minimum of 300 mm 12 inches in height. Vehicle access points shall also be bermed.

d. The liner system shall be sloped to allow collection of leachate. Storage and removal of liquid which collects in the stockpile, in accordance with paragraph Liquid Storage.

3.5.2 Roll-Off Units

Roll-off units used to temporarily store contaminated material shall be water tight. A cover shall be placed over the units to prevent precipitation from contacting the stored material. The units shall be located [as shown on the drawings] [_____]. Liquid which collects inside the units shall be removed and stored in accordance with paragraph Liquid Storage.

3.5.3 Liquid Storage

Liquid collected from excavations and stockpiles shall be temporarily stored in [220 L barrels] [[2000] [_____] L tanks]. [55 gallon barrels] [[500] [_____] gallon tanks]. Liquid storage containers shall be water-tight and shall be located [as shown on the drawings] [_____].

3.6 SAMPLING

3.6.1 Sampling of Stored Material

****

NOTE: Additional samples are sometimes collected from excavated material to determine the contaminants present prior to treatment or disposal.

Composite samples are often collected from stockpiled material. However, composite samples cannot be taken if the samples are being analyzed for volatile organic contaminants.

At sites with radioactive contamination, ex-situ sampling of excavated material is typically performed to ensure that the material meets disposal facility acceptance criteria and, in some cases, to assist with the preparation of shipping papers. The ex-situ sampling regime is site-specific. It is usually determined in consultation with the disposal facility and its regulatory agency.

****

Samples of stored material shall be collected at a frequency of once per [_____] cubic meters. yards. Samples shall be tested for the following:

Chemical Parameter	Action Level
[_____]	[_____]

Stored material with contaminant levels that exceed the action levels shall be treated [offsite. Analyses for contaminated material to be taken to an offsite treatment facility shall conform to local, state, and federal criteria as well as to the requirements of the treatment facility. Documentation of all analyses performed shall be furnished to the Contracting Officer. Additional sampling and analyses to the extent required by the approved offsite treatment, storage or disposal (TSD) facility shall be the responsibility of the Contractor and shall be [performed at no additional cost to the Government] [subject to approval by the Contracting Officer].] [onsite. Treatment shall be in accordance with Section [_____].]

3.6.2 Sampling Liquid

****

NOTE: Liquid should generally be tested for the same contaminants as are found in the contaminated solid material being removed. The frequency of testing should be determined on a site specific basis. Offsite disposal will generally require additional testing and analysis prior to disposal.

NPDES requirements must be considered for onsite disposal of liquids.

****

Liquid collected from [excavations] [storage areas] [decontamination facilities] shall be sampled at a frequency of once for every [2,000] [_____] L [500] [_____] gallons of liquid collected. Samples shall be tested for the following:

Chemical Parameter	Action Level
[_____]	[_____]

Liquid with contaminant levels that exceed action levels shall be treated [offsite. Analyses for contaminated liquid to be taken to an offsite treatment facility shall conform to local, state, and federal criteria as well as to the requirements of the treatment facility. Documentation of all analyses performed shall be furnished to the Contracting Officer. Additional sampling and analysis to the extent required by the approved offsite treatment, storage or disposal (TSD) facility receiving the material shall be the responsibility of the Contractor and shall be [performed at no additional cost to the Government] [subject to approval by the Contracting Officer].] [onsite. Treatment shall be in accordance with Section [_____].]

3.6.3 Sampling Beneath Storage Units

****

NOTE: At some sites, samples are collected to verify the soil on which a storage unit is placed has not become contaminated.

Sampling along any connecting pipelines that transport contaminated liquid may also be appropriate. A standard practice is to sample at 6 m (20 foot) intervals under piping and at connections such as bends, elbows, or tees.

****

Samples from beneath each storage unit shall be collected prior to construction of and after removal of the storage unit. Samples shall be collected at a frequency of one per each [_____] square meters yards from a depth interval of [0 to 0.15] [_____] m [0 to 0.5] [_____] feet and shall be tested for the following:

Chemical Parameter	Action Level
[_____]	[_____]

Based on test results, soil which has become contaminated above action levels shall be removed at no additional cost to the Government. Contaminated material which is removed from beneath the storage unit shall be handled in accordance with paragraph Sampling of Stored Material. As directed by the Contracting Officer and at no additional cost to the Government, additional sampling and testing shall be performed to verify areas of contamination found beneath stockpiles have been cleaned up to below action levels.

3.7 SPILLS

****

NOTE: Regarding preestablished spill reporting procedures, the designer should consult CEMP-RT memorandum of 20 July 1995, Subject: Spill Reporting Procedures for USACE Personnel Involved in HTRW Projects.

Evaluate whether a contingency plan is needed per 40 CFR 262.34. This regulation is a potential requirement for large quantity generators of hazardous waste. At military installations, a plan is typically already in place.

****

In the event of a spill or release of a hazardous substance (as designated in 40 CFR 302), pollutant, contaminant, or oil (as governed by the Oil Pollution Act (OPA), 33 U.S.C. 2701 et seq.), the Contractor shall notify the Contracting Officer immediately. If the spill exceeds the reporting threshold, the Contractor shall follow the pre-established procedures as described in the [RCRA Contingency Plan] [Base Wide Contingency Plan] [_____] for immediate reporting and containment. Immediate containment actions shall be taken to minimize the effect of any spill or leak. Cleanup shall be in accordance with applicable federal, state, and local regulations. As directed by the Contracting Officer, additional sampling and testing shall be performed to verify spills have been cleaned up. Spill cleanup and testing shall be done at no additional cost to the Government.

3.8 BACKFILLING

****

NOTE: If allowed by the regulatory authority, field analyses should be used to reduce laboratory turn-around time and minimize the duration an excavation must be left open.

After completion of backfilling, a 0.15 meter (6 inch) layer of top soil is typically placed in areas that are not paved. The topsoil is placed in a single lift to the lines and grades shown on the drawings. Top soil and seeding requirements should be described in a different section of the specification package.

****

3.8.1 Confirmation Test Results

Excavations shall be backfilled immediately after all contaminated materials have been removed and confirmation test results have been approved. Backfill shall be placed and compacted to the lines and grades shown on the drawings.

3.8.2 Compaction

****

NOTE: The following paragraph outlines density requirements for in-place backfill. If the density

of the backfill is not critical, modify this paragraph by replacing the density testing requirements with procedural requirements for compaction.

****

Approved backfill shall be placed in lifts with a maximum loose thickness of [200] [_____] mm. [8] [_____] inches. Soil shall be compacted to [90] [_____] percent of [ASTM D 698] [ASTM D 1557] maximum dry density. Density tests shall be performed at a frequency of once per [930] [_____] square meters [10,000] [_____] square feet per lift. A minimum of [one density test] [[_____] density tests] shall be performed on each lift of backfill placed. Field in-place dry density shall be determined in accordance with ASTM D 1556, ASTM D 2167, or ASTM D 2922. If ASTM D 2922 is used, a minimum of one in ten tests shall be checked using ASTM D 1556 or ASTM D 2167. Test results from ASTM D 1556 or ASTM D 2167 shall govern if there is a discrepancy with the ASTM D 2922 test results.

3.9 DISPOSAL REQUIREMENTS

Offsite disposal of contaminated material shall be in accordance with Section 02120A TRANSPORTATION AND DISPOSAL OF HAZARDOUS MATERIALS.

3.10 CLOSURE REPORT

****

NOTE: In addition to progress photos, video tapes have been used at some sites to record site activities.

****

[_____] copies of a Closure Report shall be prepared and submitted within [14] [_____] calender days of completing work at the site. The report shall be labeled with the contract number, project name, location, date, name of general contractor, and the Corps of Engineers District contracting for the work. The Closure Report shall include the following information as a minimum:

a. A cover letter signed by a [responsible company official] [Professional Engineer registered in the State of [_____] who is a responsible company official] certifying that all services involved have been performed in accordance with the terms and conditions of the contract documents and regulatory requirements.

b. A narrative report including, but not limited to, the following:

(1) site conditions, ground water elevation, and cleanup criteria;

(2) excavation logs;

(3) field screening readings;

(4) quantity of materials removed from each area of contamination;

(5) quantity of water/product removed during dewatering;

(6) sampling locations and sampling methods;

(7) sample collection data such as time of collection and method of preservation;

(8) sample chain-of-custody forms; and

(9) source of backfill.

c. Copies of all chemical and physical test results.

d. Copies of all manifests and land disposal restriction notifications.

e. Copies of all certifications of final disposal signed by the responsible disposal facility official.

f. Waste profile sheets.

g. Scale drawings showing limits of each excavation, limits of contamination, known underground utilities within 15 m 50 feet of excavation, sample locations, and sample identification numbers. On-site stockpile, storage, treatment, loading, and disposal areas shall also be shown on the drawings.

h. Progress Photographs. Color photographs shall be used to document progress of the work. A minimum of four views of the site showing the location of the area of contamination, entrance/exit road, and any other notable site conditions shall be taken before work begins. After work has been started, activities at each work location shall be photographically recorded [daily] [weekly]. Photographs shall be a minimum of 76.2 x 127.0 mm 3 x 5 inches and shall include:

(1) Soil removal and sampling.

(2) Dewatering operations.

(3) Unanticipated events such as spills and the discovery of additional contaminated material.

(4) Contaminated material/water storage, handling, treatment, and transport.

(5) Site or task-specific employee respiratory and personal protection.

(6) Fill placement and grading.

(7) Post-construction photographs. After completion of work at each site, the Contractor shall take a minimum of four views of each excavation site.

A digital version of all photos shown in the report shall be included with the Closure Report. Photographs shall be a minimum of 76mm by 127 mm 3 inches by 5 inches and shall be mounted back-to-back in double face plastic sleeves punched to fit standard three ring binders. Each print shall have an information box attached. The box shall be typewritten and arranged as follows:

Project Name:
Location:
Photograph No.:

Direction of View:
Date/Time:
Description of View:

-- End of Section --

APPENDIX E

SITELAB® UVF-3100 OPERATING MANUAL, 2006

siteLAB®
Environmental Testing Solutions
Test Soil & Water On-site for Petroleum Hydrocarbons

UVF•3100 Operating Manual

for all Sitelab Petroleum Hydrocarbon Applications

Technical Support Ce
or Dial (USA) 978 363 2299
Corporation Right Reserved
Standard Operating Procedure Version 6.0

User's Manual

All test procedures require these three very important components (right).

The standard operating procedures and instructions listed in this manual are grouped into sections. If you are looking for a specific topic, go to the categories located at the bottom of each page.

Use Sitelab's Quick Reference Guide when needed. Additional instructions are also provided with each Sitelab Calibration Kit.

Need to order more supplies? Need assistance or help getting started?

For sales or technical support:
Call USA: (978) 363-2299
Email: support@site-lab.com

1 Equipment Required

Model UVF-3100A:
For GRO, VPH, EPH/PAHs, DRO and other TPH Applications.

Model UVF-3100D:
For all 3100A applications plus Target PAH analysis.

Portable analyzer includes field case with all tools needed to perform tests. Warranty, tech support, CD-ROM with software and manual also included.

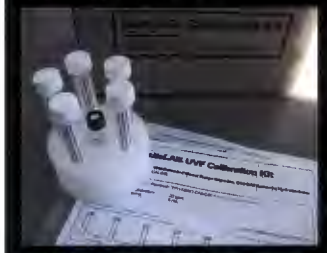
2 Use Extraction Kits

Product No. EXTR010-20
40 Test Tubes
20 Sitelab® Filters
20 Extraction Jars
20 Syringes + 20 Pipette Tips

Easy to use, disposable kits contain everything you need to prepare samples for analysis, quickly, accurately and quality controlled. Each kit contains enough supplies to test up to twenty soil, sediment or water samples. Solvent not included.

3 Select a Sitelab Calibration Kit

Certified, linear standards used for Sitelab's UVF-3100 analyzer. These products are specially designed to correlate to U.S. EPA GC Methods. All Calibration Kits are reusable for 3 months from date of purchase.



Each kit includes five linear calibrators, plus a Reference Standard, product certificate with instructions and MSDS.

Custom made, certified kits are also available using oil form you site. Call for details

WARNING! These products contain flammable alcohols. Dispose solvent waste properly.

Popular calibration kits available, which best correlate/match certified laboratory methods:

- Product No. CAL-025: GRO or VPH C6-C10 Gasoline Range Hydrocarbons (BTEX). Compares to EPA Method 8015-GRO
- Product No. CAL-042: TPH-EDRO C10-C40 Extended Diesel Range Hydrocarbons. Compares to EPA Method 8015-DRO
- Product No. CAL-060: Target PAHs for Polyaromatic Hydrocarbon Applications. Compares to EPA Method 8270 GC/MS PAHs
- Product No CAL-010: EPH C11-C22 Aromatic Hydrocarbon Fraction (Total PAHs). Compares to State TPH GC Methods for EPH
- Product No. CAL-057: TPH-Oil for Lubricating Oils, Motor/Waste Oil or Crude Oil Applications. Compares well to TPH Methods 418.1 or 1664

How Ultraviolet Fluorescence Technology Works...

Sitelab's portable Ultraviolet Fluorescence (UVF) technology is a very selective detection method. Aromatic hydrocarbons, which includes benzene, benzo[a]pyrene and other carcinogenic compounds found in petroleum, both excite and emit energy at specific wavelengths. Soil, sediment and water samples are first extracted in solvent using disposable test kits and the fluorescence response of each sample is then quantitated by the UVF-3100 analyzer on a linear, 5-point calibration curve using certified standards sensitive to the wavelengths of interest.

The analyzer contains a UV Lamp which first energizes petroleum hydrocarbons.

After solvent extraction, a sample is poured into a glass cuvette and placed into the analyzer for analysis.

The UVF-3100 is fitted with movable optical Excitation & Emission filters used to detect gasoline range, diesel range and polyaromatic range compounds separately from one another.

Accuracy & Lab Correlation...

- For maximum performance, select and use Sitelab Calibration Kits which are similar to the certified laboratory methods you are using for confirmatory analysis (see examples above).
- If you do not know which laboratory method is going to be used for comparison, or no confirmatory lab analysis is planned for your application, use a Sitelab Calibration Kit that best matches the type or source of the petroleum contamination found on your site. If the type of contamination is unknown or may involve different types of petroleum contaminants, ask Sitelab which calibration products are the most suitable.
- Use response factors to adjust and improve correlation to account for any technology differences (UVF vs. GC), sample homogeneity or other issues where the field screening results do not directly correlate. If the results are proportionately higher or lower, when compared to the lab, apply an 'average' response factor to the UVF concentrations. A new or different calibration kit may also be required.

Laboratory Setup Instructions

for Sitelab UVF•3100 Petroleum Hydrocarbon Applications

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Setup your Work Space...

Setup Work Space

- Before you begin, clear enough table space to set up your Sitelab equipment. Work space should be in a clean, dust-free area having a temperature range from 35 to 100 degrees (F).
- Connect power cords to analyzer and plug into an electric outlet. Use the DC inverter if operating from a car or truck.
- Have your Sitelab 20 Sample Extraction Kits and Calibration Kits nearby (needed to begin).

Solvent Dispenser Bottle

- Fill the dispenser bottle with methanol solvent (HPLC grade).
- Place a small cup below the nozzle to capture drips. Use this cup to collect waste solvent when cleaning/rinsing the glass cuvette during operations.

Methanol Solvent Required!

Always use "HPLC Grade" or high laboratory grade methanol only.

WARNING! Flammable alcohols. Dispose solvent waste properly.

Glass Cuvette Preparation

- Using the solvent dispenser bottle, rinse the glass cuvette with methanol several times between uses to avoid cross contamination. Pour/empty rinse solvent into the waste cup.
- When finished rinsing place cuvette upside down onto clean tissue wipes to drain.
- Handle the cuvette with care. A second cuvette is provided for back up – in case the original is scratched or damaged.

Turn On UVF-3100 Analyzer

- Turn on using the on/off switch located in the back. A 600 second warm-up countdown is displayed. Let the instrument finish it's warm up cycle at the beginning of each day or event.
- If analyzer is already warmed up, press the "H/HOME" key at any time to bypass the warm up sequence and go to the HOME screen. The HOME screen is the main screen used for testing samples or starting a calibration.

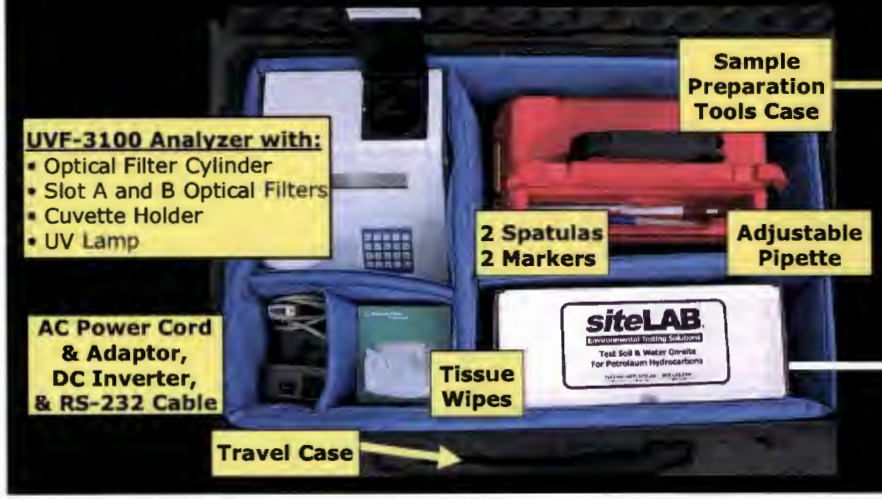
Check Lamp for UV Light

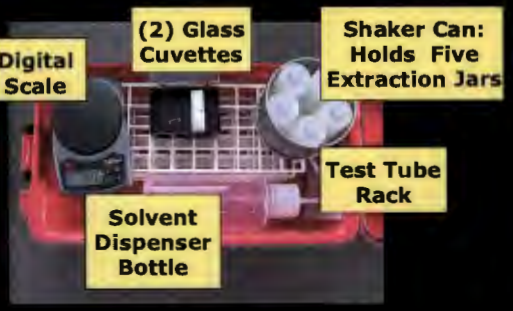
- Slide/pull out the optical filter cylinder and look down into chamber. When on, the UV lamp's blue light should be visible (fan should also be on)

Inspect/Change UV Lamp

- Open rear panel and check mercury vapor lamp. Be sure lamp is secure in socket and not damaged after shipping.
- Do not unplug fan. If you do, be sure to plug it back in!

UVF-3100 Test Equipment Check List...





Storage space to hold one:

20 Sample Extraction Kit

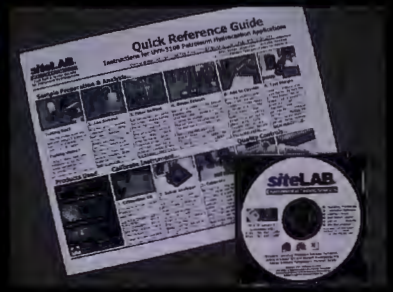
Product No. EXTR010-20

40 Test Tubes (for extracts & dilutions)

20 Sitelab® Filters

20 Extraction Jars

20 Syringes + 20 Pipette Tips



Quick Reference Guide & CD-ROM, including:

- Instruction Manual with Standard Operating Procedures
- Software Programs
- Warranty Information

Sample Testing Instructions

for Sitelab UVF•3100 Petroleum Hydrocarbon Applications

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Sample Extraction & Dilution Procedures...

Testing Soil?

- Turn on scale. Place extraction jar on top of scale. Tare weight to zero.
- Measure 5 grams of soil (recommended) into jar using the metal spatulas. Weight should be within 0.1 gram (+/-).

10 grams may also be used, but clays or loamy soils may absorb too much solvent (added in the next step), making it difficult to filter.

Testing Water?

- Using a plastic test tube, measure out 10 mL of water and pour into extraction jar.
- Hydrocarbons in your water sample may be floating on the surface. Before measuring out your sample, shake the sample first to ensure water is homogenized.

2. Add Solvent

- Fill the solvent dispenser bottle with methanol and squeeze out 10 mL of solvent into a test tube and add to extraction jar containing the soil or water sample. Cap and tighten jars when finished.
- Important! Use a marker to label jar with the sample ID and "2X" dilution.

3. Shake Extract

- Shake soil extract jars for several minutes, allowing ample time for the solvent to dissolve the contaminant. Use a timer or wrist watch, if necessary. Let extracts settle for several minutes afterward. This avoids clogs in the next step.
- Shake water extract jars for ten to twenty seconds.

4. Syringe & Filter Extract

- Remove lid and suck up 2 to 4 mL of extract from the jar's surface using a syringe.
- If syringe becomes clogged, let jar sit a few moments longer to let mud and debris settle to bottom, leaving a clear extract layer on top.
- Attach/screw a Sitelab Filter to the syringe and dispense contents back into test tube.

5. Label Extracts

- Label test tube with the sample ID and the dilution created. Examples:
- "2X" if 5 g soil extracted with 10 mL solvent.
- "1X" if 10 g soil extracted with 10 mL solvent.
- "2X" if 10 mL of a water sample was extracted with 10 mL solvent (50/50).

6. Dilute Extract ...Why?

In order for the sample to be detected within the analyzer's calibration range, a dilution must be prepared using the extract for analysis.

- We recommend you start with a 100X or 1,000X first, depending on how contaminated the sample is.
- Avoid testing Extracts! Only test Extracts if the sample has no odor OR no yellowish color.

Pipette...		Dilute To...	
Setting	Volume	5 mL	10 mL
"020"	20 uL	500X	1,000X
"100"	100 uL	100X	200X
"250" x2	500 uL	20X	40X

Note: Dilutions here include 2X from Extract

7. Prepare Dilution

Attach a tip to pipette by pressing down on the dial to extend the teeth and fit/snap in place. Be sure the tip functions properly.

- Adjust the setting on the pipette and transfer extract to a second test tube.
- Dilute with solvent to 5 mL or 10 mL line.

8. Put Dilution in Cuvette

- Fill the glass cuvette about ¾ full with sample dilution. You need enough liquid in the cuvette to clear the two windows on the bottom of the cuvette holder (~3 mL).
- Hold the top of the cuvette with one hand. With the other hand, clean the cuvette with a tissue wipe to remove any excess liquids or fingerprints.

9. Use the Cuvette Holder

- Open the lid on top of the analyzer. Pull out the black cuvette holder from the optical filter cylinder.
- Carefully place glass cuvette into the holder, held in tight by the leaf springs. Be sure to avoid spills.
- The cuvette's position in the holder does not matter – all four sides are identical.

10. Lower into Analyzer

- Lower the cuvette holder back into the analyzer's optical filter cylinder until snug between the grooves
- Important! Be sure the arrow shaped handle of the cuvette holder always points to the silver dot (to the left of the lid).

Continue to Next Step

Sample Testing Instructions

for Sitelab UVF•3100 Petroleum Hydrocarbon Applications

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Analyze Sample & Record Results...

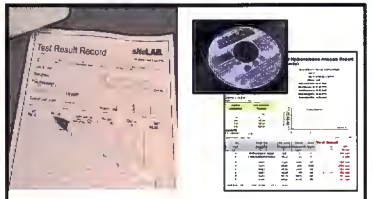
11. Wait for Reading

- Close the lid. Always read samples from the HOME screen.
- The analyzer will then display the sample's concentration.
- Allow a few seconds for the reading to stabilize.
- Concentration units are shown as "ppm" (default mode)

In soil or sediment: ppm as mg/Kg
In water: ppm as mg/mL

12. Calculate Final Result

- Multiply the reading on the display by the sample dilution being tested.
- If you are testing a 100X dilution, for example, and the sample reads "0.542 ppm," multiply the value by 100. The final result is 54.2 ppm.



13. Record Test Results

- Manually record test results using the Test Result Record included with each Sitelab Extraction Kit.
- If connected to a computer, from the HOME screen, press "D" on keypad to send data. See 'Software' section for details.
- To view the sample's raw fluorescence value, press "8" and then return to the HOME screen.

14. "OVER" Readings

- If the sample you're testing reads "OVER," the sample is above the calibration range and a larger dilution is necessary.
- Empty out the test tube and prepare a higher dilution using the Extract and re-analyze.
- If testing a 1,000X dilution, which reads "OVER," pour out all but 1 mL and re-dilute tube to the 10 mL line for a 10,000X.

15. Non-Detect Readings

- Readings between zero and the lowest calibrator should not be reported. Prepare a smaller dilution and re-analyze.
- Or report sample as "ND" by multiplying the dilution tested by the concentration of the lowest calibrator. For example, a 100X sample reads below the 0.1 ppm TPH EDRO calibrator; 100X x 0.1 = ND <10 ppm.

Helpful Pointers Testing Dilutions...

Pipetting Dilutions:

- Sitelab's Gilson® adjustable pipette has an accurate range from 20 to 250 uL (microliters), using special capillary/piston disposable tips, allowing high precision volumetric dilutions.
- After installing, be sure each tip functions properly.
- Always replace a new tip between samples. To remove, push down on the dial firmly until the tip falls off.
- Avoid air bubbles in tip when making dilutions.
- Wipe outside tip with tissue to remove excess liquid, if necessary.

Reading Samples:

- Ideally, report samples which have readings between the lowest to highest calibration standards; in the middle of the calibration curve.
- Remember! if reading is between the lowest calibrator and zero, report as ND or prepare a smaller dilution and re-analyze or test the Extract if no quenching is suspected.
- When preparing dilutions, try to be as accurate as possible when adding solvent to the test tube's 5 mL line or 10 mL line. The meniscus should be as close as possible to the tube's graduations.

Example testing three samples:

Calibrated to Total PAHs:
Linear Range = 0 to 2 ppm
Highest Calibrator = 1.5 ppm
Lowest Calibrator = 0.05 ppm (detection limit)

Dilution:	Reading:	Comments:
1: 100X	"0.550"	OK, report as 55 ppm
2: 100X	"OVER"	Perform a bigger dilution
2: 1,000X	"1.250"	OK, report as 1,250 ppm
3: 100X	"0.020"	Report as ND = <5 ppm (100X x 0.05 = 5) or perform a smaller dilution
3: 10X	"0.210"	OK to report as 2.1 ppm

Quality Controls to Perform...

Sample Quenching?

- Highly concentrated samples and/or samples having a yellowish color when extracted may sometimes "quench" or swamp the detector. Instead of producing an "OVER" reading, the UVF-3100 may display a negative or false-low reading instead.
- Non-experienced operators may not be aware a sample dilution is required. This is why we strongly recommend you prepare and test a dilution first, even if you think the sample is clean. Avoid testing Extracts!
- Quenching is more common when testing GRO, VPH or BTEX.

Check for Quenching:

- Check for quenching by running two dilutions on the same sample. If results are not within 20% from one another, quenching may be occurring.
- At a minimum, always start by testing a sample at a 100X dilution first, or higher, if necessary.
- Empty out first dilution and use the Extract to prepare a higher dilution. Or, simply add more solvent to your current dilution going from the tube's 5 mL line to 10 mL line, which doubles the dilution factor (100X becomes a 200X).

siteLAB®
Environmental Testing Solutions
Test Soil & Water On-site for Petroleum Hydrocarbons

Calibration Instructions

for Sitelab UVF•3100 Petroleum Hydrocarbon Applications

Setup Analyzer...

Choose a Calibration Kit

Select a Sitelab Calibration Kit for your application. Popular tests include GRO, EDRO, PAHs and TPH. Custom-made kits are also available using oil from your site. Ask Sitelab for details.

When to Calibrate?

Recalibrate whenever a different analysis is being performed or if the instrument suffers from drift.

Optical Filter Alignment

Pull out and rotate the optical filter cylinder so that the correct filter slots A,B,C or D are aligned next to the silver dot located to the left of the lid. See your Calibration Kit Certificate for details or use the following:

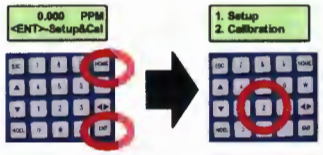
Slot A: EDRO, EPH/PAH, TPH-Oil
Slot B: VPH, GRO (BTEX)
Slot C: Other applications/PCBs
Slot D: Target PAHs

Start a New Calibration...

1. Begin from HOME Screen

Turn on analyzer. Let warm up if necessary. Confirm the lamp is on by sliding the optical filter cylinder out and looking down inside chamber (blue light should be visible). Return/align cylinder back to proper slot (A, B, C or D)

• Start a new calibration from the HOME screen. Press "ENT" from the HOME screen and Press "2" for Calibration.



2. Enter the Max Range

The Max Range setting appears. This sets the upper limit of the calibration curve. Enter the value listed with your Calibration Kit or use the following:

Max Range Values to Use:

Enter "12" for GRO, VPH, BTEX
Enter "20" for TPH-Oil
Enter "6" for TPH-EDRO
Enter "2" for EPH and PAHs

2. Max Range - Continued

• Press "1" if Max Range is OK or "9" to change it.

• When pressing 9, type in the new Max Range concentration and then press "ENT."

• Press "1" to accept the new Max Range you entered and go to next step.

Make a mistake? Press the "ESC" key at any time during the calibration process to abort and return to the HOME screen.

3. Enter Number of Stds

• The UVF-3100 will display the number of standards you want to use to create the calibration curve. For best performance, ALWAYS use all 5 calibrators included with your Sitelab kits.

• Enter "5" then press "ENT".

Note: If you choose to perform a quick, 1-point calibration, be sure to use the highest calibration standard.

4. Start with Highest Std

• You must analyze the highest concentrated standard first, each time you start a new calibration.

• The UVF-3100 displays the "Hi Std Conc." from the previous or current calibration.

• Press "1" if value is OK (if you are re-calibrating to the same analysis). Otherwise, press "9" to change it.

5. Changing the Hi Std?

• After pressing "9", enter the new Hi Std concentration (printed on the Calibrator) and then press "ENT."

• Press "1" to OK and accept the new concentration value you just entered. Examples:

VPH or GRO use:	10 ppm
TPH-Oil use:	15 ppm
TPH-EDRO use:	5 ppm
EPH or PAHs use:	1.5 ppm

6. Pour Hi Std into Cuvette

• Open the lid and pull out the cuvette holder.

• Remove the cap on the Hi Std calibrator and pour into the cuvette about ¾ full.

• Carefully place cuvette into the cuvette holder. Be sure to avoid spills. Use tissue wipes to clean the outside glass from any liquids/fingerprints, if necessary.

7. Insert Hi Std, Press <*>

• Lower the cuvette holder back into the optical filter cylinder until snug.

• Be sure the handle's arrow shaped handle is aiming at the silver dot located to the left of the lid.

• Next, close the lid and press the asterisk key <*>.

Continue to Step 8 ➡

Calibration Instructions

for Sitelab UVF•3100 Petroleum Hydrocarbon Applications

Online @ site-lab.com For Technical Support Call:
Toll Free 877 SITELAB or Dial (USA) 978-363 2299

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UVF-3100 Standard Operating Procedures Version 6.0

8. Sensitivity Set Value?

After you press the <*> key, do not open the lid. The analyzer adjusts it's sensitivity based on the concentration of the high standard. Once the sens factor is "set," the analyzer measures the Hi Std for several seconds. When finished, it will prompt you to enter the next standard.

Refer to the Calibration Kit Certificate or see Step 15 below for Sensitivity Set values to expect during calibration.

9. Remove the Hi Std

- Open the lid, pull out the cuvette holder and carefully remove cuvette. Pour the Hi Std back into it's test tube. Do not discard (calibrators are reusable)
- Rinse the cuvette several times with solvent so that the next calibrator you use, which will be lower in concentration, will not get cross-contaminated.

10. Calibrators 2 thru 5?

- After completing the Hi Std, analyzing standards 2, 3, 4 and 5 can be done in any random order you choose.
- To save time, use your lowest calibrator as the #2 Std and then go up. This avoids having to rinse the cuvette each time, as the calibrators increase in concentration and thus will not cross-contaminate each other.

11. Analyze #2 Std

- Fill the cuvette ¾ full with the lowest calibration standard and place into UVF-3100 as before.
- Press "9" to change the value. Type in the new value printed on the tube, press "ENT" and then "1" to OK.
- If you forget to change the value, an error may occur and you will need to start all over.

12. Second Std - Continued

- Insert the #2 Std into the analyzer, close the lid and press the <*> key as before.
- When the analyzer is finished and calls for the #3 Std, it is now safe to open the lid. Remove the 2nd calibrator and pour back into it's test tube.
- Invert cuvette onto tissues to drain any excess liquid.

13. Remaining Calibrators

- Analyze the 3rd, 4th and 5th calibrators the same way as the #2 Std.
- Be sure to change and enter the correct concentration for the calibrator each time.
- After testing #5 Std, the analyzer will prompt you to insert a Blank, where clean methanol solvent is used to 'zero' the instrument.

14. Analyze the Blank

- Rinse the cuvette with solvent and invert onto tissue wipes to drain any excess liquid left over from the #5 calibrator.
- Fill cuvette ¾ full with a clean dose of solvent and place into analyzer as before.
- Press "ENT" then the "0" key after value stabilizes. During GRO or VPH calibrations, the methanol will yield a positive value – do not be alarmed.

15. Calibration Complete!

When finished, the HOME screen appears and is now ready for sample analysis. The curve is electronically stored in memory. If connected to a computer, press "ENT" then "D" to send calibration data to Test Report.

Diagnostic Check

Press the "8" key to view the calibration sensitivity value.

Optimum Sensitivity Ranges for UVF-3100
Sens% for GRO, VPH, BTEX: 30-40
Sens% for PAHs, EPH, EDRO, TPH: 15-20

Quality Controls to Perform...

Calibration Checks:

- Recalibrating the analyzer each time you use it is not necessary as long as you are performing the same analysis.
- Periodically check the curve by analyzing one or two Calibrators as if they were samples to see how linear the curve is and whether or not the analyzer has suffered from drift.
- To test, fill the cuvette ¾ full with a Calibrator, place into the analyzer and wait for reading to stabilize. Do not press "ENT" for Setup/Cal.
- Calibration checks should read within 10 to 20% from their true concentration. If not, a new calibration may be required.

Methanol Blank Checks:

- Periodically analyze your methanol solvent. This is especially important before you begin extracting and testing samples. Blanks ensure the solvent used during operations is clean without interferences.
- When ever you purchase or use a new bottle of methanol, always test it first.
- To test, fill cuvette with a clean dose of solvent and place into the analyzer for analysis. Do not press the zero key.
- Readings should be at or close to zero ppm (+ or -). If not, then recalibrating the analyzer may be necessary.

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Software Installation Instructions

for Sitelab UVF•3100 Petroleum Hydrocarbon Applications

Software Features...

- Recording test results is fast, easy and improves quality control.
- Download and view the analyzer's linear 5-point calibration curve.
- Sample readings and dilutions are automatically calculated and recorded.

System Requirements...

- UVF-3100 Analyzer
- Sitelab Software CD
- RS-232 Serial Cable (standard)
- USB to Serial Adapter (optional/sold separately)
- Microsoft Windows® Operating Systems: XP, 2000, 98 or 95.
- Microsoft Excel
- Serial or USB Port

1. Install Software Programs

- Insert the Sitelab CD-ROM into your computer's compact disk drive. Wait a few moments for the auto start feature to activate your Internet Explorer browser.
- Scroll down and click "Software Installation Program," to begin the installation wizard.

- Next, choose "Run this program from its current location," and then click "Yes" in the Security Warning screen.
- Be sure to choose the Desktop Shortcut icon for easy access.
- After the installation is finished, your desktop reappears. Remove the CD from computer.

A Sitelab folder was created in your Program Files, which contains important programs to be used; a list of UVF-Guide Excel files and one Sitelab.EXE file which serves as the Interface Driver. If, during use, an error occurs or no data is received, check the Sitelab folder for these files.

2. Connect to Analyzer

Standard Cable Connection to Serial Port:

- Use the RS-232 cable supplied with your UVF-3100 and connect it to the male outlet of your computer's serial port.
- Connect the other end of the cable to the female outlet on the back of the UVF-3100.

No Serial Port?

Use Sitelab's USB to Serial Adapter:

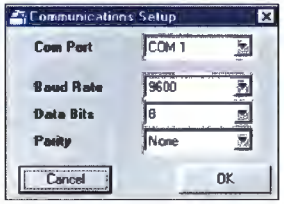
- Compatible with new computers that only have Universal Serial Bus (USB) ports.
- Sold Separately, Product No. 3100USB
- Includes Sitelab CD, USB cable, USB driver CD and installation instructions.

3. Check/Modify the Communication Settings...

About the Sitelab Interface Driver...

The Interface Driver is a program which receives all the raw data coming from the instrument. Computers with different operating systems are configured differently from one another. As such, after installing the Sitelab software, check the Communication Settings on your computer to make sure the data will be received correctly:

- Open the Interface Driver by clicking on the icon. Go to "Com Setup" found in the Interface Driver's Options Menu and click "Communications Setup."
- Parity must be set to None, Baud Rate set to 9600 and Data Bits set to 8. Adjust these settings if necessary.
- Up to 9 Com Port options are listed. Switch/change the Com Port, if necessary, to accommodate the serial cable or USB connected to your computer.



- The Driver's white window box will display the raw data received from the UVF-3100.
- Click here to keep the Interface Driver open, but out of view (minimize).
- Be sure to close the Interface Driver prior to opening a new UVF Guide.

Run Time Errors?

- If you experience a Run Time Error when sending data from the analyzer, the Interface Driver is on, but the UVF-Guide test report program you are using was either closed or you are trying to send the data to an Excel file that has a different name.
- If a Run Time Error occurs, close out the Interface Driver and any Excel files. Start over by clicking onto the Sitelab icon on your desktop.

Software Test Report Programs

for Sitelab UVF•3100 Petroleum Hydrocarbon Applications

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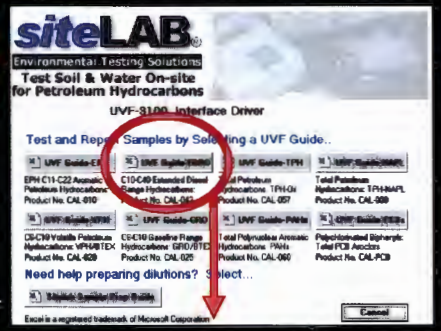
Open the Interface Driver and choose a UVF Guide to record your test results..

Sitelab UVF-3100

When you open the Interface Driver, a menu screen first appears (right).

The different UVF Guides contain spreadsheets where calibration and sample results are received and recorded.



Select the UVF Guide which matches the test you are performing

- Sitelab's UVF Guides are formatted in Microsoft Excel®, which automatically starts up after you make your selection. The "Test Report" worksheet will open by default.

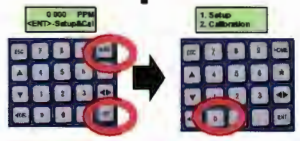
- The UVF Guides are "Read Only" files, which serve as templates. When it comes time to save your Test Report, you will be asked to save the UVF Guide under a new file name.
- Once you save the UVF Guide under a new name, you can no longer send data to that file as the Interface Driver only delivers data to the Read Only files.
- To begin sending data again, you must close out the Interface Driver and Excel and start over.

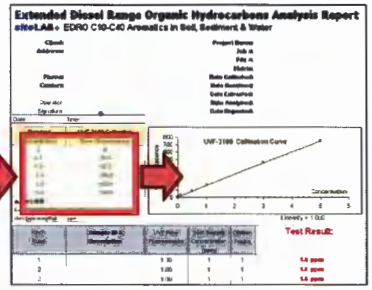
Send Calibration Curve to Test Report...

- Sending a new or current calibration curve from the UVF-3100 to the Test Report can be performed at any time as long as the software is running and the cable is connected.
- Starting from the HOME screen, press "ENT" so that the "1.Setup 2.Calibration" screen is displayed and then press the "D" key.

Your computer will then indicate "New Standards Received." Click OK if you want to replace the example calibration curve in the Test Report with the actual calibration data from the instrument.

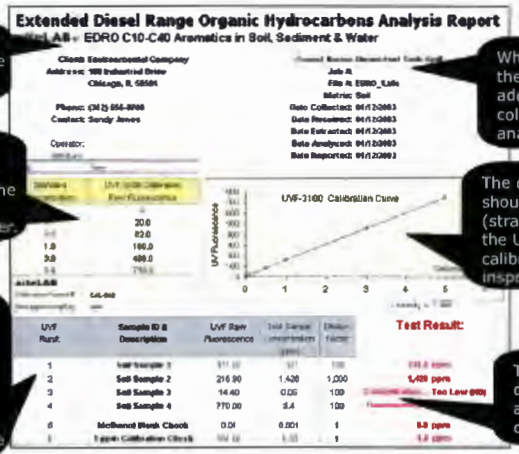
- Press the "H/HOME" key to return to the HOME screen. Do not press "2" unless you want to re-calibrate. Once you click OK, the instrument's concentration and fluorescence response values for all 5 Calibrators and the Blank will be placed into the Test Report and a linear curve will be generated for visual observations.





Note: Refer to the Manual's Software Section, available on the Sitelab CD-ROM, for instructions in using the "Multi-Calibration Guide" feature.

Saving & Editing your Test Report...



Be sure the analysis you performed matches the title and calibration kit applied.

When finished, enter the project name, address, sample collection date, analysis date, etc.

Replace the example calibration curve, which opens by default, with the actual calibration data directly from the analyzer.

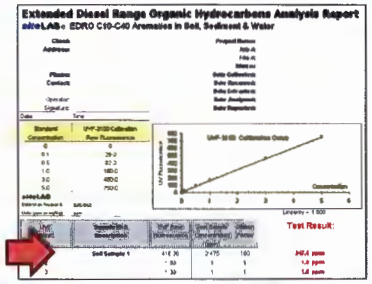
The calibration curve should have a linear slope (straight line). Confirm the UVF-3100 is properly calibrated by visually inspecting the curve.

Each report can record up to 20 sample results, including any calibration checks or other quality control tests performed. If all 20 rows are used up, save the UVF Guide and open a new one to continue.

The Test Report will display if a sample is above or below the calibration range.

Send Sample Data to Test Report...

- Send sample results from the UVF-3100 to the computer by pressing the "D" key from the HOME screen at any time. Be sure the sample is inside the instrument with the lid closed before doing so.
- Your computer will then indicate "New Sample Received" and ask you to enter the sample ID and dilution factor – Important!
- Once you name the sample and type in the appropriate dilution being tested, press enter. The sample's data is placed into the Test Report and the final result is calculated (on the right hand side in **red**). Then, continue to the next sample. If you make a mistake, click onto the worksheet and manually enter the information.



Software Test Report Programs

for Sitelab UVF•3100 Petroleum Hydrocarbon Applications

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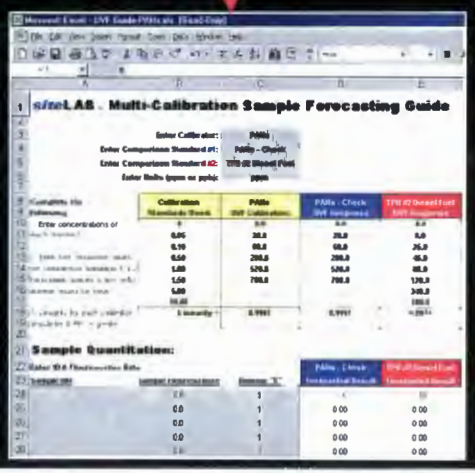
Using the Multi-Calibration Sample Forecasting Guide?

This time saving feature allows you to report test results simultaneously to two different calibration curves, without having to re-calibrate the instrument, even though the UVF-3100 generates results to only one curve at a time. Since both sets of calibration standards are linear to one another, the computer will generate the exact same result as if you re-calibrated the instrument and then re-analyzed the sample to the other calibration curve. Note: the same optics must be used when using this application: Slot A or B, but not both! This excludes a GRO and DRO combination.

Typical applications include: testing TPH and EDRO together, weathered diesel and fresh diesel together and total PAHs and fuel oils together (as illustrated here). This is also helpful if a petroleum site has mixed types of contamination and you are unsure as to which Calibration Kit should be used to report results, especially if confirmatory lab analysis is performed. The "Forecast Guide" worksheet can be found at the bottom of your screen in each UVF Guide program.

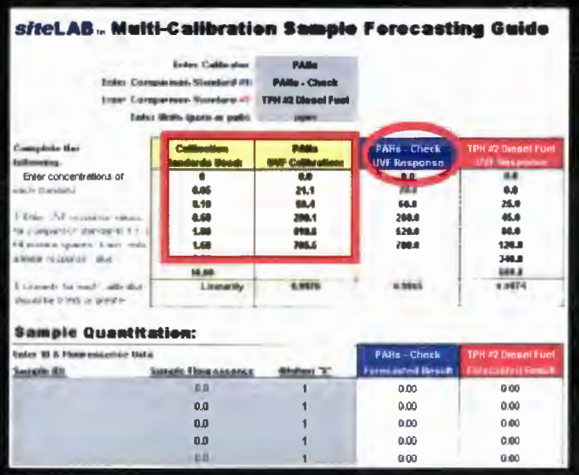
Test Report / Forecast Guide / Data Archive



STEP 1: Send Calibration to Forecast Guide

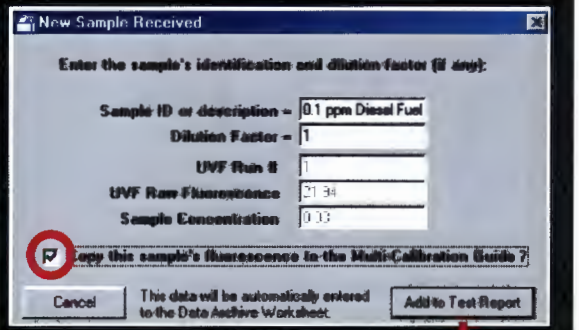
Before you begin analyzing samples, replace the example calibration curve (in yellow blocks) in the UVF Forecast Guide, by checking the box (circled in red below) each time you send a calibration curve from the instrument to the computer as before. Then press OK.

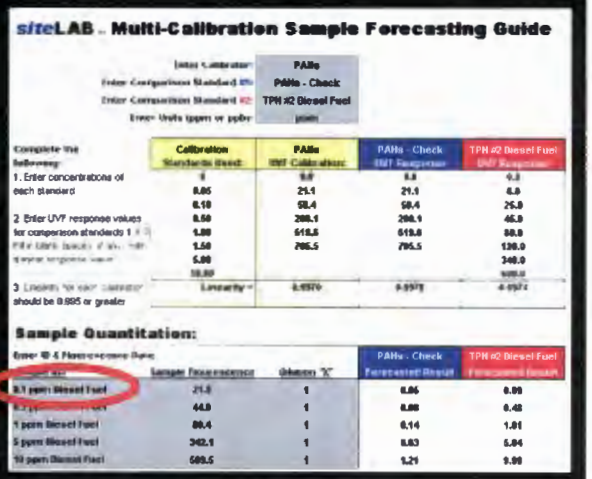
In this example, the blue column is used for Quality Control so that both the computer and UVF-3100 display the same reading. Manually type in the same UVF response values from the UVF's calibration (in yellow).



STEP 2: Analyze 2nd Calibrators for Forecast Guide

Using a different Sitelab Calibration Kit, analyze each of the five Calibrators one at a time as if they were samples. Download the results into the Forecast Guide by checking the box (circled in red below).





Software Test Report Programs

for Sitelab UVF•3100 Petroleum Hydrocarbon Applications

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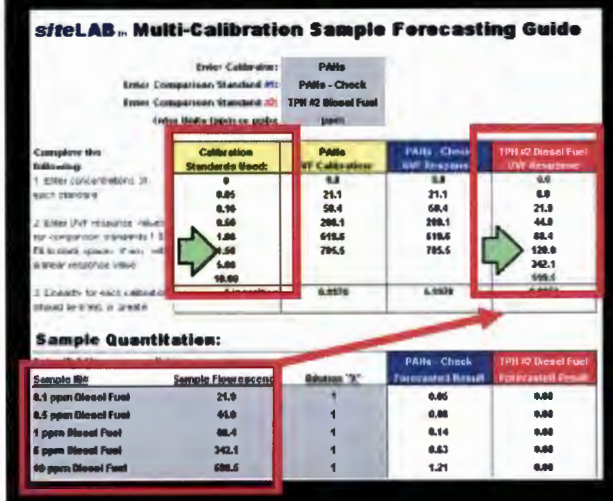
STEP 3: Transfer 2nd Calibration Data to Red Column:

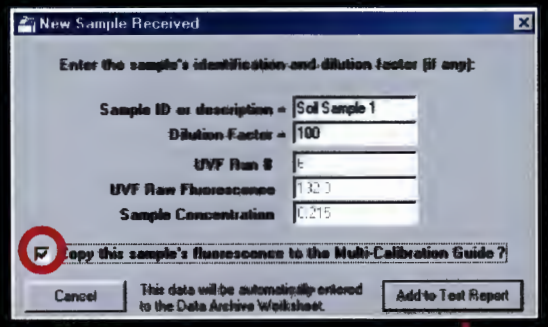
- Manually type the fluorescence response values generated by each of the new Calibrators by replacing the "dummy" UVF responses in the upper right red block.
- Be sure to match these five new fluorescence responses to their respective concentrations displayed in the upper left yellow block.

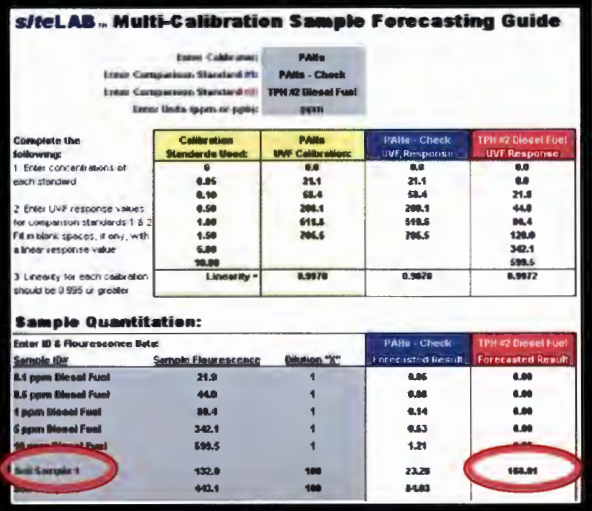
Important! Some of the 2nd set of Calibrators may not be available at the same concentrations as the 1st set. In this case, type in a number which provides the best "linear fit." In this example, the #2 Diesel Fuel Calibration Kit does not contain a 1.5 ppm Calibrator, where as the PAH kit does. Thus, a "120" UVF response value was placed into the space provided by multiplying the Diesel's 1 ppm fluorescence response by 1.5 (green)



STEP 4: Test & Send Sample Data to Multi-Calibration Guide:

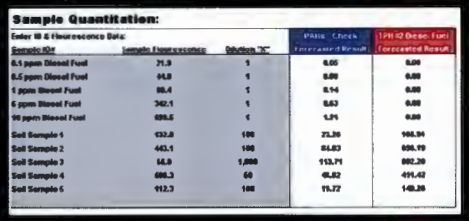
Now that your calibrators are complete, analyze your samples and download the results by checking the box (circled in red) as before. The blue and red columns will display the new concentrations for each curve.

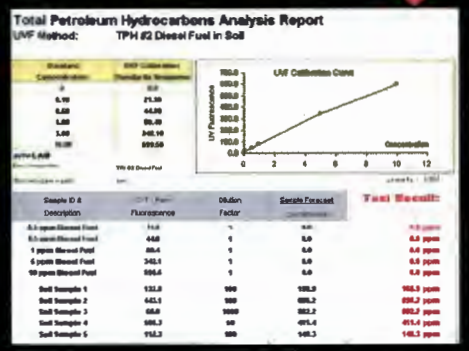




Create a Test Report to the New Calibration Curve:

- Test Reports reflecting the calibration curves you applied and the sample results generated in both the blue and red columns can be found by scrolling down the worksheet.
- Within these Test Reports, be sure to manually type in the concentrations of the calibrators applied, including the fluorescence response values so that the calibration curve can be graphed and visually inspected.
- Since the Sitelab UVF Guides are "Read Only" files, each time you open this program you must manually re-enter the fluorescence response and concentration values in the upper yellow, blue, and red blocks as before. Re-analyzing these new standards each time, however, is not necessary, unless the UVF-3100 itself is re-calibrated to something else.
- To view the UVF-3100's calibration and sample results, click back to the Test Report worksheet at the bottom of your screen.





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Troubleshooting Instructions

for Sitelab UVF•3100 Petroleum Hydrocarbon Applications

Questions and answers to common problems you may be experiencing...

Software Installation:

Problem: My CD doesn't run when I put it into my computer.

Solution: The CD's auto start feature isn't working. Go into My Computer and manually open the "SitelabInstall.EXE" file.

Problem: Files are missing. Only the SitelabInstall file was downloaded. No other files were installed, including the Excel UVF Guide files.

Solution: In the first "File Download" screen, click "Run this program from its current location." Do not choose "Save this program to disk."

Problem: No data is received when using the USB Serial Adapter.

Solution: Open the Interface Driver and go to the Com Setup feature under the options menu. Change the Com Port setting and re-try.
Use the "HyperTerminal" feature on your computer as an alternative method to receive data. See the instructions included with your Sitelab USB Serial Adapter for details.

Computer Connection:

Problem: Cable is connected from UVF-3100 to computer. But when I press "D" nothing happens, no data is sent.

Solution: Interface Driver and UVF Guide Programs must both be open.

Problem: I get a "Run Time Error" when pressing D.

Solution: The Interface Driver program crashed, as the UVF Guide program was either closed or saved under a new name. Close down both programs and start over again.

Problem: When I press "D" to send data, the computer displays very strange or scrambled data.

Solution: Go to Com Setup in the About menu found in your Interface Driver. Set Parity to "None."

Problem: Pressing "D" on the analyzer's keypad isn't sending calibration data.

Solution: From the HOME screen, press "ENT" to go to the "1.Setup 2.Calibration" screen. Now press D. Press "H" to return to the HOME screen.

UVF-3100 Calibration:

Problem: I get a "Bad Cal" error during or after the calibration process.

Solution: Press "ESC" and then "1" to Abort. Start calibration over again. Be sure you type in the correct concentrations for all 5 Calibrators, including the Max Range value. Check if the correct optical filters (Slot A, B, etc.) are aligned properly next to silver dot to the left of the lid.

Problem: I get "Error5: Blk reads > Std#" message when calibrating.

Solution: The solvent you are using for the Blank fluoresces higher than one of the calibration standards. Be sure the methanol you are using is clean and the glass cuvette is thoroughly rinsed after testing the calibrators. If you try and recalibrate the analyzer and the Blank still creates an error, you may need to prepare new calibrators using your solvent and the Reference Standard supplied with your calibration kit. Refer to the product certificate for preparation instructions. By making new calibrators using your solvent, any methanol interferences will be zeroed out the next time you calibrate.

Refer to the Quality Controls listed in the Calibration Instructions page for additional information.

UVF-3100 Sample Analysis:

Problem: Sample has no reading, or a negative reading, when inside the chamber.

Solution: Check the alignment of the cuvette holder. Be sure the arrow shaped handle points to the silver dot to the left of the lid. The lid must also be closed when reading samples.

Problem: Sample readings drift slowly over time and do not settle.

Solution: Confirm the analyzer is properly calibrated by testing one or two of the calibration standards as if they were samples. If the calibrator concentrations are off and/or the readings drift, recalibrate the analyzer. Before doing so, however, visually inspect the curve by downloading the calibration data to a computer using the software. Be sure you are using the correct optical filters and that the optical filter cylinder is aligned properly. In addition, confirm the UV lamp is on by sliding out the optical filter cylinder. A blue light should be visible from down inside the chamber.

Refer to the Quality Controls listed in the Sample Testing Instructions page for additional information.

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Quick Reference Guide

for Sitelab UVF•3100 Petroleum Hydrocarbon Applications

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Sample Preparation & Analysis...

Testing Soil?

Using the digital scale and spatulas, weigh 5 grams of soil into an extraction jar (within +/- 0.1 gram)

Testing Water?

Using a plastic test tube, measure out 10 mL of water sample and add to extraction jar.

2. Add Solvent

Add Methanol to solvent dispenser bottle. Using a test tube, dispense solvent to the 10 mL line. Empty into the extraction jar. This creates a 2X Extract Dilution. Shake soil jars by hand for several minutes. Shake water jars for ten to twenty seconds.

3. Filter Extract

Let soil extract jars settle for a few minutes before removing lid. Suck up 2 to 4 mL of extract from the jar's surface using a syringe. Attach/screw a filter to the syringe and dispense contents into test tube. Label extract tube with sample ID and 2X Dilution – keep track!

4. Dilute Extract

Adjust the setting on the Sitelab pipette, attach a tip and use a 2nd test tube to prepare a larger dilution for analysis - in order for the sample to be detected within the analyzer's calibration range.

Recommended Dilutions:
Extract Volume + Solvent = DIL
"100"uL into 5 mL = 100X (start)
"020"uL into 10 mL = 1,000X

5. Add to Cuvette

Pour the dilution made in Step 4 into the glass cuvette. Cuvette needs to be about ¾ full. Use tissue wipes to clean outside glass to remove fingerprints and liquids. Next, carefully slide cuvette into the black cuvette holder. Be sure not to spill sample.

6. Test Sample

Lower into analyzer and close the lid. Be sure the cuvette holder's arrow shaped handle points to silver dot (to left of chamber). Wait a few seconds for concentration to stabilize. Multiply the reading by the dilution tested. Avoid readings below detection limit.

Products Used...

Sitelab test procedures listed here require the following...

UVF-3100 Analyzer & Tools:
Product No. UVF-3100A

- Optic Emission Filters
- Scale & Spatulas
- Adjustable Pipette
- Solvent Dispenser
- Tissues & Markers
- Software & Manual

20 Sample Extraction Kits:
Product No. EXTR010-20

- 40 Test Tubes
- 20 Sitelab® Filters
- 20 Jars
- 20 Syringes
- 20 Pipette Tips

WARNING! Product uses flammable alcohols – Methanol, HPLC grade. Dispose solvent waste properly.

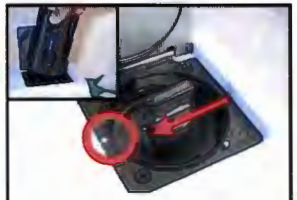
Calibrate Instrument...

1. Calibration Kit

Choose a certified Sitelab Calibration Kit for your application:

Cal Kit & Emission Optics	
GRO/BTEX	Slot B
Total PAHs/EPH	Slot A
TPH-EDRO Range	Slot A
TPH-Oil Range	Slot A
Target PAHs	Slot D

Or ask about custom kits available



2. Setup Analyzer

Turn on. Allow to warm up or press "H" to bypass Rotate filter cylinder so that correct Emission Optics are aligned next to silver dot (to left). Press "ENT" then "2" and enter the proper Maximum Range setting (see cal kit certificate for details).

3. Calibrate

Always start using the highest calibrator first. Pour calibrator into cuvette and lower into analyzer. Be sure to enter and/or change the correct concentration. Pour calibrator back into test tube when finished. Test remaining calibrators

Quality Controls...

4. Clean Cuvette

Rinse with solvent into a waste jar between samples or calibrators. Place upside down onto tissue wipes to drain. Fill with clean methanol and analyze when prompted at end of each calibration. Wait for value to stabilize before pressing zero.

5. Check Curve

Periodically check the calibration curve for drift and linearity by testing one or two standards as if they were samples, including the methanol (as blank). To view curve and report test results, download data using Sitelab UVF3100 software

APPENDIX F

NEW MEXICO ENVIRONMENT DEPARTMENT TPH SCREENING GUIDELINES, OCTOBER 2006

NEW MEXICO ENVIRONMENT DEPARTMENT TPH SCREENING GUIDELINES
October 2006

In some instances, it may be practical to assess areas of soil contamination that are the result of releases of petroleum products such as jet fuel and diesel, using total petroleum hydrocarbon (TPH) analyses. TPH results may be used to delineate the extent of petroleum-related contamination at these sites and ascertain if the residual level of petroleum products in soil represents an unacceptable risk to future users of the site. Petroleum hydrocarbons represent complex mixtures of compounds, some of which are regulated constituents and some compounds that are not regulated. In addition, the amount and types of the constituent compounds in a petroleum hydrocarbon release differ widely depending on what type of product was spilled and how the spill has weathered. This variability makes it difficult to determine the toxicity of weathered petroleum products in soil solely from TPH results; however, these results can be used to approximate risk in some cases, depending upon the nature of the petroleum product, the release scenario, how well the site has been characterized, and anticipated potential future land uses. In some cases, site clean up cannot be based solely on results of TPH sampling. The New Mexico Environment Department (NMED) will make these determinations on a case by case basis. If NMED determines that additional data are necessary, these TPH guidelines must be used in conjunction with the screening guidelines for individual petroleum-related contaminants in Table 3 and other contaminants, as applicable.

The screening levels for each petroleum carbon range from the Massachusetts Department of Environmental Protection (MADEP) Volatile Petroleum Hydrocarbons/Extractable Petroleum Hydrocarbons (VPH/EPH) approach and the percent composition table below were used to generate screening levels corresponding to total TPH. Except for waste oil, the information in the compositional assumptions table was obtained from the Massachusetts Department of Environmental Protection guidance document *Implementation of the MADEP VPH/EPH Approach* (October 31, 2002). TPH toxicity was based only on the weighted sum of the toxicity of the hydrocarbon fractions listed in Table 1.

Table 1. TPH Compositional Assumptions in Soil

Petroleum Product	C11-C22 Aromatics	C9-C18 Aliphatics	C19-C36 Aliphatics
Diesel #2/ new crankcase oil	60%	40%	0%
#3 and #6 Fuel Oil	70%	30%	0%
Kerosene and jet fuel	30%	70%	0%
Mineral oil dielectric fluid	20%	40%	40%
Unknown oil[a]	100%	0%	0%
Waste Oil[b]	0%	0%	100%

[a] Sites with oil from unknown sources must be tested for volatile organic compounds (VOCs), semi-volatile organic compounds (SVOCs), metals, and polychlorinated biphenyls (PCBs) to determine if other potentially toxic constituents are present. The TPH guidelines in Table 2 are not designed to be protective of exposure to these constituents therefore they must be tested for, and compared to, their individual NMED soil screening guidelines.

[b] Compositional assumption for waste oil developed by NMED is based on review of chromatographs of several types of waste oil. Sites with waste oil must be tested for VOCs, SVOCs, metals, and PCBs to determine if other potentially toxic constituents are present. The TPH guidelines in Table 2 are not designed to be protective of exposure to these constituents therefore they must be tested for, and compared to, their individual NMED soil screening guidelines.

A TPH screening guideline was calculated for each of the types of petroleum product based on the assumed composition from Table 1 for petroleum products and the direct soil standards incorporating ceiling concentrations given in the MADEP VPH/EPH Excel spreadsheet for each of the carbon fractions. Groundwater concentrations are based on the weighted sum of the noncarcinogenic toxicity of the petroleum fractions.

Method 1 from the MADEP VPH/EPH document was applied, which represents generic cleanup standards for soil and groundwater. Method 1 applies if contamination exists in only soil and groundwater. The MADEP VPH/EPH further divides groundwater into standards. Standard GW-1 applies when groundwater may be used for drinking water purposes. GW-1 standards are based upon ingestion and use of groundwater as a potable water supply. The TPH screening guidelines for sites with potable groundwater are presented in Table 2a.

Table 2a. TPH Screening Guidelines for Potable Groundwater (GW-1)

TPH			Concentration in Groundwater (mg/L)
Petroleum Product	**Residential Direct Exposure (mg/kg)**	**Industrial Direct Exposure (mg/kg)**	
Diesel #2/crankcase oil	520	1120	1.72
#3 and #6 Fuel Oil	440	890	1.34
Kerosene and jet fuel	760	1810	2.86
Mineral oil dielectric fluid	1440	3040	3.64
Unknown oil [a]	200	200	0.2
Waste Oil [b]	2500	5000	Petroleum-Related Contaminants
Gasoline	Not applicable	Not applicable	Petroleum-Related Contaminants

[a] Sites with oil from unknown sources must be tested for volatile organic compounds (VOCs), semi-volatile organic compounds (SVOCs), metals, and polychlorinated biphenyls (PCBs) to determine if other potentially toxic constituents are present. The TPH guidelines in Table 2 are not designed to be protective of exposure to these constituents therefore they must be tested for, and compared to, their individual NMED soil screening guidelines.

[b] Compositional assumption for waste oil developed by NMED is based on review of chromatographs of several types of waste oil. Sites with waste oil must be tested for VOCs, SVOCs, metals, and PCBs to determine if other potentially toxic constituents are present. The TPH guidelines in Table 2 are not designed to be protective of exposure to these constituents therefore they must be tested for, and compared to, their individual NMED soil screening guidelines.

The second standard is GW-2, which is applicable for sites where the depth to groundwater is less than 15 feet from the ground surface and within 30 feet of an occupied structure. The structure may be either residential or industrial. GW-2 standards are based upon "inhalation exposures that could occur to occupants of the building impacted by volatile compounds, which partition from the groundwater" (MADEP 2001). The GW-2 screening guidelines ONLY apply for the evaluation of inhalation exposures. If potential ingestion or contact with contaminated soil and/or

groundwater could occur, then the screening guidelines provided in Table 2.a should be applied. Table 2.b lists the TPH screening guidelines for the inhalation scenario.

Table 2b. TPH Screening Guidelines – Vapor Migration and Inhalation of Groundwater (GW-2)

TPH			Concentration in Groundwater (mg/L)
Petroleum Product	**Residential Direct Exposure (mg/kg)**	**Industrial Direct Exposure (mg/kg)**	
Diesel #2/crankcase oil	880	2200	30.4
#3 and #6 Fuel Oil	860	2150	35.3
Kerosene and jet fuel	940	2350	15.7
Mineral oil dielectric fluid	1560	3400	10.4
Unknown oil [a]	800	2000	50.0
Waste Oil [b]	2500	5000	Petroleum-Related Contaminants
Gasoline	Not applicable	Not applicable	Petroleum-Related Contaminants

[a] Sites with oil from unknown sources must be tested for volatile organic compounds (VOCs), semi-volatile organic compounds (SVOCs), metals, and polychlorinated biphenyls (PCBs) to determine if other potentially toxic constituents are present. The TPH guidelines in Table 2 are not designed to be protective of exposure to these constituents therefore they must be tested for, and compared to, their individual NMED soil screening guidelines.

[b] Compositional assumption for waste oil developed by NMED is based on review of chromatographs of several types of waste oil. Sites with waste oil must be tested for VOCs, SVOCs, metals, and PCBs to determine if other potentially toxic constituents are present. The TPH guidelines in Table 2 are not designed to be protective of exposure to these constituents therefore they must be tested for, and compared to, their individual NMED soil screening guidelines.

Mineral oil based hydraulic fluids can be evaluated for petroleum fraction toxicity using the screening guidelines from Tables 2a and 2b specified for waste oil, because this type of hydraulic fluid is composed of approximately the same range of carbon fractions as waste oil. However, these hydraulic fluids often contain proprietary additives that may be significantly more toxic than the oil itself; these additives must be considered on a site- and product-specific basis (see ATSDR hydraulic fluids profile reference). **Use of alternate screening guideline values requires prior written approval from the New Mexico Environment Department.** TPH screening guidelines in Tables 2a and 2b must be used in conjunction with the screening levels for petroleum-related contaminants given in Table 3 because the TPH screening levels are NOT designed to be protective of exposure to these individual petroleum-related contaminants. Table 3 petroleum-related contaminants screening levels are based on the *NMED Technical Background Document for Development of Soil Screening Levels, Rev 4.0 (June 2006).*

The list of petroleum-related contaminants does not include polyaromatic hydrocarbons (PAHs) with individual screening levels that would exceed the total TPH screening levels (acenaphthene, anthracene, flouranthene, flourene, and pyrene). In addition, these TPH screening guidelines are based solely on human health, not ecological risk considerations, protection of surface water, or

potential indoor air impacts from soil vapors. Potential soil vapor impacts to structures or utilities are not addressed by these guidelines. Site-specific investigations for potential soil vapor impacts to structures or utilities must be done to assure that screenings are consistently protective of human health, welfare or use of the property. NMED believes that use of these screening guidelines will allow more efficient screenings of petroleum release sites at sites while protecting human health and the environment. Copies of the references cited below are available on the MADEP website at http://www.state.ma.us/dep/bwsc/vph_eph.htm and the NMED website at http://www.nmenv.state.nm.us/HWB/guidance.html.

Revised Table 3. Petroleum-Related Contaminants Screening Guidelines

Petroleum-Related Contaminants	Values for Direct Exposure to Soil		NMED DAF[a] 20 GW Protection (mg/kg in soil)	NMED DAF[b] 1 GW Protection (mg/kg in soil)
	NMED Residential SSL (mg/kg)	NMED Industrial SSL (mg/kg)		
Benzene	1.03E+01	2.58E+01	2.01E-02	1.00E-03
Toluene	2.52E+02	2.52E+02	2.17E+01	1.08E+00
Ethylbenzene	1.28E+02	1.28E+02	2.02E+01	1.01E+00
Xylenes[c]	8.20E+01	8.20E+01	2.06E+00	1.03E-01
Naphthalene	7.95E+01	3.00E+02	3.94E-01	1.97E-02
2-Methyl naphthalene[d]	5.00E+02	1.00E+03	---[e]	---[e]
Benzo(a)anthracene	6.21E+00	2.34E+01	1.09E+01	5.43E-01
Benzo(b)fluoranthene	6.21E+00	2.34E+01	3.35E+01	1.68E+00
Benzo(k)fluoranthene	6.21E+01	2.34E+02	3.35E+02	1.68E+01
Benzo(a)pyrene	6.21E-01	2.34E+00	2.78E+00	1.39E-01
Chrysene	6.15E+02	2.31E+03	3.48E+02	1.74E+01
Dibenz(a,h)anthracene	6.21E-01	2.34E+00	1.04E+01	5.18E-01
Indeno(1,2,3-c,d)pyrene	6.21E+00	2.34E+01	9.46E+01	4.73E+00

[a] DAF - Dilution Attenuation Factor

[b] For contaminated soil in contact with groundwater.

[c] Based upon total xylenes

[d] No NMED value available, value taken from Massachusetts Contingency Plan, 310 CMR 40.0985, 4/3/06.

[e] No NMED value available and leachability-based value for DAF =1 or 20 not established in the Massachusetts Contingency Plan, 310 CMR 40.0985, 4/3/06.

References

Agency for Toxic Substances and Disease Registry (ATSDR). 1997. Toxicological Profile for Hydraulic fluids.

Massachusetts Department of Environmental Protection, Bureau of Waste Site Cleanup and Office of Research and Standards. 1994. "Background Documentation for the Development of the MCP Numerical Standards."

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Contaminated Sites: Implementation of the MADEP VPH/EPH Approach," Policy, October 31, 2002.

Massachusetts Department of Environmental Protection, Bureau of Waste Site Cleanup and Office of Research and Standards. 2003. "Updated Petroleum Hydrocarbon Fraction Toxicity Values for the VPH/EPH/APH Methodology." November 2003.

New Mexico Environment Department, Hazardous Waste Bureau and Groundwater Quality Bureau Voluntary Remediation Program. 2006. "Technical Background Document for Development of Soil Screening Levels." June 2006. Revision 4.0.

APPENDIX G

ASTM D2922 STANDARD TEST METHODS FOR DENSITY OF SOIL AND SOIL-AGGREGATE IN PLACE BY NUCLEAR METHODS (SHALLOW DEPTH)

Standard Test Methods for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth)[1]

This standard is issued under the fixed designation D 2922; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ε) indicates an editorial change since the last revision or reapproval.

These test methods have been approved for use by agencies of the Department of Defense. Consult the DoD Index of Specifications and Standards for the specific year of issue which has been adopted by the Department of Defense.

[ε1] NOTE—Table 1 was corrected editorially in December 1997.

1. Scope

1.1 These test methods cover the determination of the total or wet density of soil and soil-rock mixtures by the attenuation of gamma radiation where the source and detector(s) remain on the surface (Backscatter Method) or the source or detector is placed at a known depth up to 300 mm (12 in.) while the detector(s) or source remains on the surface (Direct Transmission Method).

1.2 The density in mass per unit volume of the material under test is determined by comparing the detected rate of gamma radiation with previously established calibration data.

1.3 The values tested in SI units are to be regarded as the standard. The inch-pound equivalents may be approximate.

It is common practice in the engineering profession to concurrently use pounds to represent both a unit of mass (lbm) and a unit of force (lbf). This implicitly combines two separate systems of units; that is, the absolute system and the gravitational system. It is scientifically undesirable to combine the use of two separate sets of inch-pound units within a single standard. This standard has been written using the gravitational system of units when dealing with the inch-pound system. In this system the pound (lbf) represents a unit of force (weight). However, the use of balances or scales recording pounds of mass (lbm), or the recording of density in lbm/ft^3 should not be regarded as nonconformance with this standard.

1.5 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.* For specific Hazard statements, see Section 6.

2. Referenced Documents

2.1 *ASTM Standards:*

D 698 Test Method for Moisture-Density Relations of Soil and Soil-Aggregate Mixtures Using 5.5-lb (2.49-kg) Rammer and 12-in. (305-mm) Drop[2]

D 1557 Test Method for Moisture-Density Relations of Soil and Soil-Aggregate Mixtures Using 10-lb (4.54-kg) Rammer and 18-in. (457-mm) Drop[2]

D 3216 Test Method for Laboratory Determination of Water (Moisture) Content of Soil, Rock, and Soil-Aggregate Mixtures[3]

D 3017 Test Method for Water Content of Soil and Rock In-Place by Nuclear Methods (Shallow Depth)[2]

D4253 Test Method for Maximum Index Density and Unit Weight of Soils Using a Vibratory Table[2]

D4643 Test Method for Determination of Water Content by the Microwave Oven Method[2]

D 4718 Practice for Correction of Unit Weight and Water Content for Soils Containing Oversize Particles[2]

D4944 Test Method for Field Determination of Water (Moisture) Content of Soil by the Calcium Carbide Gas Pressure Tester Method[3]

D4959 Test Method for Determination of Water (Moisture) Content by Direct Heating Method[3]

3. Significance and Use

3.1 The test methods described are useful as rapid, nondestructive techniques for the in-place determination of density of soil and rock.

3.2 The test methods are suitable for quality control and acceptance testing for construction and for research and development applications.

3.3 The nondestructive nature of the tests allow repetitive measurements to be made at a single test location.

4. Interferences

4.1 The chemical composition of the sample may affect the measurement, and adjustments may be necessary.

4.2 The test methods exhibit spatial bias in that the instrument is more sensitive to the density of the material in close proximity to the surface (Backscatter Method only).

NOTE 1—The nuclear gauge density measurements are somewhat biased to the surface layers of the soil being tested. This bias has *largely*

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[1] These test methods are under the jurisdiction of ASTM Committee D-18 on Soil and Rock and are the direct responsibility of Subcommittee D18.08 on Special and Construction Control Tests.

Current edition approved Oct. 10, 1996. Published February 1997. Originally published as D 2922 – 71. Last previous edition D 2922 – 91.

[2] *Annual Book of ASTM Standards*, Vol 04.08.

[3] *Annual Book of ASTM Standards*, Vol 04.09.

been corrected out of the direct transmission method and any remaining bias is insignificant. The backscatter method is still more sensitive to the material within the first several inches from the surface.

4.3 Oversize rocks or large voids in the source-detector path may cause higher or lower density determination. Where lack of uniformity in the soil due to layering, rock or voids is suspected, the test volume site should be dug up and visually examined to determine if the test material is representative of the full material in general and if rock correction (see 9.6) is required.

4.4 The sample volume is approximately 0.0028 m^3 (0.10 ft^3) for the Backscatter Method and 0.0057 m^3 (0.20 ft^3) for the Direct Transmission Method when the test depth is 15 cm (6 in.). The actual sample volume is indeterminate and varies with the apparatus and the density of the material. In general, the higher the density the smaller the volume.

5. Apparatus

5.1 *Nuclear Gage*—An electronic counting instrument, capable of being seated on the surface of the material under test, and which contains:

5.1.1 A sealed source of high energy gamma radiation such as cesium or radium.

5.1.2 *Gamma* Detector-Any type of gamma detector such as a Geiger-Mueller tube(s).

5.2 *Reference Standard-A* block of material used for checking instrument operation and to establish conditions for a reproducible reference count rate.

5.3 *Site Preparation* Device-A plate, straightedge, or other suitable leveling tool which may be used for planning the test site to the required smoothness, and in the Direct Transmission Method, guiding the drive pin to prepare a perpendicular hole.

5.4 *Drive Pin-A* pin of slightly larger diameter than the rod in the Direct Transmission Instrument, used to prepare a hole in the material under test for inserting the rod.

5.5 *Drive Pin Extractor-A* tool that may be used to remove the drive pin in a vertical direction so that the pin will not distort the hole in the extraction process.

5.5.1 A slide hammer, with a drive pin attached, may also be used both to prepare a hole in the material to be tested and to extract the pin without distortion to the hole.

6. Hazards

6.1 This equipment utilizes radioactive materials that may be hazardous to the health of the users unless proper precautions are taken. Users of this equipment must become familiar with applicable safety procedures and government regulations.

6.2 Effective user instructions together with routine safety procedures, such as source leak tests, recording and evaluation of film badge data, etc., are a recommended part of the operation and storage of this instrument.

7. Calibration

7.1 Calibration of the instrument will be in accordance with Annex A1.

8. Standardization and Reference Check

8.1 Nuclear gages are subject to long-term aging of the radioactive source, detectors, and electronic systems, which may change the relationship between count rate and material density. To offset this aging, the gage may be calibrated as the ratio of the measured count rate to a count rate made on a reference standard or to an air-gap count (for the backscatter air-gap technique, see 9.5.1.3). The reference count rate should be of the same order of magnitude as the measured count rate over the useful density range of the instrument.

8.2 Standardization of the gage shall be performed at the start of each day's work, and a permanent record of these data shall be retained. Perform the standardization with the gage located at least 8 m (25 ft) away from other sources of radioactive material, and clear of large masses or other items which may affect the reference count rate.

8.2.1 If recommended by the instrument manufacturer to provide more stable and consistent results: (*1*) turn on the gauge prior to use to allow it to stabilize, (2) leave the power on during the use of the gage for that day.

8.2.2 Using the reference standard, take at least four repetitive readings at the normal measurement period and determine the mean. If available on the gage, one measurement period of four or more times the normal period is acceptable. This constitutes one standardization check.

8.2.3 If the value obtained above is within the limits stated below, the gage is considered to be in satisfactory condition, and the value may be used to determine the count ratios for the day of use. If the value is outside these limits, allow additional time for the gage to stabilize, make sure the area is clear of sources of interference, and then conduct another standardization check. If the second standardization check is within the limits, the gage may be used, but if it also fails the test, the gage shall be adjusted or repaired as recommended by the manufacturer. The limits are as follows:

$$|N_s - N_o| \leq 2.0 \sqrt{N_o/F} \quad (1)$$

where:

N_s = value of current standardization count,

N_o = average of the past four values of N_s taken for prior usage, and

F = value of prescale. [The prescale value (F) is a divisor which reduces the actual value for the purpose of display. The manufactor will supply this value if other than 1.0.] Some instruments may have provisions to compute and display these values.

8.2.3.1 If the instrument standardization has not been checked within the previous three months, perform at least four new standardization checks, and use the mean as the value for N_o.

8.3 Use the value of N_s to determine the count ratios for the current day's use of the instrument. If for any reason the measured density becomes suspect during the day's use, perform another standardization check.

9. Procedure for Field Use

9.1 Standardize the gage. (See Section 8.)

9.2 Select a test location. If the gage will be closer than 250 mm (10 in.) to any vertical mass that might influence the result, such as in a trench or alongside a pipe, follow the manufacturer's correction procedure.

9.3 Remove all loose and disturbed material. Remove

additional material as necessary to reach the material that represents a valid sample of the zone or stratum to be tested. Surface drying and spatial bias should be considered in determining the depth of material to be removed.

9.4 Plane or scrape a smooth horizontal surface so as to obtain maximum contact between the gage and the material being tested. The placement of the gage on the surface of the material to be tested is always important, but is especially critical to the successful determination of density when using the *backscatter* method. The optimum condition in all cases, is total contact between the bottom surface of the gauge and the surface of the material being tested. To correct for surface irregularities, use of native fines or fine sand as a filler may be necessary. The depth of the filler should not exceed approximately 3 mm (1/8 in.) and the total area filled should not exceed 10 % of the bottom area of the instrument. The maximum depth of any void beneath the gage that can be tolerated without filling shall not exceed approximately 3 mm (1/8 in.). Several trial sealings may be required to achieve these conditions.

9.5 Proceed with the test in the following manner:

9.5.1 *Backscatter Procedure*

9.5.1.1 Seat the gage firmly on the prepared test site.

9.5.1.3 Keep all other radioactive sources away from the gauge to avoid affecting the measurement so as not to affect the readings.

9.5.1.3 Secure and record one or more readings for the normal measurement period in the backscatter position.

NOTE 2—When using the backscatter air-gap procedure, follow the instrument manufacturers instructions regarding apparatus set up. Take the same number of readings for the normal measurement period in the air-gap position as in the standard backscatter position. Determine the air-gap ratio by dividing counts per minute obtained in the air-gap position by counts per minute obtained in standard backscatter position.

9.5.1.4 Determine the ratio of the reading to the standard count or to the air gap count. From this count ratio and the appropriate calibration and adjustment data, determine the in-place wet density.

9.5.2 *Direct Transmission Procedure.*

9.5.2.1 Make a hole perpendicular to the prepared surface using the guide and the hole-forming device 5.4, or by drilling if necessary. The hole shall be of such depth and alignment that insertion of the probe will not cause the gage to tilt from the plane of the prepared area. The depth of the hole must be deeper than the depth to which the probe will be placed. The guide shall be the same size as the base of the gauge, with the hole in the same location on the guide as the probe on the gauge. The corners of the guide are marked by scoring the surface of the soil. The guide plate is then removed and any necessary repairs are made to the prepared surface.

9.5.2.2 Proceed with testing in the following manner:

9.5.2.3 Set the gage on the soil surface, carefully aligning it with the marks on the soil so that the probe will be directly over the pre-formed hole.

9.5.2.4 Insert the probe in the hole.

9.5.2.5 Seat the gage firmly by rotating it about the probe with a back and forth motion.

9.5.2.6 Pull gently on the gage in the direction that will bring the side of the probe against the side of the hole that is closest to the detector (or source) location in the gauge housing.

9.5.2.7 Keep all other radioactive sources away from the gage to avoid affecting the measurement.

9.5.2.8 Secure and record one or more readings for the normal measurement period.

9.5.2.9 Determine the ratio of the reading to the standard count. From this count ratio and the appropriate calibration and adjustment data, determine the in-place wet density.

NOTE 3—Some instruments have built-in provisions to compute the ratio, wet density, and to enter an adjustment bias. Additionally some instruments may have provisions to measure and compute moisture content, and dry density.

9.6 If the volume tested as defined in 4.4 has excess oversize material with respect to the limitations in the appropriate Test Methods D 698, D 1557 or D 4253, then a correction for wet density (unit weight) and water content must be applied. This correction will be done in accordance with Practice D 4718. This test method requires sampling from the actual test volume.

9.6.1 If samples of the measure material are to be taken for purposes of correlation with other test methods or rock correction, the volume measured can be approximated by a 200 mm (8 in.) diameter cylinder located directly under the center line of the radioactive source and detector(s). The height of the cylinder to be excavated will be the depth setting of the source rod when using the Direct Transmission method or approximately 75 mm (3 in.) when using the Backscatter Method.

9.6.2 An alternative to the correction for oversize particles, that can be used with mass density methods or minimal oversize situations, involves multiple tests. Tests may be taken at adjacent locations and the results averaged to get a representative value. Comparisons need to be made to evaluate whether the presence of a single large rock or void in the soil is producing unrepresentative values of density. Whenever values obtained are questionable, the test volume site should be dug up and visually examined.

10. Calculation of Results

10.1 The in-place wet density is determined as outlined in 9.5. If dry density is required, the in-place water content shall be determined using either gravimetric samples and laboratory determination of water content (Test Methods D 2216, D 4643, D 4959, D 4944), or an instrument which determines water content by neutron thermalization (Test Method D 3017).

10.1.1 If the water content is determined by nuclear methods, Test Method D 3017, subtract the kg/m^3 (lbf/ft^3) of moisture from the kg/m^3 (lbf/ft^3) of wet density, and obtain dry density in kg/m^3 (lbf/ft^3).

10.1.2 If the water content is determined by other methods, and is in the form of percent, proceed as follows:

$$\rho_d = \frac{100\rho_m}{100 + w} \quad (2)$$

where:

ρ_d = dry density in kg/m^3 (lbf/ft^3),
ρ_m = wet density in kg/m^3 (lbf/ft^3), and
W = water as a percent of the dry mass.

11. Report

11.1 Report the following information:

11.1.1 Standardization and adjustment data for the date of the tests.

11.1.2 Make, model and serial number of the test instrument.

11.1.3 Name of the operator(s).

11.1.4 Test site identification.

11.1.5 Visual description of material tested.

11.1.6 Test mode (backscatter or direct transmission) and test depth (if applicable).

11.1.7 Wet and dry densities in kg/m^3 or unit weights in lb/ft^3.

11.1.8 Water content in percent of dry mass or dry unit weight.

12. Precision and Bias

12.1 *Precision:*

12.1.1 Precision-Criteria for judging the acceptability of wet density test results obtained by this test method are given in Table 1. The figure in column three represents the standard deviations that have been found to be appropriate for the materials tested in column one. The figures given in column four are the limits that should not be exceeded by the difference between the results of two properly conducted tests. The figures given are based upon an interlaboratory study in which five test sites containing soils, with wet densities as shown in column two were tested by eight different devices and operators. The wet density of each test site was determined three times by each device.[4]

12.1.2 An instrument count precision of 8 kg/m^3 (0.5 lbf/ft^3) for the Backscatter Method and 4 kg/m^3 (0.25 lbf/ft^3) Direct Transmission Method are typical on a material of approximately 2000 kg/m^3 (125 lbf/ft^3) density, with a measurement time of one minute.

[4] The data used to establish this precision statement is contained in a Research Report available from ASTM Headquarters. Request RR:D 18- 1004.

TABLE 1 Results of Statistical Analysis

Precision and Soil Type	Average kg/m^3 (lb/ft^3)	Standard Deviation, kg/m^3 (lb/ft^3)	Acceptable Range of Two Results kg/m^3 (lb/ft^3)
Single Operator Precision:			
Direct Transmission:			
CL	1637 (114.7)	5.4 (0.34)	15.1 (0.94)
SP	1937 (120.9)	4.3 (0.27)	11.9 (0.74)
ML	2064 (130.1)	7.4 (0.46)	20.5 (1.28)
Backscatter:			
ML	1996 (124.6)	19.4 (1.21)	54.3 (3.39)
Multilaboratory Precision:			
Direct Transmission:			
a	1637 (114.7)	10.6 (0.66)	29.8 (1.86)
SP	1937 (120.9)	10.9 (0.65)	30.6 (1.91)
ML	2084 (130.1)	12.3 (0.77)	34.4 (2.15)
Backscatter:			
ML	1996 (124.6)	30.1 (2.36)	107 (6.67)

12.1.2.1 Instrument count precision is defined as the change in density that occurs corresponding to a one standard deviation change in the count due to the random decay of the radioactive source. The density of the material and the time period of the count must be stated. It may be determined from a series of 20 or more counts taken without moving the instrument, or alternately from the calibration data using the assumption that σ is equal to the $\sqrt{\text{count}}$ at that density. The count must be the true instrument count corrected for any pre-scaling (see 8.2.3).

$$P = \frac{\sigma}{S} \tag{3}$$

where:

P = instrument precision in density (kg/m^3 or lbf/ft^3)

σ = one standard deviation of the count

S = the slope of the calibration curve at the defined density value.

12.2 *Bias:*

12.2.1 There is no accepted reference value for this test method, therefore, bias cannot be determined.

13. Keywords

13.1 density; field density; nuclear methods

ANNEX

(Mandatory Information)

A1. CALIBRATION

A1.1 Verify or reestablish calibration curves, tables, or equation coefficients at least once every 12 to 18 months and after all major repairs which may affect the instrument geometry.

A1.2 The instrument shall be calibrated in such a way as to produce a calibration response within ± 16 kg/m^3 (± 1.0 lbf/ft^3) on blocks of materials (standards) of established densities. (This calibration may be done by the manufacturer, the user, or an independent vendor.) Nuclear instrument response is influenced by the chemical composition of measured material. This response must be taken into account in establishing the assigned standard block density. The densities of materials used to establish or verify the calibration should extend through a range representative of the density of the materials to be tested. The density of these material standards shall be determined to an accuracy of ± 0.2 %.

A1.3 Sufficient data shall be taken on each density standard to ensure an instrument count precision of at least one-half the instrument count precision required for field use. The data may be presented in the form of a graph, table, equation coefficients, or stored in the gauge, to allow covering the count rate data to material density.

A1.4 The method and test procedures used in establishing

the calibration count rate data shall be the same as those used for obtaining the field count rate data.

A1.5 The material type, actual density and assigned standard block density of each calibration standard used to establish or verify the instrument calibration shall be stated as part of the calibration data.

A1.6 The standards shall be of sufficient size to not change the count rate if enlarged in any dimension. Minimum surface dimensions of approximately 610 mm long by 430 mm wide (24 by 17 in.) have proven satisfactory. For the Backscatter Method a minimum depth of 230 mm (9 in.) is adequate; for the Direct Transmission Method the depth shall be at least 50 mm (2 in.) deeper than the deepest rod depth. A larger surface area may be required for the Backscatter Air-Gap technique. Minimum surface dimensions may be reduced slightly if the standards are adjacent to a dense material.

A1.7 The most successful standards that have been established for accurate calibration have been made of aluminum, magnesium, aluminum/magnesium, granite and limestone. These standards have been used in combination with each other and with historical curve information to produce accurate and reliable calibration.

A1.7.1 Standards of soil, rock, and concrete that have the characteristics of reproducible uniformity are difficult to prepare. These standards may be of use for some special calibration or field calibration where local site material chemistry or background situation require special adaptation.

The American Society for Testing and Materials takes no position respecting the validity of any patent rights asserted in connection with any item mentioned in this standard. Users of this standard are expressly advised that determination of the validity of any such patent rights, and the risk of infringement of such rights, are entirely their own responsibility.

This standard is subject to revision at any time by the responsible technical committee and must be reviewed every five years and if not revised, either reapproved or withdrawn. Your comments are invited either for revision of this standard or for additional standards and should be addressed to ASTM Headquarters. Your comments will receive careful consideration at a meeting of the responsible technical committee, which you may attend. If you feel that your comments have not received a fair hearing you should make your views known to the ASTM Committee on Standards, 100 Barr Harbor Drive, West Conshohocken, PA 19428.

APPENDIX H

UFGS SECTION 02770A *CONCRETE SIDEWALKS AND CURBS AND GUTTERS*, MARCH 2004

****
USACE / NAVFAC / AFCESA UFGS-02770A (March 2004)

Preparing Activity: USACE Superseding
UFGS-02770A (March 1998)

UNIFIED FACILITIES GUIDE SPECIFICATIONS

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SECTION 02770A

CONCRETE SIDEWALKS AND CURBS AND GUTTERS
03/04

NOTE: This guide specification covers the requirements for concrete sidewalks and curbs and gutters.

Comments and suggestions on this guide specification are welcome and should be directed to the technical proponent of the specification. A listing of technical proponents, including their organization designation and telephone number, is on the Internet.

Recommended changes to a UFGS should be submitted as a Criteria Change Request (CCR).

Use of electronic communication is encouraged.

This guide specification includes tailoring options for sidewalks, and curbs and gutters. Selection or deselection of a tailoring option will include or exclude that option in the section, but editing the resulting section to fit the project is still required.

Brackets are used in the text to indicate designer choices or locations where text must be supplied by the designer.

PART 1 GENERAL

AND=GUTTERS> s/public.html> AND=GUTTERS> s/public.html>NOTE: This specification may be adjusted to cover separate curbs and gutters or combination curbs and gutters. This guide specification will not be used for integral or

monolithic curbs of concrete pavement or for curbs and gutters for bridges.

****

1.1 REFERENCES

****

NOTE: Issue (date) of references included in project specifications need not be more current than provided by the latest guide specification.

****

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS (AASHTO)

AASHTO M 182	(1991; R 2000) Burlap Cloth Made from Jute or Kenaf

ASTM INTERNATIONAL (ASTM)

ASTM A 185	(2002) Steel Welded Wire Reinforcement, Plain, for Concrete
ASTM A 615/A 615M	(2003a) Deformed and Plain Billet-Steel Bars for Concrete Reinforcement
ASTM C 143/C 143M	(2003) Slump of Hydraulic Cement Concrete
ASTM C 171	(2003) Sheet Materials for Curing Concrete
ASTM C 172	(1999) Sampling Freshly Mixed Concrete
ASTM C 173	(1994ael) Air Content of Freshly Mixed Concrete by the Volumetric Method
ASTM C 231	(2003) Air Content of Freshly Mixed Concrete by the Pressure Method
ASTM C 309	(2003) Liquid Membrane-Forming Compounds for Curing Concrete
ASTM C 31/C 31M	(2003a) Making and Curing Concrete Test Specimens in the Field
ASTM C 920	(2002) Elastomeric Joint Sealants
ASTM D 1751	(1999) Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types)

ASTM D 1752	(1984; R 1996e1) Preformed Sponge Rubber and Cork Expansion Joint Fillers for Concrete Paving and Structural Construction
ASTM D 5893	(1996) Cold Applied, Single Component, Chemically Curing Silicone Joint Sealant for Portland Cement Concrete Pavements

1.2 MEASUREMENT FOR PAYMENT

****

NOTE: The MEASUREMENT FOR PAYMENT and BASIS FOR PAYMENT paragraphs will be deleted if the work covered by this section of the specifications is included in one lump-sum contract price for the entire work covered by the invitation for bids.

****

1.2.1 Sidewalks

The quantities of sidewalks to be paid for will be the number of square meters yards of each depth of sidewalk constructed as indicated.

AND=GUTTERS> s/public.html> AND=GUTTERS> s/public.html>1.2.2 Curbs and Gutters

The quantities of curbs and gutters to be paid for will be the number of linear meters feet of each cross section constructed as indicated, measured along the face of the curb at the gutter line.

1.3 BASIS FOR PAYMENT

1.3.1 Sidewalks

Payment of the quantities of sidewalks measured as specified will be at the contract unit price per square meter yard of the thickness specified.

AND=GUTTERS> s/public.html> AND=GUTTERS> s/public.html>1.3.2 Curbs and Gutters

Payment of the quantities of curbs and gutters measured as specified will be at the contract unit price per linear meter foot of each cross section.

1.4 SUBMITTALS

****

NOTE: Submittals must be limited to those necessary for adequate quality control. The importance of an item in the project should be one of the primary factors in determining if a submittal for the item should be required.

A "G" following a submittal item indicates that the

submittal requires Government approval. Some submittals are already marked with a "G". Only delete an existing "G" if the submittal item is not complex and can be reviewed through the Contractor's Quality Control system. Only add a "G" if the submittal is sufficiently important or complex in context of the project.

For submittals requiring Government approval on Army projects, a code of up to three characters within the submittal tags may be used following the "G" designation to indicate the approving authority. Codes for Army projects using the Resident Management System (RMS) are: "AE" for Architect-Engineer; "DO" for District Office (Engineering Division or other organization in the District Office); "AO" for Area Office; "RO" for Resident Office; and "PO" for Project Office. Codes following the "G" typically are not used for Navy projects.

Submittal items not designated with a "G" are considered as being for information only for Army projects and for Contractor Quality Control approval for Navy projects.

****

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only or as otherwise designated. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-03 Product Data

Concrete

Copies of certified delivery tickets for all concrete used in the construction.

SD-06 Test Reports

Field Quality Control

Copies of all test reports within 24 hours of completion of the test.

1.5 WEATHER LIMITATIONS

1.5.1 Placing During Cold Weather

Concrete placement shall not take place when the air temperature reaches 5 degrees C 40 degrees F and is falling, or is already below that point.

Placement may begin when the air temperature reaches 2 degrees C 35 degrees F and is rising, or is already above 5 degrees C 40 degrees F. Provisions shall be made to protect the concrete from freezing during the specified curing period. If necessary to place concrete when the temperature of the air, aggregates, or water is below 2 degrees C 35 degrees F, placement and protection shall be approved in writing. Approval will be contingent upon full conformance with the following provisions. The underlying material shall be prepared and protected so that it is entirely free of frost when the concrete is deposited. [Mixing water and aggregates] [Mixing water] [Aggregates] shall be heated as necessary to result in the temperature of the in-place concrete being between 10 and 30 degrees C 50 and 85 degrees F. Methods and equipment for heating shall be approved. The aggregates shall be free of ice, snow, and frozen lumps before entering the mixer. Covering and other means shall be provided for maintaining the concrete at a temperature of at least 10 degrees C 50 degrees F for not less than 72 hours after placing, and at a temperature above freezing for the remainder of the curing period.

1.5.2 Placing During Warm Weather

The temperature of the concrete as placed shall not exceed 30 degrees C 85 degrees F except where an approved retarder is used. The mixing water and/or aggregates shall be cooled, if necessary, to maintain a satisfactory placing temperature. The placing temperature shall not exceed 35 degrees C 95 degrees F at any time.

1.6 PLANT, EQUIPMENT, MACHINES, AND TOOLS

1.6.1 General Requirements

Plant, equipment, machines, and tools used in the work shall be subject to approval and shall be maintained in a satisfactory working condition at all times. The equipment shall have the capability of producing the required product, meeting grade controls, thickness control and smoothness requirements as specified. Use of the equipment shall be discontinued if it produces unsatisfactory results. The Contracting Officer shall have access at all times to the plant and equipment to ensure proper operation and compliance with specifications.

AND=GUTTERS> s/public.html> AND=GUTTERS> s/public.html>1.6.2 Slip Form Equipment

Slip form paver or curb forming machine, will be approved based on trial use on the job and shall be self-propelled, automatically controlled, crawler mounted, and capable of spreading, consolidating, and shaping the plastic concrete to the desired cross section in 1 pass.

PART 2 PRODUCTS

2.1 CONCRETE

Concrete shall conform to the applicable requirements of [Section 03300A CAST-IN-PLACE STRUCTURAL CONCRETE] [Section 02753A CONCRETE PAVEMENT FOR AIRFIELDS AND OTHER HEAVY-DUTY PAVEMENTS] [Section 02754A CONCRETE

PAVEMENTS FOR SMALL PROJECT] except as otherwise specified. Concrete shall have a minimum compressive strength of 24 MPa 3500 psi at 28 days. Maximum size of aggregate shall be 37.5 mm 1-1/2 inches.

2.1.1 Air Content

****

NOTE: The air content specified is for concrete that will be subjected to freezing weather and the possible action of deicing chemicals. In climates where freezing is not a factor but where air entrainment is used in local commercial practice to improve the workability and placeability of concrete, concrete having air content percent of 4.5 plus or minus 1.5 percent may be specified as Contractor's option to non air-entrained concrete.

****

Mixtures shall have air content by volume of concrete of 5 to 7 percent, based on measurements made immediately after discharge from the mixer.

2.1.2 Slump

****

NOTE: The desired slump will be inserted. Suggested limits are 75 mm (3 inches) plus or minus 25 mm (1 inch) for hand placed concrete or 25 mm (1 inch) plus or minus 10 mm (1/2 inch) for slipformed concrete.

****

The concrete slump shall be 50 mm plus or minus 25 mm 2 inches plus or minus 1 inch where determined in accordance with ASTM C 143/C 143M.

2.1.3 Reinforcement Steel

****

NOTE: Reinforcement steel normally will not be required for curb and gutter construction. Where conditions exist that make it advantageous to use reinforcement steel, the reinforcing steel details will be indicated, and the following paragraphs will be included in the contract specification.

****

Reinforcement bars shall conform to ASTM A 615/A 615M. Wire mesh reinforcement shall conform to ASTM A 185.

2.2 CONCRETE CURING MATERIALS

2.2.1 Impervious Sheet Materials

Impervious sheet materials shall conform to ASTM C 171, type optional, except that polyethylene film, if used, shall be white opaque.

2.2.2 Burlap

Burlap shall conform to AASHTO M 182.

2.2.3 White Pigmented Membrane-Forming Curing Compound

White pigmented membrane-forming curing compound shall conform to ASTM C 309, Type 2.

2.3 CONCRETE PROTECTION MATERIALS

Concrete protection materials shall be a linseed oil mixture of equal parts, by volume, of linseed oil and either mineral spirits, naphtha, or turpentine. At the option of the contractor, commercially prepared linseed oil mixtures, formulated specifically for application to concrete to provide protection against the action of deicing chemicals may be used, except that emulsified mixtures are not acceptable.

2.4 JOINT FILLER STRIPS

AND=GUTTERS> s/public.html> AND=GUTTERS> s/public.html>2.4.1 Contraction Joint Filler for Curb and Gutter

Contraction joint filler for curb and gutter shall consist of hard-pressed fiberboard.

2.4.2 Expansion Joint Filler, Premolded

****

NOTE: Either type of joint sealer may be specified if determined necessary by the Contracting Officer and the inapplicable publication removed. Joint sealing material may be omitted where sealing of expansion joints is not deemed essential or advisable.

****

Expansion joint filler, premolded, shall conform to ASTM D 1751 or ASTM D 1752, 13 mm 1/2 inch thick, unless otherwise indicated.

2.5 JOINT SEALANTS

Joint sealant, cold-applied shall conform to ASTM C 920 or ASTM D 5893.

2.6 FORM WORK

Form work shall be designed and constructed to ensure that the finished concrete will conform accurately to the indicated dimensions, lines, and elevations, and within the tolerances specified. Forms shall be of wood or steel, straight, of sufficient strength to resist springing during depositing and consolidating concrete. Wood forms shall be surfaced plank, 50 mm 2 inches nominal thickness, straight and free from warp, twist, loose knots, splits or other defects. Wood forms shall have a nominal length of

3 m 10 feet. Radius bends may be formed with 19 mm 3/4 inch boards, laminated to the required thickness. Steel forms shall be channel-formed sections with a flat top surface and with welded braces at each end and at not less than two intermediate points. Ends of steel forms shall be interlocking and self-aligning. Steel forms shall include flexible forms for radius forming, corner forms, form spreaders, and fillers. Steel forms shall have a nominal length of 3 m 10 feet with a minimum of 3 welded stake pockets per form. Stake pins shall be solid steel rods with chamfered heads and pointed tips designed for use with steel forms.

2.6.1 Sidewalk Forms

Sidewalk forms shall be of a height equal to the full depth of the finished sidewalk.

AND=GUTTERS> s/public.html> AND=GUTTERS> s/public.html>2.6.2 Curb and Gutter Forms

Curb and gutter outside forms shall have a height equal to the full depth of the curb or gutter. The inside form of curb shall have batter as indicated and shall be securely fastened to and supported by the outside form. Rigid forms shall be provided for curb returns, except that benders or thin plank forms may be used for curb or curb returns with a radius of 3 m 10 feet or more, where grade changes occur in the return, or where the central angle is such that a rigid form with a central angle of 90 degrees cannot be used. Back forms for curb returns may be made of 38 mm 1-1/2 inch benders, for the full height of the curb, cleated together. In lieu of inside forms for curbs, a curb "mule" may be used for forming and finishing this surface, provided the results are approved.

PART 3 EXECUTION

3.1 SUBGRADE PREPARATION

****

NOTE: On most projects, major grading operations involving excavation and construction of embankments will be performed and paid for under other sections of the specifications and, therefore, are not included in this guide specification. Where such work, including the construction of any required subbase, must be done under this section, paragraphs FORM SETTING, SIDEWALK CONCRETE PLACEMENT AND FINISHING, and CURB AND GUTTER CONCRETE PLACEMENT AND FINISHING will be revised to cover necessary additional requirements. The subgrade will be indicated as extending at least 600 mm (2 feet) in width back of curb, gutter, entrance, and combination curb and gutters.

****

The subgrade shall be constructed to the specified grade and cross section prior to concrete placement. Subgrade shall be placed and compacted [as directed] [in conformance with Section [_____]].

3.1.1 Sidewalk Subgrade

The subgrade shall be tested for grade and cross section with a template extending the full width of the sidewalk and supported between side forms.

AND=GUTTERS> s/public.html> AND=GUTTERS> s/public.html>3.1.2 Curb and Gutter Subgrade

The subgrade shall be tested for grade and cross section by means of a template extending the full width of the curb and gutter. The subgrade shall be of materials equal in bearing quality to the subgrade under the adjacent pavement.

3.1.3 Maintenance of Subgrade

The subgrade shall be maintained in a smooth, compacted condition in conformity with the required section and established grade until the concrete is placed. The subgrade shall be in a moist condition when concrete is placed. The subgrade shall be prepared and protected to produce a subgrade free from frost when the concrete is deposited.

3.2 FORM SETTING

Forms shall be set to the indicated alignment, grade and dimensions. Forms shall be held rigidly in place by a minimum of 3 stakes per form placed at intervals not to exceed 1.2 m 4 feet. Corners, deep sections, and radius bends shall have additional stakes and braces, as required. Clamps, spreaders, and braces shall be used where required to ensure rigidity in the forms. Forms shall be removed without injuring the concrete. Bars or heavy tools shall not be used against the concrete in removing the forms. Any concrete found defective after form removal shall be promptly and satisfactorily repaired. Forms shall be cleaned and coated with form oil each time before concrete is placed. Wood forms may, instead, be thoroughly wetted with water before concrete is placed, except that with probable freezing temperatures, oiling is mandatory.

3.2.1 Sidewalks

Forms for sidewalks shall be set with the upper edge true to line and grade with an allowable tolerance of 3 mm 1/8 inch in any 3 m 10 foot long section. After forms are set, grade and alignment shall be checked with a 3 m 10 foot straightedge. Forms shall have a transverse slope [as indicated] [of 20 mm per meter 1/4 inch per foot] with the low side adjacent to the roadway. Side forms shall not be removed for 12 hours after finishing has been completed.

AND=GUTTERS> s/public.html> AND=GUTTERS> s/public.html>3.2.2 Curbs and Gutters

The forms of the front of the curb shall be removed not less than 2 hours nor more than 6 hours after the concrete has been placed. Forms back of curb shall remain in place until the face and top of the curb have been finished, as specified for concrete finishing. Gutter forms shall not be

removed while the concrete is sufficiently plastic to slump in any direction.

3.3 SIDEWALK CONCRETE PLACEMENT AND FINISHING

3.3.1 Formed Sidewalks

Concrete shall be placed in the forms in one layer. When consolidated and finished, the sidewalks shall be of the thickness indicated. After concrete has been placed in the forms, a strike-off guided by side forms shall be used to bring the surface to proper section to be compacted. The concrete shall be consolidated with an approved vibrator, and the surface shall be finished to grade with a strike off.

3.3.2 Concrete Finishing

After straightedging, when most of the water sheen has disappeared, and just before the concrete hardens, the surface shall be finished with a wood float or darby to a smooth and uniformly fine granular or sandy texture free of waves, irregularities, or tool marks. A scored surface shall be produced by brooming with a fiber-bristle brush in a direction transverse to that of the traffic, followed by edging.

3.3.3 Edge and Joint Finishing

All slab edges, including those at formed joints, shall be finished with an edger having a radius of 3 mm 1/8 inch. Transverse joint shall be edged before brooming, and the brooming shall eliminate the flat surface left by the surface face of the edger. Corners and edges which have crumbled and areas which lack sufficient mortar for proper finishing shall be cleaned and filled solidly with a properly proportioned mortar mixture and then finished.

3.3.4 Surface and Thickness Tolerances

Finished surfaces shall not vary more than 8 mm 5/16 inch from the testing edge of a 3 m 10-foot straightedge. Permissible deficiency in section thickness will be up to 6 mm 1/4 inch.

AND=GUTTERS> s/public.html> AND=GUTTERS> s/public.html>3.4 CURB AND GUTTER CONCRETE PLACEMENT AND FINISHING

3.4.1 Formed Curb and Gutter

Concrete shall be placed to the section required in a single lift. Consolidation shall be achieved by using approved mechanical vibrators. Curve shaped gutters shall be finished with a standard curb "mule".

3.4.2 Curb and Gutter Finishing

Approved slipformed curb and gutter machines may be used in lieu of hand placement.

3.4.3 Concrete Finishing

Exposed surfaces shall be floated and finished with a smooth wood float until true to grade and section and uniform in texture. Floated surfaces shall then be brushed with a fine-hair brush with longitudinal strokes. The edges of the gutter and top of the curb shall be rounded with an edging tool to a radius of 13 mm 1/2 inch. Immediately after removing the front curb form, the face of the curb shall be rubbed with a wood or concrete rubbing block and water until blemishes, form marks, and tool marks have been removed. The front curb surface, while still wet, shall be brushed in the same manner as the gutter and curb top. The top surface of gutter and entrance shall be finished to grade with a wood float.

3.4.4 Joint Finishing

Curb edges at formed joints shall be finished as indicated.

3.4.5 Surface and Thickness Tolerances

Finished surfaces shall not vary more than 6 mm 1/4 inch from the testing edge of a 3 m 10-foot straightedge. Permissible deficiency in section thickness will be up to 6 mm 1/4 inch.

3.5 SIDEWALK JOINTS

Sidewalk joints shall be constructed to divide the surface into rectangular areas. Transverse contraction joints shall be spaced at a distance equal to the sidewalk width or 1.5 m 5 feet on centers, whichever is less, and shall be continuous across the slab. Longitudinal contraction joints shall be constructed along the centerline of all sidewalks 3 m 10 feet or more in width. Transverse expansion joints shall be installed at sidewalk returns and opposite expansion joints in adjoining curbs. Where the sidewalk is not in contact with the curb, transverse expansion joints shall be installed as indicated. Expansion joints shall be formed about structures and features which project through or into the sidewalk pavement, using joint filler of the type, thickness, and width indicated. Expansion joints are not required between sidewalks and curb that abut the sidewalk longitudinally.

3.5.1 Sidewalk Contraction Joints

The contraction joints shall be formed in the fresh concrete by cutting a groove in the top portion of the slab to a depth of at least one-fourth of the sidewalk slab thickness, using a jointer to cut the groove, or by sawing a groove in the hardened concrete with a power-driven saw, unless otherwise approved. Sawed joints shall be constructed by sawing a groove in the concrete with a 3 mm 1/8 inch blade to the depth indicated. An ample supply of saw blades shall be available on the job before concrete placement is started, and at least one standby sawing unit in good working order shall be available at the jobsite at all times during the sawing operations.

3.5.2 Sidewalk Expansion Joints

****

NOTE: For projects which do not reference Section 02760A FIELD MOLDED SEALANTS FOR SEALING JOINTS IN RIGID PAVEMENTS, the last paragraph will replace the reference to Section 02760A.

****

Expansion joints shall be formed with 13 mm 1/2 inch joint filler strips. Joint filler in expansion joints surrounding structures and features within the sidewalk may consist of preformed filler material conforming to ASTM D 1752 or building paper. Joint filler shall be held in place with steel pins or other devices to prevent warping of the filler during floating and finishing. Immediately after finishing operations are completed, joint edges shall be rounded with an edging tool having a radius of 3 mm 1/8 inch, and concrete over the joint filler shall be removed. At the end of the curing period, expansion joints shall be cleaned and filled with cold-applied joint sealant. Joint sealant shall be gray or stone in color. [Joints shall be sealed as specified in Section 02760A FIELD MOLDED SEALANTS FOR SEALING JOINTS IN RIGID PAVEMENTS.] [The joint opening shall be thoroughly cleaned before the sealing material is placed. Sealing material shall not be spilled on exposed surfaces of the concrete. Concrete at the joint shall be surface dry and atmospheric and concrete temperatures shall be above 10 degrees C 50 degrees F at the time of application of joint sealing material. Excess material on exposed surfaces of the concrete shall be removed immediately and concrete surfaces cleaned.]

3.5.3 Reinforcement Steel Placement

****

NOTE: Reinforcement steel normally will not be required for curb and gutter construction. Where conditions exist that make it advantageous to use reinforcement steel, the reinforcing steel details will be indicated, and the following paragraphs will be included in the contract specification.

****

Reinforcement steel shall be accurately and securely fastened in place with suitable supports and ties before the concrete is placed.

AND=GUTTERS> s/public.html> AND=GUTTERS> s/public.html>3.6 CURB AND GUTTER JOINTS

Curb and gutter joints shall be constructed at right angles to the line of curb and gutter.

3.6.1 Contraction Joints

Contraction joints shall be constructed directly opposite contraction joints in abutting portland cement concrete pavements and spaced so that

monolithic sections between curb returns will not be less than 1.5 m 5 feet nor greater than 4.5 m 15 feet in length. Contraction joints shall be constructed by means of 3 mm 1/8 inch thick separators and of a section conforming to the cross section of the curb and gutter. Separators shall be removed as soon as practicable after concrete has set sufficiently to preserve the width and shape of the joint and prior to finishing.

3.6.2 Expansion Joints

****

NOTE: For projects which do not reference Section 02760A FIELD MOLDED SEALANTS FOR SEALING JOINTS IN RIGID PAVEMENTS, the last paragraph will replace the reference to Section 02760A.

****

Expansion joints shall be formed by means of preformed expansion joint filler material cut and shaped to the cross section of curb and gutter. Expansion joints shall be provided in curb and gutter directly opposite expansion joints of abutting portland cement concrete pavement, and shall be of the same type and thickness as joints in the pavement. Where curb and gutter do not abut portland cement concrete pavement, expansion joints at least 13 mm 1/2 inch in width shall be provided at intervals not less than 10 meters (30 feet) nor greater than 35 meters (120 feet). Expansion joints shall be provided in nonreinforced concrete gutter at locations indicated. Expansion joints shall be sealed immediately following curing of the concrete or as soon thereafter as weather conditions permit. [Joints shall be sealed as specified in Section 02760A FIELD MOLDED SEALANTS FOR SEALING JOINTS IN RIGID PAVEMENTS.] [Expansion joints and the top 25 mm 1 inch depth of curb and gutter contraction-joints shall be sealed with joint sealant. The joint opening shall be thoroughly cleaned before the sealing material is placed. Sealing material shall not be spilled on exposed surfaces of the concrete. Concrete at the joint shall be surface dry and atmospheric and concrete temperatures shall be above 10 degrees C 50 degrees F at the time of application of joint sealing material. Excess material on exposed surfaces of the concrete shall be removed immediately and concrete surfaces cleaned.]

3.7 CURING AND PROTECTION

****

NOTE: Only the methods of curing appropriate to local weather conditions and construction practices will be retained, but Contractor's option of at least 2 curing methods will be retained to promote competition in bidding.

****

3.7.1 General Requirements

Concrete shall be protected against loss of moisture and rapid temperature changes for at least 7 days from the beginning of the curing operation.

Unhardened concrete shall be protected from rain and flowing water. All equipment needed for adequate curing and protection of the concrete shall be on hand and ready for use before actual concrete placement begins. Protection shall be provided as necessary to prevent cracking of the pavement due to temperature changes during the curing period.

3.7.1.1 Mat Method

The entire exposed surface shall be covered with 2 or more layers of burlap. Mats shall overlap each other at least 150 mm 6 inches. The mat shall be thoroughly wetted with water prior to placing on concrete surface and shall be kept continuously in a saturated condition and in intimate contact with concrete for not less than 7 days.

3.7.1.2 Impervious Sheeting Method

The entire exposed surface shall be wetted with a fine spray of water and then covered with impervious sheeting material. Sheets shall be laid directly on the concrete surface with the light-colored side up and overlapped 300 mm 12 inches when a continuous sheet is not used. The curing medium shall not be less than 450 mm 18-inches wider than the concrete surface to be cured, and shall be securely weighted down by heavy wood planks, or a bank of moist earth placed along edges and laps in the sheets. Sheets shall be satisfactorily repaired or replaced if torn or otherwise damaged during curing. The curing medium shall remain on the concrete surface to be cured for not less than 7 days.

3.7.1.3 Membrane Curing Method

A uniform coating of white-pigmented membrane-curing compound shall be applied to the entire exposed surface of the concrete as soon after finishing as the free water has disappeared from the finished surface. Formed surfaces shall be coated immediately after the forms are removed and in no case longer than 1 hour after the removal of forms. Concrete shall not be allowed to dry before the application of the membrane. If any drying has occurred, the surface of the concrete shall be moistened with a fine spray of water and the curing compound applied as soon as the free water disappears. Curing compound shall be applied in two coats by hand-operated pressure sprayers at a coverage of approximately 5 square meters/L 200 square feet per gallon for the total of both coats. The second coat shall be applied in a direction approximately at right angles to the direction of application of the first coat. The compound shall form a uniform, continuous, coherent film that will not check, crack, or peel and shall be free from pinholes or other imperfections. If pinholes, abrasion, or other discontinuities exist, an additional coat shall be applied to the affected areas within 30 minutes. Concrete surfaces that are subjected to heavy rainfall within 3 hours after the curing compound has been applied shall be resprayed by the method and at the coverage specified above. Areas where the curing compound is damaged by subsequent construction operations within the curing period shall be resprayed. Necessary precautions shall be taken to insure that the concrete is properly cured at sawed joints, and that no curing compound enters the joints. The top of the joint opening and the joint groove at exposed edges shall be tightly sealed before the concrete in the region of the joint is

resprayed with curing compound. The method used for sealing the joint groove shall prevent loss of moisture from the joint during the entire specified curing period. Approved standby facilities for curing concrete pavement shall be provided at a location accessible to the jobsite for use in the event of mechanical failure of the spraying equipment or other conditions that might prevent correct application of the membrane-curing compound at the proper time. Concrete surfaces to which membrane-curing compounds have been applied shall be adequately protected during the entire curing period from pedestrian and vehicular traffic, except as required for joint-sawing operations and surface tests, and from any other possible damage to the continuity of the membrane.

3.7.2 Backfilling

After curing, debris shall be removed and the area adjoining the concrete shall be backfilled, graded, and compacted to conform to the surrounding area in accordance with lines and grades indicated.

3.7.3 Protection

Completed concrete shall be protected from damage until accepted. The Contractor shall repair damaged concrete and clean concrete discolored during construction. Concrete that is damaged shall be removed and reconstructed for the entire length between regularly scheduled joints. Refinishing the damaged portion will not be acceptable. Removed damaged portions shall be disposed of as directed.

3.7.4 Protective Coating

****

NOTE: Concrete may require protection against the action of urea, sodium chloride, and calcium chloride used for de-icing purposes. Protection against these chemicals is not required for concrete of the specified air content that will be in place for a cumulative time of 6 weeks at a continuous minimum temperature of 5 degrees C (40 degrees F), excluding the curing time. Concrete which is to receive protective coating should be moist cured to eliminate the need for removing a curing membrane prior to application of the protective coating. ACI Committee Report 515 provides a detailed discussion of protective coating for concrete. The following paragraphs will be inserted if protective coating is required.

****

Protective coating, of linseed oil mixture, shall be applied to the exposed-to-view concrete surface after the curing period, if concrete will be exposed to de-icing chemicals within 6 weeks after placement. Concrete to receive a protective coating shall be moist cured.

3.7.4.1 Application

Curing and backfilling operation shall be completed prior to applying two coats of protective coating. Concrete shall be surface dry and clean before each application. Coverage shall be by spray application at not more than 11 square meters/L 50 square yards per gallon for first application and not more than 15.5 square meters/L 70 square yards per gallon for second application, except that the number of applications and coverage for each application for commercially prepared mixture shall be in accordance with the manufacturer's instructions. Coated surfaces shall be protected from vehicular and pedestrian traffic until dry.

3.7.4.2 Precautions

Protective coating shall not be heated by direct application of flame or electrical heaters and shall be protected from exposure to open flame, sparks, and fire adjacent to open containers or applicators. Material shall not be applied at ambient or material temperatures lower than 10 degrees C 50 degrees F.

3.8 FIELD QUALITY CONTROL

3.8.1 General Requirements

The Contractor shall perform the inspection and tests described and meet the specified requirements for inspection details and frequency of testing. Based upon the results of these inspections and tests, the Contractor shall take the action and submit reports as required below, and any additional tests to insure that the requirements of these specifications are met.

3.8.2 Concrete Testing

3.8.2.1 Strength Testing

The Contractor shall provide molded concrete specimens for strength tests. Samples of concrete placed each day shall be taken not less than once a day nor less than once for every 190 cubic meters 250 cubic yards of concrete. The samples for strength tests shall be taken in accordance with ASTM C 172. Cylinders for acceptance shall be molded in conformance with ASTM C 31/C 31M by an approved testing laboratory. Each strength test result shall be the average of 2 test cylinders from the same concrete sample tested at 28 days, unless otherwise specified or approved. Concrete specified on the basis of compressive strength will be considered satisfactory if the averages of all sets of three consecutive strength test results equal or exceed the specified strength, and no individual strength test result falls below the specified strength by more than 4 MPa 500 psi.

3.8.2.2 Air Content

Air content shall be determined in accordance with ASTM C 173 or ASTM C 231. ASTM C 231 shall be used with concretes and mortars made with relatively dense natural aggregates. Two tests for air content shall be made on randomly selected batches of each class of concrete placed during each

shift. Additional tests shall be made when excessive variation in concrete workability is reported by the placing foreman or the Government inspector. If results are out of tolerance, the placing foreman shall be notified and he shall take appropriate action to have the air content corrected at the plant. Additional tests for air content will be performed on each truckload of material until such time as the air content is within the tolerance specified.

3.8.2.3 Slump Test

Two slump tests shall be made on randomly selected batches of each class of concrete for every 190 cubic meters 250 cubic yards, or fraction thereof, of concrete placed during each shift. Additional tests shall be performed when excessive variation in the workability of the concrete is noted or when excessive crumbling or slumping is noted along the edges of slip-formed concrete.

3.8.3 Thickness Evaluation

The anticipated thickness of the concrete shall be determined prior to placement by passing a template through the formed section or by measuring the depth of opening of the extrusion template of the curb forming machine. If a slip form paver is used for sidewalk placement, the subgrade shall be true to grade prior to concrete placement and the thickness will be determined by measuring each edge of the completed slab.

3.8.4 Surface Evaluation

The finished surface of each category of the completed work shall be uniform in color and free of blemishes and form or tool marks.

3.9 SURFACE DEFICIENCIES AND CORRECTIONS

3.9.1 Thickness Deficiency

When measurements indicate that the completed concrete section is deficient in thickness by more than 6 mm 1/4 inch the deficient section will be removed, between regularly scheduled joints, and replaced.

3.9.2 High Areas

In areas not meeting surface smoothness and plan grade requirements, high areas shall be reduced either by rubbing the freshly finished concrete with carborundum brick and water when the concrete is less than 36 hours old or by grinding the hardened concrete with an approved surface grinding machine after the concrete is 36 hours old or more. The area corrected by grinding the surface of the hardened concrete shall not exceed 5 percent of the area of any integral slab, and the depth of grinding shall not exceed 6 mm 1/4 inch. Pavement areas requiring grade or surface smoothness corrections in excess of the limits specified above shall be removed and replaced.

3.9.3 Appearance

Exposed surfaces of the finished work will be inspected by the Government

and any deficiencies in appearance will be identified. Areas which exhibit excessive cracking, discoloration, form marks, or tool marks or which are otherwise inconsistent with the overall appearances of the work shall be removed and replaced.

-- End of Section --

APPENDIX I

SEVERN TRENT LABORATORIES, USACE LABORATORY VALIDATION APPROVAL, US DEPARTMENT OF ARMY

DEPARTMENT OF THE ARMY
U.S. ARMY CORPS OF ENGINEERS
12565 WEST CENTER ROAD
OMAHA NE 68144-3869

REPLY TO
ATTENTION OF

June 6, 2005

Hazardous, Toxic and Radioactive Waste
Center of Expertise

Mike Schmitt
STL Denver
4955 Yarrow Street
Arvada, CO 80002

Dear Mr. Schmitt:

This correspondence addresses the recent evaluation of STL Denver of Arvada, CO for the U.S. Army Corps of Engineers (USACE) for radiological analysis in support of the USACE Hazardous, Toxic and Radioactive Waste Program.

Your laboratory is now validated for the parameters listed below:

METHOD(1)	PARAMETERS	MATRIX(2)
300.0/9056	Anions(5)	Water(3)
300.0/9056	Anions(5)	Solids(3)
1664A	Oil and Grease (HEM)	Water(3)
9071B	Oil and Grease (HEM)	Solids(6)
9010B/9012A	Cyanide	Water(3)
9010B/9012A	Cyanide	Solids(3)
3535/8330	Explosives	Water(6)
8330	Explosives	Solids(3)
3535/8321A	Explosives	Water(6)
8321A	Explosives	Solids(3)
8151A	Herbicides	Water(3)
8151A	Herbicides	Solids(3)
9071B	Oil & Grease	Solids(3)
3510C/8081A	Organochlorine Pesticides	Water(3)
3550B/8081A	Organochlorine Pesticides	Solids(3)
3510C/8082	Polychlorinated Biphenyls	Water(3)
3550B/8082	Polychlorinated Biphenyls	Solids(3)
3510C/8310	Polynuclear Aromatic Hydrocarbons	Water(3)
3550B/8310	Polynuclear Aromatic Hydrocarbons	Solids(3)

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3520C/8270C	Semivolatile Organics	Water(3)
3550B/8270C	Semivolatile Organics	Solids(3)
3010A/6010B/7470A	TAL Metals(4)	Water(3)
3050B/6010B/7471A	TAL Metals(4)	Solids(3)
3020A/6020	TAL Metals(4)	Water(3)
3050B/6020	TAL Metals(4)	Solids(3)
9060	Total Organic Carbon	Water(3)
9060 Mod	Total Organic Carbon	Solids(6)
3510C/Mod 8015	TPH – DRO	Water(3)
3550B/Mod 8015	TPH – DRO	Solids(3)
5030B/Mod 8015	TPH – GRO	Water(3)
5035/Mod 8015	TPH - GRO(7)	Solids(3)
5030B/8260B	Volatile Organics	Water(3)
5035/8260B	Volatile Organics	Solids(3)
DEN-RAD-0009	Gamma Emitting Radionuclides	Water(6)
DEN-RAD-0009	Gamma Emitting Radionuclides	Solids(6)
DEN-RAD-0004	Americium, Plutonium, Thorium, and Uranium by Alpha Spectrometry	Water(6)
DEN-RAD-0004	Americium, Plutonium, Thorium, and Uranium by Alpha Spectrometry	Solids(6)
DEN-RAD-0005	Calibration, Use and Maintenance of the Alpha Spectrometer	NA(6)
DEN-RAD-0007	Radium-226 in Water by Precipitation and GFPC Counting	Water(6)
DEN-RAD-0003	Gas Flow Proportional Counter – Calibration, Usage, and Maintenance	NA(6)

Remarks:

1) Sample preparation methods have been added to reflect program policy change.

2) 'Solids' includes soils, sediments, and solid waste.

3) The laboratory has successfully analyzed a Proficiency Testing (PT) sample for this method/matrix.

4) TAL Metals: Aluminum, antimony, arsenic, barium, beryllium, cadmium, calcium, chromium, cobalt, copper, iron, lead, magnesium, manganese, mercury, nickel, potassium, selenium, silver, sodium, thallium, vanadium, and zinc.

5) Anions: Chloride, fluoride, sulfate, nitrate, nitrite, and ortho-phosphate.

6) Approval for this parameter is based on review of SOPs only.

7) Approval is for Method 5035 medium-level (methanol extraction) method only.

Enclosed for your information is a copy of the Laboratory Inspection and Evaluation Report. Only radiological parameters were evaluated during the on-site inspection. Your laboratory has responded to the deficiencies as noted in the report. No further responses are necessary.

Approval for chemical parameters was previously established and was based on acceptable past performance, successful analysis of the National Environmental Laboratory Accreditation Conference Proficiency Testing samples and review of SOPs and laboratory Quality Management documentation. Approval for radiological parameters is based on review of the laboratory's SOPs; the results of the laboratory inspection, the Corrective Action Report, and the laboratory's analysis of Performance Evaluation samples from commercial suppliers and for the DOE Quality Assessment Program (QAP). The evaluation, which was conducted for your facility, is based substantially on ISO Guide 25 (General Requirements for the Competence of Testing Laboratories) and USACE Engineering Manual (EM) 200-1-3, Appendix I (Shell for Analytical Chemistry Requirements). The period of validation has been previously established and expires on September 14, 2006.

The USACE reserves the right to conduct additional laboratory inspections or to suspend validation status for any or all of the listed parameters if deemed necessary. It should be noted that your laboratory may not subcontract USACE analytical work to any other laboratory location without the approval of this office. This laboratory validation does not guarantee the delivery of any analytical samples from a USACE Contracting Officer Representative.

Any questions or comments can be directed to Dr. Jan Dunker at (402) 697-2566.

Sincerely,

for Marcia C. Davies, Ph.D.
Director, USACE Hazardous,
Toxic and Radioactive Waste
Center of Expertise

Enclosure

APPENDIX J

NMED SOIL SCREENING LEVELS, REVISION 4.0, JUNE 2006

Appendix A

State of New Mexico Soil Screening Levels

Table A-1 provides State of New Mexico Soil Screening Levels (SSLs), as developed by the New Mexico Environment Department (NMED) Hazardous Waste Bureau (HWB) and the Ground Water Quality Bureau Voluntary Remediation Program for 208 chemicals most commonly associated with environmental releases within the state. These NMED SSLs are derived using default exposure parameter values (as presented in Table A-2) and chemical- and State of New Mexico-specific physical parameters (as presented in Table B-1 of Appendix B). These default values are assumed to be appropriately conservative in the face of uncertainty and are likely to be protective for the majority of site conditions relevant to soil exposures within New Mexico.

However, the NMED SSLs are not necessarily protective of all known human exposure pathways, reasonable land uses or ecological threats. Thus, before applying NMED SSLs at a site, it is extremely important to compare the conceptual site model (CSM) with the assumptions upon which the NMED SSLs are predicated to ensure that the site conditions and exposure pathways match those used to develop the NMED SSLs. If this comparison indicates that the site at issue is more complex than the corresponding SSL scenarios, or that there are significant exposure pathways not accounted for by the NMED SSLs, then the NMED SSLs are insufficient for use in a defensible assessment of the site. A more detailed site-specific approach will be necessary to evaluate the additional pathways or site conditions.

Table A-1

Column 1:	The first column in Table A-1 presents the names of the chemicals for which NMED has developed SSLs.
Column 2:	The second column presents NMED SSLs predicated on residential soil exposures.
Column 3, 5, 7, and 10:	These columns present indicator categories for the NMED SSL residential, industrial, construction, and tap water basis, whether predicated on carcinogenic effects (ca), noncarcinogenic effects (nc), soil saturation limits (sat) or a non-risk based "max" determination. NMED SSLs predicated on a carcinogenic endpoint reflect age-adjusted child-to-adult exposures. NMED SSLs predicated on a noncarcinogenic endpoint reflect child-only exposures. Detected concentrations above the "sat" value may indicate the presence of nonaqueous phase liquid (NAPL). For certain inorganic and semivolatile organic compounds (SVOCs) that exhibit relatively low toxicity, a non risk-based maximum concentration of 10^5 mg/kg is given when the risk-based SSL exceeds that level. These are noted as "max" in the tables.
Columns 4 and 6:	The fourth and sixth columns present NMED SSLs analogous to Column 1, with the exception that these values correspond to Industrial/Occupational and Construction worker (adult-only) exposures, respectively.
Columns 5 and 7:	The fifth and seventh columns present endpoint bases analogous to Column 3

for the Industrial/Occupational and Construction worker receptor populations, respectively. Unlike the Residential population, noncarcinogenic endpoint notes for these receptor populations are predicated on adult-only exposures.

Column 8: The eighth column notes which chemicals are considered VOCs (for inhalation considerations). Those chemicals not considered VOCs are evaluated within the SSLs relative to inhalation of particulate emissions.

Column 9: Presents the tap water SSL for the residential scenario.

Columns 11 and 12: The ninth column presents NMED SSLs for the migration to groundwater pathway developed using a default dilution attenuation factor (DAF) of 1, which assumes no effective dilution or attenuation. These values can be considered at sites where little or no dilution or attenuation of soil leachate concentrations is expected (e.g., shallow water tables, karst topography). Column 10 presents NMED SSLs for the migration to groundwater pathway developed using a DAF of 20 to account for natural processes that reduce contaminant concentrations in the subsurface.

As noted above, separate NMED SSLs are presented for use in evaluating three discrete potential receptor populations: Residential, Industrial/Occupational, and Construction. Each NMED SSL considers incidental ingestion of soil, inhalation of volatiles (limited to those chemicals noted as volatile organic compounds [VOCs] within Table A-1) or particulate emissions from impacted soil, and dermal contact with soil.

Generally, if a contaminant is detected at a level in soil exceeding the most relevant NMED SSL, and the site-specific CSM is in general agreement with the underlying assumptions upon which the NMED SSLs are predicated, this result indicates the potential for adverse human health effects to occur. Conversely, if no contaminants are detected above the most relevant NMED SSL, this tends to indicate to the user that environmental conditions may not necessitate remedial action of the surface soil or the vadose zone.

A detection above an NMED SSL does not indicate that unacceptable exposures are, in fact, occurring. The NMED SSLs are predicated on relatively conservative exposure assumptions and an exceedance only tends to indicate the potential for adverse effects. The NMED SSLs do not account for additive exposures, whether for carcinogenic or noncarcinogenic endpoints. Section 5 of Part A addresses a methodology by which an environmental manager may determine whether further site-evaluation is warranted, however, this methodology does not replace the need for defensible risk assessment where indicated.

The NMED SSLs address a basic subset of exposures fundamental to the widest array of environmentally-impacted sites within the State of New Mexico. The NMED SSLs cannot address all relevant exposure pathways associated with all sites. The utility of the NMED SSLs depends heavily upon the understanding of site conditions as accurately reflected in the CSM and nature and extent of contamination determinations. Consideration of the NMED SSLs does not preclude the need for site-specific risk assessment in all instances.

Table A-1: NMED Soil Screening Levels

Chemical	Residential Soil (mg/kg)	End-point	Industrial/ Occupational Soil (mg/kg)	End-point	Construction Worker Soil (mg/kg)	End-point	VOC	Tap Water (ug/L)	End-point	DAF 1 (mg/kg)	DAF 20 (mg/kg)
Acenaphthene	3.73E+03	nc	3.35E+04	nc	1.41E+04	nc	x	3.65E+02	nc	2.75E+00	5.49E+01
Acetaldehyde	1.06E+02	nc	3.84E+02	nc	3.45E+02	nc	x	1.72E+01	ca		
Acetone	2.81E+04	nc	1.00E+05	max	9.85E+04	nc	x	5.48E+03	nc	9.55E-01	1.91E+01
Acrylonitrile	4.27E+00	ca	1.26E+01	ca	5.75E+01	nc	x	3.81E-01	ca	6.68E-05	1.34E-03
Acetophenone	1.48E+03	sat	1.48E+03	sat	1.48E+03	sat	x	6.08E+02	nc	1.48E-01	2.95E+00
Acrolein	2.06E-01	nc	7.52E-01	nc	6.75E-01	nc	x	4.16E-02	nc	8.55E-06	1.71E-04
Aldrin	2.84E-01	ca	1.12E+00	ca	6.99E+00	nc		3.87E-02	ca	1.42E-01	2.84E+00
Aluminum	7.78E+04	nc	1.00E+05	max	1.44E+04	nc		3.65E+04	nc	5.48E+04	1.10E+06
Anthracene	2.20E+04	nc	1.00E+05	max	8.60E+04	nc	x	1.83E+03	nc	8.11E+01	1.62E+03
Antimony	3.13E+01	nc	4.54E+02	nc	1.24E+02	nc		1.46E+01	nc	6.61E-01	1.32E+01
Arsenic	3.90E+00	ca	1.77E+01	ca	8.52E+01	nc		4.42E-01	ca	1.45E-02	2.90E-01
Barium	1.56E+04	nc	1.00E+05	max	6.02E+04	nc		7.30E+03	nc	3.01E+02	6.03E+03
Benzene	1.03E+01	ca	2.58E+01	ca	1.74E+02	nc	x	3.49E+00	ca	1.00E-03	2.01E-02
Benzidine	2.11E-02	ca	8.33E-02	ca	7.09E-01	ca		2.89E-03	ca	1.24E-05	2.47E-04
Benzo(a)anthracene	6.21E+00	ca	2.34E+01	ca	2.12E+02	ca		9.09E-01	ca	5.43E-01	1.09E+01
Benzo(a)pyrene	6.21E-01	ca	2.34E+00	ca	2.12E+01	ca		9.09E-02	ca	1.39E-01	2.78E+00
Benzo(b)fluoranthene	6.21E+00	ca	2.34E+01	ca	2.12E+02	ca		9.09E-01	ca	1.68E+00	3.35E+01
Benzo(k)fluoranthene	6.21E+01	ca	2.34E+02	ca	2.12E+03	ca		9.09E+00	ca	1.68E+01	3.35E+02
Beryllium	1.56E+02	nc	2.25E+03	nc	5.62E+01	nc		7.30E+01	nc	5.77E+01	1.15E+03
a-BHC (HCH)	9.02E-01	ca	3.99E+00	ca	3.00E+01	ca		1.05E-01	ca	2.13E-04	4.25E-03
b-BHC (HCH)	3.16E+00	ca	1.40E+01	ca	5.39E+01	nc		3.69E-01	ca	7.61E-04	1.52E-02
g-BHC	4.37E+00	ca	1.93E+01	ca	8.09E+01	nc		5.10E-01	ca	9.08E-04	1.82E-02
1,1-Biphenyl	3.08E+03	nc	2.73E+04	nc	1.17E+04	nc	x	3.04E+02	nc	3.61E+00	7.22E+01
Bis(2-chloroethyl) ether	2.44E+00	ca	7.45E+00	ca	1.05E+02	ca	x	9.65E-02	ca	2.77E-05	5.55E-04
Bis(2-chloroisopropyl) ether	3.87E+01	ca	1.19E+02	ca	4.53E+02	sat	x	2.71E+00	ca	7.21E-04	1.44E-02
Bis(2-ethylhexyl) phthalate	3.47E+02	ca	1.37E+03	ca	4.66E+03	nc		4.74E+01	ca	1.07E+03	2.15E+04
Bis(chloromethyl) ether	4.72E-03	ca	1.23E-02	ca	2.32E-01	ca	x	5.09E-04	ca	8.95E-08	1.79E-06
Boron	1.56E+04	nc	1.00E+05	max	3.09E+04	nc		7.30E+03	nc	2.40E+01	4.80E+02
Bromobenzene	3.70E+01	nc	1.37E+02	nc	1.21E+02	nc	x	2.06E+01	nc	1.07E-02	2.14E-01
Bromodichloromethane	1.44E+01	ca	3.72E+01	ca	7.17E+02	ca	x	1.78E+00	ca	5.90E-04	1.18E-02

Chemical	Residential Soil (mg/kg)	End-point	Industrial/ Occupational Soil (mg/kg)	End-point	Construction Worker Soil (mg/kg)	End-point	VOC	Tap Water (ug/L)	End-point	DAF 1 (mg/kg)	DAF 20 (mg/kg)
Bromomethane	8.51E+00	nc	3.28E+01	nc	2.82E+01	nc	x	8.66E+00	nc	1.87E-03	3.74E-02
1,3-Butadiene	9.93E-01	ca	2.38E+00	ca	4.59E+00	nc	x	1.26E+00	ca		
2-Butanone (MEK)	3.18E+04	nc	4.87E+04	sat	4.87E+04	sat	x	7.06E+03	nc	1.27E+00	2.55E+01
tert-Butyl methyl ether (MTBE)	3.88E+02	ca	9.84E+02	ca	1.96E+04	ca	x	6.14E+01	ca		
n-Butylbenzene	6.21E+01	sat	6.21E+01	sat	6.21E+01	sat	x	6.08E+01	nc	2.70E-01	5.40E+00
sec-Butylbenzene	6.06E+01	sat	6.06E+01	sat	6.06E+01	sat	x	6.08E+01	nc	2.17E-01	4.33E+00
tert-Butylbenzene	1.06E+02	sat	1.06E+02	sat	1.06E+02	sat	x	6.08E+01	nc	2.15E-01	4.30E+00
Cadmium	3.90E+01	nc	5.64E+02	nc	1.54E+02	nc		1.83E+01	nc	1.37E+00	2.75E+01
Carbon disulfide	4.60E+02	sat	4.60E+02	sat	4.60E+02	sat	x	1.04E+03	nc	3.95E-01	7.89E+00
Carbon tetrachloride	3.47E+00	ca	8.64E+00	ca	1.80E+02	ca	x	1.69E+00	ca	9.74E-04	1.95E-02
Chlordane	1.62E+01	ca	7.19E+01	ca	1.30E+02	nc		1.90E+00	ca	3.42E-01	6.83E+00
2-Chloroacetophenone	4.25E-02	nc	1.62E-01	nc	1.41E-01	nc	x	5.22E-02	nc	4.37E-05	8.75E-04
2-Chloro-1,3-butadiene	6.32E+00	nc	2.30E+01	nc	2.06E+01	nc	x	1.43E+01	nc	5.66E-03	1.13E-01
1-Chloro-1,1-difluoroethane	2.11E+02	sat	2.11E+02	sat	2.11E+02	sat	x	8.66E+04	nc	6.28E+01	1.26E+03
Chlorobenzene	1.94E+02	nc	2.45E+02	sat	2.45E+02	sat	x	1.06E+02	nc	5.50E-02	1.10E+00
1-Chlorobutane	1.22E+02	nc	2.99E+02	sat	2.99E+02	sat	x	2.43E+02	nc	9.63E-02	1.93E+00
Chlorodifluoromethane	2.11E+02	sat	2.11E+02	sat	2.11E+02	sat	x	9.75E+04	nc	7.07E+01	1.41E+03
Chloroethane	6.33E+01	ca	1.54E+02	ca	1.42E+03	sat	x	3.81E+01	ca	9.41E-03	1.88E-01
Chloroform	4.00E+00	ca	9.59E+00	ca	2.16E+02	ca	x	1.65E+00	ca	4.12E-04	8.25E-03
Chloromethane	2.18E+01	ca	5.34E+01	ca	2.84E+02	nc	x	1.49E+01	ca	5.02E-03	1.00E-01
b-Chloronaphthalene	3.99E+03	nc	2.78E+04	nc	1.47E+04	nc	x	4.87E+02	nc	1.25E+00	2.51E+01
o-Chloronitrobenzene	1.49E+00	nc	5.48E+00	nc	4.88E+00	nc	x	1.45E-01	nc	3.94E-05	7.88E-04
p-Chloronitrobenzene	1.05E+01	nc	4.23E+01	nc	3.51E+01	nc	x	1.20E+00	nc	3.25E-04	6.51E-03
2-Chlorophenol	1.66E+02	nc	8.85E+02	nc	5.86E+02	nc	x	3.04E+01	nc	2.36E-02	4.72E-01
2-Chloropropane	2.83E+02	nc	7.05E+02	sat	7.05E+02	sat	x	1.76E+02	nc	4.60E-02	9.19E-01
o-Chlorotoluene	2.02E+02	sat	2.02E+02	sat	2.02E+02	sat	x	1.22E+02	nc	5.22E-02	1.04E+00
Chromium III	1.00E+05	max	1.00E+05	max	1.00E+05	max		5.48E+04	nc	9.86E+07	1.97E+09
Chromium VI	2.34E+02	nc	3.40E+03	nc	2.61E+01	ca		1.10E+02	nc	2.10E+00	4.20E+01
Chrysene	6.15E+02	ca	2.31E+03	ca	2.12E+04	ca	x	2.91E+01	ca	1.74E+01	3.48E+02
Cobalt	1.52E+03	nc	2.05E+04	nc	6.10E+01	nc		7.30E+02	nc	3.31E+01	6.61E+02
Copper	3.13E+03	nc	4.54E+04	nc	1.24E+04	nc		1.46E+03	nc	5.15E+01	1.03E+03
Crotonaldehyde	7.01E-02	ca	1.70E-01	ca	3.73E+00	ca	x	5.82E-02	ca	1.49E-04	2.99E-03

Chemical	Residential Soil (mg/kg)	End-point	Industrial/ Occupational Soil (mg/kg)	End-point	Construction Worker Soil (mg/kg)	End-point	VOC	Tap Water (ug/L)	End-point	DAF 1 (mg/kg)	DAF 20 (mg/kg)
Cumene (isopropylbenzene)	2.71E+02	nc	3.89E+02	sat	3.89E+02	sat	x	6.78E+02	nc	4.10E+00	8.21E+01
Cyanide	1.22E+03	nc	1.37E+04	nc	4.76E+03	nc		7.30E+02	nc	7.35E+00	1.47E+02
Cyanogen	1.71E+03	sat	1.71E+03	sat	1.71E+03	sat	x	1.46E+03	nc	2.91E-01	5.82E+00
Cyanogen bromide	2.02E+03	sat	2.02E+03	sat	2.02E+03	sat	x	3.29E+03	nc	7.76E-01	1.55E+01
Cyanogen chloride	2.02E+03	sat	2.02E+03	sat	2.02E+03	sat	x	1.83E+03	nc	4.31E-01	8.62E+00
DDD	2.44E+01	ca	1.11E+02	ca	8.07E+02	ca		2.77E+00	ca	4.15E+00	8.30E+01
DDE	1.72E+01	ca	7.81E+01	ca	5.70E+02	ca		1.95E+00	ca	1.31E+01	2.62E+02
DDT	1.72E+01	ca	7.81E+01	ca	1.38E+02	nc		1.95E+00	ca	7.70E+00	1.54E+02
Dibenz(a,h)anthracene	6.21E-01	ca	2.34E+00	ca	2.12E+01	ca		9.09E-02	ca	5.18E-01	1.04E+01
Dibenzofuran	1.42E+02	nc	1.62E+03	nc	5.52E+02	nc	x	1.22E+01	nc	1.44E-01	2.87E+00
1,2-Dibromo-3-chloropropane	1.84E+00	nc	9.68E+00	nc	6.48E+00	nc	x	3.47E-01	nc	1.49E-04	2.98E-03
Dibromochloromethane	1.48E+01	ca	3.95E+01	ca	7.16E+02	ca	x	1.32E+00	ca	3.58E-04	7.16E-03
1,2-Dibromoethane	5.04E-01	ca	1.31E+00	ca	2.48E+01	ca	x	5.53E-02	ca	1.20E-05	2.40E-04
1,4-Dichloro-2-butene	1.22E-01	ca	3.23E-01	ca	5.97E+00	ca	x	1.19E-02	ca	2.93E-06	5.87E-05
1,2-Dichlorobenzene	3.74E+01	sat	3.74E+01	sat	3.74E+01	sat	x	4.96E+01	nc	1.19E-02	2.37E-01
1,3-Dichlorobenzene	3.26E+01	nc	3.74E+01	sat	3.74E+01	sat	x	1.83E+01	nc	4.36E-03	8.73E-02
1,4-Dichlorobenzene	3.95E+01	ca	1.03E+02	ca	1.96E+03	ca	x	4.95E+00	ca	5.49E-03	1.10E-01
3,3-Dichlorobenzidine	1.08E+01	ca	4.26E+01	ca	3.63E+02	ca		1.47E+00	ca	1.86E-03	3.71E-02
Dichlorodifluoromethane	1.61E+02	nc	2.11E+02	sat	2.11E+02	sat	x	3.95E+02	nc	2.86E-01	5.72E+00
1,1-Dichloroethane	1.40E+03	nc	1.42E+03	sat	1.42E+03	sat	x	1.22E+03	nc	3.39E-01	6.79E+00
1,2-Dichloroethane	6.04E+00	ca	1.52E+01	ca	6.42E+01	nc	x	1.22E+00	ca	2.85E-04	5.71E-03
cis-1,2-Dichloroethene	7.65E+01	nc	3.00E+02	nc	2.54E+02	nc	x	6.08E+01	nc	1.49E-02	2.99E-01
trans-1,2-Dichloroethene	1.12E+02	nc	4.29E+02	nc	3.70E+02	nc	x	1.22E+02	nc	3.33E-02	6.67E-01
1,1-Dichloroethene	2.06E+02	nc	7.77E+02	nc	6.78E+02	nc	x	3.39E+02	nc	1.34E-01	2.68E+00
2,4-Dichlorophenol	1.83E+02	nc	2.05E+03	nc	6.99E+02	nc		1.10E+02	nc	4.31E-02	8.63E-01
1,2-Dichloropropane	6.00E+00	ca	1.49E+01	ca	3.33E+01	nc	x	1.63E+00	ca	4.10E-04	8.19E-03
1,3-Dichloropropene	1.20E+01	ca	3.17E+01	ca	8.98E+01	nc	x	3.90E+00	ca	1.16E-03	2.31E-02
Dicyclopentadiene	2.21E+01	nc	8.26E+01	nc	7.28E+01	nc	x	1.39E+01	nc	1.50E-02	3.00E-01
Dieldrin	3.04E-01	ca	1.20E+00	ca	1.02E+01	ca		4.15E-02	ca	1.34E-03	2.68E-02
Diethyl phthalate	4.89E+04	nc	1.00E+05	max	1.00E+05	max		2.92E+04	nc	1.77E+01	3.54E+02
Dimethyl phthalate	1.00E+05	max	1.00E+05	max	1.00E+05	max		3.65E+05	nc	8.36E+01	1.67E+03
Di-n-butyl phthalate	6.11E+03	nc	6.84E+04	nc	2.33E+04	nc		3.65E+03	nc	1.86E+02	3.72E+03

Chemical	Residential Soil (mg/kg)	End-point	Industrial/ Occupational Soil (mg/kg)	End-point	Construction Worker Soil (mg/kg)	End-point	VOC	Tap Water (ug/L)	End-point	DAF 1 (mg/kg)	DAF 20 (mg/kg)
2,4-Dimethylphenol	1.22E+03	nc	1.37E+04	nc	4.66E+03	nc		7.30E+02	nc	3.55E-01	7.11E+00
4,6-Dinitro-o-cresol	6.11E+00	nc	6.84E+01	nc	2.33E+01	nc		3.65E+00	nc	3.93E-03	7.85E-02
2,4-Dinitrophenol	1.22E+02	nc	1.37E+03	nc	4.66E+02	nc		7.30E+01	nc	5.25E-02	1.05E+00
2,4-Dinitrotoluene	1.22E+02	nc	1.37E+03	nc	4.66E+02	nc		7.30E+01	nc	2.31E-02	4.62E-01
1,2-Diphenylhydrazine	6.08E+00	ca	2.39E+01	ca	2.04E+02	ca		8.30E-01	ca	4.48E-03	8.95E-02
Endosulfan	3.67E+02	nc	4.10E+03	nc	1.40E+03	nc		2.19E+02	nc	7.41E-01	1.48E+01
Endrin	1.83E+01	nc	2.05E+02	nc	6.99E+01	nc		1.10E+01	nc	2.04E-01	4.08E+00
Epichlorohydrin	1.66E+01	nc	6.56E+01	nc	5.54E+01	nc	x	2.03E+00	nc	3.62E-04	7.25E-03
Ethyl acetate	2.10E+04	sat	2.10E+04	sat	2.10E+04	sat	x	5.48E+03	nc	1.44E+00	2.87E+01
Ethyl acrylate	2.79E+00	ca	6.75E+00	ca	5.22E+01	sat	x	2.30E+00	ca	5.86E-03	1.17E-01
Ethyl chloride	6.33E+01	ca	1.54E+02	ca	1.42E+03	sat	x	3.81E+01	ca	9.41E-03	1.88E-01
Ethyl ether	1.94E+03	sat	1.94E+03	sat	1.94E+03	sat	x	1.22E+03	nc	2.37E-01	4.73E+00
Ethyl methacrylate	5.27E+01	sat	5.27E+01	sat	5.27E+01	sat	x	5.48E+02	nc	1.41E+00	2.81E+01
Ethylbenzene	1.28E+02	sat	1.28E+02	sat	1.28E+02	sat	x	1.34E+03	nc	1.01E+00	2.02E+01
Ethylene oxide	2.65E+00	ca	8.07E+00	ca	1.15E+02	ca	x	2.41E-01	ca	4.27E-05	8.54E-04
Fluoranthene	2.29E+03	nc	2.44E+04	nc	8.73E+03	nc		1.46E+03	nc	2.35E+02	4.69E+03
Fluorene	2.66E+03	nc	2.65E+04	nc	1.02E+04	nc	x	2.43E+02	nc	2.93E+00	5.85E+01
Fluoride	3.67E+03	nc	4.10E+04	nc	1.43E+04	nc		2.19E+03	nc	3.29E+02	6.58E+03
Furan	5.53E+00	nc	2.12E+01	nc	1.83E+01	nc	x	6.08E+00	nc	1.32E-03	2.63E-02
Heptachlor	1.08E+00	ca	4.26E+00	ca	3.63E+01	ca		1.47E-01	ca	3.12E-01	6.24E+00
Hexachlorobenzene	3.04E+00	ca	1.20E+01	ca	1.02E+02	ca		4.15E-01	ca	3.43E-02	6.86E-01
Hexachloro-1,3-butadiene	1.22E+01	nc	1.37E+02	nc	4.66E+01	nc		7.30E+00	nc	5.90E-01	1.18E+01
Hexachlorocyclopentadiene	3.66E+02	nc	4.10E+03	nc	4.31E+02	nc		2.19E+02	nc	6.58E+01	1.32E+03
Hexachloroethane	6.11E+01	nc	6.84E+02	nc	2.33E+02	nc		3.65E+01	nc	1.04E-01	2.09E+00
n-Hexane	3.80E+01	sat	3.80E+01	sat	3.80E+01	sat	x	4.16E+02	nc	8.64E-01	1.73E+01
HMX	3.06E+03	nc	3.42E+04	nc	1.17E+04	nc		1.83E+03	nc	5.39E+00	1.08E+02
Hydrogen cyanide	2.24E+01	nc	8.22E+01	nc	7.33E+01	nc	x	6.20E+00	nc	1.24E-03	2.47E-02
Indeno(1,2,3-c,d)pyrene	6.21E+00	ca	2.34E+01	ca	2.12E+02	ca		9.09E-01	ca	4.73E+00	9.46E+01
Iron	2.35E+04	nc	1.00E+05	max	9.29E+04	nc		1.10E+04	nc	2.77E+02	5.54E+03
Isobutanol	1.38E+04	nc	2.26E+04	sat	2.26E+04	sat	x	1.83E+03	nc	4.86E-01	9.72E+00
Isophorone	5.12E+03	ca	2.02E+04	ca	4.66E+04	nc		6.99E+02	ca	1.70E-01	3.40E+00
Lead	4.00E+02	IEUBK	8.00E+02	IEUBK	8.00E+02	IEUBK					

Chemical	Residential Soil (mg/kg)	End-point	Industrial/ Occupational Soil (mg/kg)	End-point	Construction Worker Soil (mg/kg)	End-point	VOC	Tap Water (ug/L)	End-point	DAF 1 (mg/kg)	DAF 20 (mg/kg)
Lead (tetraethyl-)	6.11E-03	nc	6.84E-02	nc	2.38E-02	nc		3.65E-03	nc	6.33E-07	1.27E-05
Maleic hydrazide	1.61E+03	sat	1.61E+03	sat	1.61E+03	sat	x	3.04E+03	nc	8.12E-01	1.62E+01
Manganese	3.59E+03	nc	4.84E+04	nc	1.50E+02	nc		1.72E+03	nc	1.12E+02	2.24E+03
Mercury (elemental)	1.00E+05	max	1.00E+05	max	9.27E+02	nc				1.05E-01	2.09E-03
Mercury (methyl)	6.11E+00	nc	6.84E+01	nc	2.38E+01	nc		3.65E+00	nc	8.26E-04	1.65E-02
Methacrylonitrile	3.84E+00	nc	2.20E+01	nc	1.37E+01	nc	x	1.04E+00	nc	1.83E-04	3.65E-03
Methomyl	8.44E+01	nc	3.17E+02	nc	2.78E+02	nc	x	1.52E+02	nc	5.74E-02	1.15E+00
Methyl acetate	3.76E+04	nc	1.00E+05	max	1.00E+05	max	x	6.08E+03	nc	1.08E+00	2.15E+01
Methyl acrylate	9.28E+01	nc	1.57E+02	sat	1.57E+02	sat	x	1.83E+02	nc	4.64E-01	9.29E+00
Methyl isobutyl ketone	5.51E+03	nc	7.01E+03	sat	7.01E+03	sat	x	1.99E+03	nc	7.35E-01	1.47E+01
Methyl methacrylate	2.92E+03	sat	2.92E+03	sat	2.92E+03	sat	x	1.42E+03	nc	2.76E-01	5.52E+00
Methyl styrene (alpha)	2.17E+02	sat	2.17E+02	sat	2.17E+02	sat	x	4.26E+02	nc	3.08E-01	6.17E+00
Methyl styrene (mixture)	1.39E+02	nc	2.17E+02	sat	2.17E+02	sat	x	5.48E+01	nc	3.96E-02	7.93E-01
Methylcyclohexane	7.89E+01	sat	7.89E+01	sat	7.89E+01	sat	x	5.23E+03	nc	2.88E+01	5.77E+02
Methylene bromide	1.79E+02	nc	7.85E+02	nc	6.09E+02	nc	x	6.08E+01	nc	2.72E-02	5.44E-01
Methylene chloride	1.82E+02	ca	4.90E+02	ca	2.63E+03	sat	x	4.22E+01	ca	8.51E-03	1.70E-01
Molybdenum	3.91E+02	nc	5.68E+03	nc	1.55E+03	nc		1.83E+02	nc	3.70E+00	7.40E+01
Naphthalene	7.95E+01	nc	3.00E+02	nc	2.62E+02	nc	x	6.20E+00	nc	1.97E-02	3.94E-01
Nickel	1.56E+03	nc	2.27E+04	nc	6.19E+03	nc		7.30E+02	nc	4.77E+01	9.53E+02
Nitrate	1.00E+05	max	1.00E+05	max	1.00E+05	max		5.84E+04	nc	1.67E+01	3.35E+02
Nitrite	7.82E+03	nc	1.00E+05	max	3.10E+04	nc		3.65E+03	nc	7.63E-01	1.53E+01
Nitrobenzene	2.28E+01	nc	1.47E+02	nc	8.28E+01	nc	x	3.40E+00	nc	9.18E-04	1.84E-02
Nitroglycerin	3.47E+02	ca	1.37E+03	ca	1.17E+04	ca		4.74E+01	ca	2.80E-02	5.61E-01
N-Nitrosodiethylamine	3.24E-02	ca	1.28E-01	ca	1.09E+00	ca		4.42E-03	ca	8.73E-06	1.75E-04
N-Nitrosodimethylamine	9.54E-02	ca	3.76E-01	ca	1.86E+00	nc		1.30E-02	ca	1.17E-05	2.34E-04
N-Nitrosodi-n-butylamine	2.69E-01	ca	7.28E-01	ca	1.24E+01	ca	x	1.99E-02	ca	1.12E-05	2.24E-04
N-Nitrosodiphenylamine	9.93E+02	ca	3.91E+03	ca	4.66E+03	nc		1.35E+02	ca	2.86E-01	5.71E+00
N-Nitrosopyrrolidine	2.32E+00	ca	9.12E+00	ca	7.77E+01	ca		3.16E-01	ca	1.30E-04	2.60E-03
m-Nitrotoluene	5.69E+02	sat	5.69E+02	sat	5.69E+02	sat	x	1.22E+02	nc	3.30E-02	6.59E-01
o-Nitrotoluene	1.08E+01	ca	3.23E+01	ca	4.73E+02	ca	x	4.81E-01	ca	1.30E-04	2.61E-03
p-Nitrotoluene	1.46E+02	ca	4.37E+02	ca	1.55E+03	nc	x	6.51E+00	ca	1.76E-03	3.53E-02
Pentachlorobenzene	4.89E+01	nc	5.47E+02	nc	1.86E+02	nc		2.92E+01	nc	9.37E-02	1.87E+00

Chemical	Residential Soil (mg/kg)	End-point	Industrial/ Occupational Soil (mg/kg)	End-point	Construction Worker Soil (mg/kg)	End-point	VOC	Tap Water (ug/L)	End-point	DAF 1 (mg/kg)	DAF 20 (mg/kg)
Pentachlorophenol	2.98E+01	ca	1.00E+02	ca	1.02E+03	ca		5.53E+00	ca	5.87E-03	1.17E-01
Phenanthrene	1.83E+03	nc	2.05E+04	nc	6.99E+03	nc		1.10E+03	nc	2.32E+01	4.64E+02
Phenol	1.83E+04	nc	1.00E+05	max	6.99E+04	nc		1.10E+04	nc	2.37E+00	4.74E+01
Polychlorinatedbiphenyls											
Aroclor 1016	3.93E+00	nc	4.13E+01	nc	1.50E+01	nc		2.56E+00	nc	1.73E-01	3.45E+00
Aroclor 1221	1.12E+00	nc	8.26E+00	ca	4.28E+00	nc		3.32E-01	ca	2.24E-02	4.47E-01
Aroclor 1232	1.12E+00	nc	8.26E+00	ca	4.28E+00	nc		3.32E-01	ca	2.24E-02	4.47E-01
Aroclor 1242	1.12E+00	nc	8.26E+00	ca	4.28E+00	nc		3.32E-01	ca	2.24E-02	4.47E-01
Aroclor 1248	1.12E+00	nc	8.26E+00	ca	4.28E+00	nc		3.32E-01	ca	2.64E-01	5.28E+00
Aroclor 1254	1.12E+00	nc	8.26E+00	ca	4.28E+00	nc		3.32E-01	ca	2.64E-01	5.28E+00
Aroclor 1260	1.12E+00	nc	8.26E+00	ca	4.28E+00	nc		3.32E-01	ca	2.64E-01	5.28E+00
n-Propylbenzene	6.21E+01	sat	6.21E+01	sat	6.21E+01	sat	x	6.08E+01	nc	2.70E-01	5.40E+00
Propylene oxide	2.22E+01	ca	9.33E+01	ca	7.92E+02	nc	x	2.18E+00	ca	4.60E-04	9.20E-03
Pyrene	2.29E+03	nc	3.09E+04	nc	9.01E+03	nc	x	1.83E+02	nc	1.86E+01	3.73E+02
RDX	4.42E+01	ca	1.74E+02	ca	6.99E+02	nc		6.03E+00	ca	1.68E-03	3.36E-02
Selenium	3.91E+02	nc	5.68E+03	nc	1.55E+03	nc		1.83E+02	nc	9.52E-01	1.90E+01
Silver	3.91E+02	nc	5.68E+03	nc	1.55E+03	nc		1.83E+02	nc	1.57E+00	3.13E+01
Strontium	4.69E+04	nc	1.00E+05	max	1.00E+05	max		2.19E+04	nc	7.73E+02	1.55E+04
Styrene	1.00E+02	sat	1.00E+02	sat	1.00E+02	sat	x	1.62E+03	nc	5.23E-01	1.05E+01
1,2,4,5-Tetrachlorobenzene	1.83E+01	nc	2.05E+02	nc	6.99E+01	nc		1.10E+01	nc	2.14E-02	4.29E-01
1,1,1,2-Tetrachloroethane	4.32E+01	ca	1.14E+02	ca	2.11E+03	ca	x	4.27E+00	ca	1.25E-03	2.50E-02
1,1,2,2-Tetrachloroethane	5.55E+00	ca	1.46E+01	ca	2.71E+02	ca	x	5.46E-01	ca	1.60E-04	3.21E-03
Tetrachloroethene	1.25E+01	ca	3.16E+01	ca	1.34E+02	sat	x	4.32E+00	ca	2.87E-03	5.74E-02
Thallium	5.16E+00	nc	7.49E+01	nc	2.04E+01	nc		2.41E+00	nc	1.72E-01	3.43E+00
Toluene	2.52E+02	sat	2.52E+02	sat	2.52E+02	sat	x	2.27E+03	nc	1.08E+00	2.17E+01
Toxaphene	4.42E+00	ca	1.74E+01	ca	1.48E+02	ca		6.03E-01	ca	2.33E-01	4.65E+00
Tribromomethane	6.21E+02	ca	2.46E+03	ca	4.44E+03	nc		2.44E+01	ca	1.73E-01	3.47E+00
1,1,2-Trichloro-1,2,2-trifluoroethane	3.28E+03	sat	3.28E+03	sat	3.28E+03	sat	x	5.92E+04	nc	1.68E+02	3.36E+03
1,2,4-Trichlorobenzene	6.93E+01	nc	2.69E+02	nc	2.30E+02	nc	x	7.16E+00	nc	2.04E-02	4.08E-01
1,1,1-Trichloroethane	5.63E+02	sat	5.63E+02	sat	5.63E+02	sat	x	3.17E+03	nc	1.33E+00	2.65E+01
1,1,2-Trichloroethane	1.19E+01	ca	3.02E+01	ca	1.94E+02	nc	x	1.97E+00	ca	4.98E-04	9.95E-03
Trichloroethylene	6.38E-01	ca	1.56E+00	ca	3.36E+01	ca	x	2.77E-01	ca	1.00E-04	2.00E-03

Chemical	Residential Soil (mg/kg)	End-point	Industrial/ Occupational Soil (mg/kg)	End-point	Construction Worker Soil (mg/kg)	End-point	VOC	Tap Water (ug/L)	End-point	DAF 1 (mg/kg)	DAF 20 (mg/kg)
Trichlorofluoromethane	5.88E+02	nc	9.83E+02	sat	9.83E+02	sat	x	1.29E+03	nc	1.12E+00	2.23E+01
2,4,5-Trichlorophenol	6.11E+03	nc	6.84E+04	nc	2.33E+04	nc		3.65E+03	nc	7.13E+00	1.43E+02
2,4,6-Trichlorophenol	6.11E+00	nc	6.84E+01	nc	2.33E+01	nc		3.65E+00	nc	7.13E-03	1.43E-01
1,1,2-Trichloropropane	2.53E+01	nc	9.64E+01	nc	8.35E+01	nc	x	3.04E+01	nc	1.17E-02	2.35E-01
1,2,3-Trichloropropane	8.61E-02	ca	2.09E-01	ca	4.57E+00	ca	x	5.53E-02	ca	2.07E-05	4.14E-04
1,2,3-Trichloropropene	1.21E+00	nc	4.39E+00	nc	3.95E+00	nc	x	2.10E+00	nc	7.88E-04	1.58E-02
Triethylamine	4.90E+01	nc	2.33E+02	nc	1.69E+02	nc	x	1.21E+01	nc	2.14E-03	4.29E-02
1,2,4-Trimethylbenzene	5.80E+01	nc	2.13E+02	nc	1.90E+02	nc	x	1.23E+01	nc	7.09E-02	1.42E+00
1,3,5-Trimethylbenzene	2.48E+01	nc	6.92E+01	sat	6.92E+01	sat	x	1.23E+01	nc	1.77E-02	3.55E-01
2,4,6-Trinitrotoluene	3.06E+01	nc	3.42E+02	nc	1.17E+02	nc		1.83E+01	nc	5.34E-02	1.07E+00
Vanadium	7.82E+01	nc	1.14E+03	nc	3.10E+02	nc		3.65E+01	nc	3.65E+01	7.30E+02
Vinyl acetate	1.07E+03	nc	3.68E+03	sat	3.52E+03	nc	x	4.12E+02	nc	7.57E-02	1.51E+00
Vinyl bromide	2.85E+00	ca	6.84E+00	ca	1.93E+01	nc	x	1.18E+00	ca	4.71E-04	9.41E-03
Vinyl chloride (Child)	2.25E+00	ca					x	4.28E-01	ca	1.40E-04	2.80E-03
Vinyl chloride (adult)	4.37E+00	ca	1.40E+01	ca	1.82E+02	ca	x	8.33E-01	ca	2.72E-04	5.45E-03
m-Xylene	8.20E+01	sat	8.20E+01	sat	8.20E+01	sat	x	2.03E+02	nc	1.03E-01	2.06E+00
o-Xylene	9.95E+01	sat	9.95E+01	sat	9.95E+01	sat	x	7.30E+03	nc	4.07E+00	8.14E+01
Xylenes	8.20E+01	sat	8.20E+01	sat	8.20E+01	sat	x	2.03E+02	nc	1.03E-01	2.06E+00
Zinc	2.35E+04	nc	1.00E+05	max	9.29E+04	nc		1.10E+04	nc	6.82E+02	1.36E+04

Table A-2

Default Exposure Factors

Symbol	Definition (units)	Default	Reference
CSF_o	Cancer slope factor oral $(mg/kg\text{-}day)^{-1}$	Chem.-spec.	IRIS, HEAST, or NCEA
CSF_i	Cancer slope factor inhaled $(mg/kg\text{-}day)^{-1}$	Chem.-spec.	IRIS, HEAST, or NCEA
RfD_o	Reference dose oral (mg/kg-day)	Chem.-spec.	IRIS, HEAST, or NCEA
RfD_i	Reference dose inhaled (mg/kg-day)	Chem.-spec.	IRIS, HEAST, or NCEA
TR	Target cancer risk	1E-05	NMED-specific value
THQ	Target hazard quotient	1	US EPA, 1989
BW	Body weight (kg)		
	-- adult	70	US EPA, 1989
	-- child	15	US EPA, 1991
AT	Averaging time (days)		
	-- carcinogens	25550	US EPA, 1989
	-- noncarcinogens	ED*365	
SA	Exposed surface area for soil/dust (cm^2/day)		US EPA, 1989
	– adult resident	5700	US EPA, 1996a
	– adult worker	3300	US EPA, 1996a
	-- child	2800	US EPA, 1989
AF	Adherence factor, soils (mg/cm^2)		US EPA, 1989
	– adult resident	0.07	US EPA, 1996a
	– adult worker	0.2	US EPA, 1996a
	-- child resident	0.2	US EPA, 1989
	– construction worker	0.3	NMED-specific value
ABS	Skin absorption defaults (unitless):		
	– semi-volatile organics	0.1	US EPA, 1989
	– volatile organics	na	US EPA, 2003a
	– inorganics	na	US EPA, 2000s
IRA	Inhalation rate (m^3/day)		
	-- adult resident	20	US EPA, 1991
	– adult worker	20	US EPA, 2001a
	-- child resident	10	Exposure Factors, (US EPA, 1997)
IRW	Drinking water ingestion rate (L/day)		
	-- adult	2	US EPA, 2004b
	-- child	1	US EPA, 2004b
IRS	Soil ingestion (mg/day)		
	-- adult resident	100	US EPA, 1991
	-- child resident	200	US EPA, 1991
	-- commercial/industrial worker	100	US EPA, 2001a
	construction worker	330	US EPA, 1991
EF	Exposure frequency (days/yr)		
	-- residential	350	US EPA, 1991
	-- commercial/industrial	225	US EPA, 2001a
	– construction worker	250	NMED-specific value
ED	Exposure duration (years)		
	-- residential	30[a]	US EPA, 1991)
	-- child	6	(US EPA, 1991)
	-- commercial/industrial	25	(US EPA, 1999)
	– construction worker	1	NMED-specific value
	Age-adjusted factors for carcinogens		
IFSadj	Ingestion factor, soils ([mg-yr]/[kg-day])	114	US EPA, 2001a
SFSadj	Dermal factor, soils ([mg-yr]/[kg-day])	361	US EPA, 2001a
InhFadj	Inhalation factor, air ([m^3-yr]/[kg-day])	11	By analogy to RAGS: Part B, (US EPA, 1991)
IFWadj	Ingestion factor, water ([L-yr]/[kg-day])	1.1	By analogy to RAGS: Part B, (US EPA, 1991)
PEF	Particulate emission factor (m^3/kg)	Chem.-spec.	US EPA, 2001a
VFs	Volatilization factor for soil (m^3/kg)	Chem.-spec.	US EPA, 2001a
VFw	Volatilization factor for water (L/m^3)	0.5	US EPA, 1991
Csat	Soil saturation concentration (mg/kg)	Chem.-spec.	US EPA, 2001a

[a]Exposure duration for lifetime residents is assumed to be 30 years total. For carcinogens, exposures are combined for children (6 years) and adults (24 years).

Chem.-spec.- Chemical-specific value
na - not applicable
RAGS – Risk Assessment Guidance for Superfund
IRIS – Integrated Risk Information System, USEPA, 2003b
HEAST – Health Effects Assessment Summary Tables, USEPA, 1997
NCEA – National Center for Environmental Assessment, Office of Research and Development (USEPA, 2003c)
NMED – New Mexico Environment Department