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Hazardous Waste Bureau

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12-26-2014 P02:02

New Mexico Environment Department
Attn: Mr. John Kieling, Chief
Hazardous Waste Bureau
2905 Rodeo Park Drive East, Building 1
Santa Fe NM

Dear Mr. Kieling

Holloman Air Force Base is pleased to submit the Supplemental Information your office requested regarding SWMU 183 in MS Word and Excel formats on the enclosed CD for your review.

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

If you have any questions, please contact me at (575) 572-3931 or by e-mail at deanna.rothhaupt@holloman.af.mil.

Sincerely

DEANNA ROTHHAUPT, GS-12, DAFC

Attachment:
Supplemental Information on SWMU 183 in electronic format (CD)

cc:
(w/CD)
Mr. David Strasser
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5500 San Antonio Dr, NE
Albuquerque NM 87109-4127

FINAL
RCRA FACILITY INVESTIGATION REPORT
SWMU 183 – BASEWIDE SEWER SYSTEM
HOLLOMAN AIR FORCE BASE, NEW MEXICO

Prepared for:

49 CES/CEAN
Holloman Air Force Base
New Mexico

Under Contract to:

U.S. Army Corps of Engineers-
Albuquerque District
HTRW Branch
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FINAL
RCRA FACILITY INVESTIGATION REPORT
SWMU 183 – BASEWIDE SEWER SYSTEM
HOLLOMAN AIR FORCE BASE, NEW MEXICO

TABLE OF CONTENTS

Figures

Plates

Tables

Attachments

Appendices

LIST OF ACRONYMS

AAF	Army Air Field
AFFF	Aqueous film-forming foam
amsl	Above mean sea level
AOC	Area of Concern
bgs	Below ground surface
Bhate	Bhate Environmental Associates, Inc.
BOD	Biological oxygen demand
°C	Degrees Celsius
CCD	Customer Concept Document
CES/ CEAN	Civil Engineering Squadron/ Environmental Asset Management Flight
COD	Chemical oxygen demand
COPC	Chemicals of potential concern
CSM	Conceptual Site Model
%D	Percent Difference
DPT	Direct push technology
DQO	Data quality objectives
DRO	Diesel Range Organics
EA	Environmental Assessment
EGM	Earth Gravitational Model
ERP	Environmental Restoration Program
°F	Degrees Fahrenheit
ft	Feet/foot
FWENC	Foster Wheeler Environmental Corporation
gpd	Gallons per day
GPS	Global Positioning System
GRO	Gasoline Range Organics
HAFB	Holloman Air Force Base
HASP	Health and Safety Plan
HHMSSL	Human Health Medium Specific Screening Level
IDW	Investigation Derived Waste
I/I	Infiltration and Inflow
ICS	Interference Check Sample
ICV	Initial Calibration Verification
IWPMP	Industrial Wastewater Pretreatment Management Plan
J	Data Qualifier (denotes an estimated value)
LCS	Laboratory Control Sample
LOC	Lines of Concern
M	Data Qualifier (denotes a manually integrated compound)
MCL	Maximum Contaminant Level
MDC	Minimum Detectable Concentration
MDL	Method detection limit
MFH	Military Family Housing
µg/L	Micrograms per liter

MGD	Million Gallons per Day
mg/kg	Milligrams per kilogram
mg/L	Milligrams per liter
NTU	Nephelometric Turbidity Unit
NAD	North American Datum
NFA	No Further Action
NGA	National Geospatial-Intelligence Agency
NMAC	New Mexico Administrative Code
NMED	New Mexico Environment Department
NMWQCC	New Mexico Water Quality Control Commission
NMWRRS	New Mexico Water Rights Reporting System
NPDES	National Pollutant Discharge Elimination System Permit
ORO	Oil Range Organics
OSD	Office of the Secretary of Defense
OWS	Oil Water Separator
PCB	Polychlorinated Biphenyl
pCi/g	Pico-curies per gram
PDS	Post Digestate Spike
pH	Potential of Hydrogen (measurement of acidity)
PID	Photoionization detector
POL	Petroleum, Oil, and Lubricants
PRG	Preliminary Remediation Goal
PVC	Polyvinyl chloride
QA	Quality Assurance
QAPP	Quality Assurance Project Plan
QC	Quality Control
%R	Percent Recovery
RBC	Risk Based Concentration
RCRA	Resource Conservation Recovery Act
RFI	RCRA Facility Investigation
RI	Remedial Investigation
RL	Reporting Limit
RPD	Relative Percent Difference
RSL	Regional Screening Level
SAP	Sampling and Analysis Plan
SO_2	Sulfur Dioxide
SOP	Standard Operating Procedure
SSLs	Soil Screening Levels
SVOC	Semi-volatile organic compound
SWMU	Solid Waste Management Unit
TAL	Target Analyte List
TCE	Trichloroethylene
TDS	Total dissolved solids
TPH	Total petroleum hydrocarbons
TSS	Total suspended solids

USACE	United States Army Corps of Engineers
USAF	United States Air Force
USDA	United States Department of Agriculture
USEPA	United States Environmental Protection Agency
UTL	Upper Tolerance Limit
VOC	Volatile organic compound
WRCC	Western Regional Climate Center
WWTP	Wastewater Treatment Plant

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1 INTRODUCTION

This Resource Conservation and Recovery Act (RCRA) Facility Investigation (RFI) Report was prepared for the Holloman Air Force Base (HAFB) 49th Civil Engineering Squadron/Environmental Asset Management Flight (CES/CEAN) by NationView, LLC under U.S. Army Corps of Engineers (USACE), Albuquerque District Contract No. W912PL-07-D-0050, Delivery Order No. DM01. This report presents the results of the Solid Waste Management Unit (SWMU) 183 RFI performed by NationView between April 20 and August 13, 2010. SWMU 183 (Basewide Sewer System) is listed in Table A of the HAFB Hazardous Waste Facility Permit (No. NM6572124422), Appendix 4-A (New Mexico Environment Department [NMED], 2005), which requires the site to be investigated and undergo corrective action if warranted.

The SWMU 183 RFI field work was conducted in accordance with the *Final RCRA Facility Investigation Work Plan SWMU 183 – Basewide Sewer System, Holloman Air Force Base, New Mexico* (NationView, 2009) and the RFI requirements set forth in the HAFB Hazardous Waste Facility Permit No. NM6572124422, Appendix 4-B (NMED, 2004a). The Final SWMU 183 Work Plan (NationView, 2009) was revised to include deficiencies outlined by the NMED in correspondence dated May 14, 2009, and was approved by the NMED on March 26, 2010 (Attachment A). The preparation and submittal of this RFI Report was substantially delayed at the request of the NMED until the background concentration of metals at HAFB could be finalized (NMED, 2011).

1.1 Investigation Objectives

The purpose of the SWMU 183 RFI was to obtain site-specific data to identify and characterize potential releases from the HAFB basewide sewer system. The primary project objectives of the SWMU 183 RFI were to:

1. Identify locations where releases to the environment from the sewer system have occurred,
2. Characterize the nature and extent of contaminants of concern in identified releases to soil and/or groundwater,
3. Collect sufficient analytical data to complete a site specific risk assessment to determine the affect of releases on human health and/or the environment, and
4. Collect the proper data to meet the data quality objectives (DQOs) to support a No Further Action (NFA) Status under NFA Criterion 5 and obtain a Class III permit modification to remove this site from Table A of the HAFB Hazardous Waste Facility Permit No. NM6572124422.

1.2 Report Organization

This RFI Report is organized according to the format suggested in Appendix 4-B of the RFI Report Requirements found in the HAFB Permit (NMED, 2004a). The document contains the following nine sections:

- Section 1 – Introduction
- Section 2 – Site Background
- Section 3 – Environmental Setting
- Section 4 – Conceptual Site Model
- Section 5 – RFI Field Activities
- Section 6 – Laboratory Analysis and Data Validation Summary
- Section 7– Nature and Extent of Contamination
- Section 8 – Conclusions and Recommendations
- Section 9 – References

The tables and figures referenced throughout this RFI Report are included following the text (after Section 9). This report also includes the following attachments and appendices:

- Attachment A – NMED Correspondence
- Attachment B – Variance Form
- Appendix A – Historical Data from Previous Investigations
- Appendix B – Soil Boring Logs
- Appendix C – Monitoring Well Construction Diagrams
- Appendix D – Monitoring Well Development Forms
- Appendix E – Monitoring Well Sample Collection Forms
- Appendix F – Analytical Data Packages (Provided on Enclosed CD)
- Appendix G – Data Validation Reports

2 SITE BACKGROUND

2.1 HAFB Facility Description and Operational History

HAFB is located in south central New Mexico, in the northwest central part of Otero County, approximately 75 miles north-northeast of El Paso, Texas (Figure 2-1). HAFB has a population of 6,000, and supports approximately 21,000 active-duty Air Force, National Guard, Air Force Reserve, retirees, civilians, and their family members. HAFB occupies approximately 60,000 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 is located approximately 7 miles east of the base and has a population of approximately 35,000.

HAFB was first established in 1942 as Alamogordo Army Air Field (AAF). From 1942 through 1945, Alamogordo AAF served as the training ground 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, conducting fighter aircraft training and operations. HAFB has also served as the German Air Force's Tactical Training Center since 1996.

2.2 SWMU 183 Site Description and Background

The following background information for the Holloman AFB Sewer System was obtained from the *Final Infiltration and Inflow Study Report, Volume I, Holloman Air Force Base* (Radian, 1998). The SWMU 183 – Basewide Sewer System (Figure 2-2) is unique in that, rather than being a waste management system of limited to moderate size in a singular physical location, it is a subsurface feature comprised of approximately 165,000 linear feet (ft) of sewer line (see Table 2-2, located in Appendix A-1) that serves the entire developed portions of the Base. In addition, the HAFB sewer system is divided into 10 Sub-Basins and includes 715 active and 131 inactive (abandoned and removed) manholes, 24 lift (pumping) stations, and hundreds of variably contributing sources distributed throughout the entire Base. The sources include direct discharges from industrial/operational facilities and domestic structures, as well as pass-through discharges from additional waste management systems such as oil/water separators (OWSs). The sewer collects and transports both sanitary and mixed industrial wastes to the Base's wastewater treatment plant (WWTP), which is located at the central-southern boundary of the Base (Figure 2-2). The sewer system was originally installed in 1947 and expanded to its current configuration as the Base was subsequently developed. In 1996, the 1.5 million gallon per day (gpd) WWTP was constructed and remains in service.

2.3 HAFB Industrial Activities and Waste Generation

The industrial operations facilities at HAFB historically produced a variety of wastes, many of which were discharged into the sewer system. Current waste discharges are conveyed to the HAFB WWTP. In a prior industrial wastewater pretreatment study (Ecology & Environment, 1998) the industrial wastewater discharges of 55 industrial facilities were assessed to identify what chemicals of potential concern (COPCs) were being introduced into the wastewater system. The study identified a number of COPCs, including:

- Volatile organic compounds (VOCs);
- Semi-volatile organic compounds (SVOCs);
- Petroleum, oil, and lubricants (POLs);
- Oil and grease;
- Heavy metals;
- Herbicides and pesticides;
- Total Suspended Solids (TSS);
- Biological oxygen demand (BOD) and chemical oxygen demand (COD);
- Phosphates, sulfides, and chlorides; and
- Possible radionuclides (Carbon-14, tritium, iodine 125, radium 226, and radium 228).

Common waste-generating activities included vehicle, aircraft, equipment, and floor washing; x-ray and photo processing; and fuel canister rinsing. Many of these facilities used pretreatment features such as grit chambers, grease traps, holding ponds, and OWSs before wastes were discharged into the sewer system. Table 1-7 in Appendix A-2 of this Report (from Ecology & Environment, 1998) presents a summary of the study results, including building name and number, waste flow type, average and maximum daily flow volumes, identified COPCs, and pretreatment systems existing at the time of the study. Plates 1 and 2 show the locations of all of the buildings identified as discharging COPCs into the sewer system, as well as the HAFB-designated Sewer Sub-Basins each is located within.

2.4 Previously Identified Contamination

The nature and extent of contamination resulting from any suspected or unknown releases from the sewer system has not been previously documented. As shown on Plates 1 and 2 there are three suspected sewer release areas located in Sub-Basins 5, 8, and 9. However, based on prior structural evaluations of the sewer, certain lengths of the sewer have been lined to improve the integrity of the sewer system. It is possible that releases to the environment may have occurred in sewer lines whose material of construction has been compromised.

2.5 Applicable Screening Criteria

The analytical data collected during this RFI was evaluated against all of the applicable regulatory screening criteria that are specified in Appendix 4-F *Action Levels and Cleanup Levels* of the Holloman AFB Hazardous Waste Permit No. NM6572124422 (NMED, 2004b). Soil and groundwater data evaluation consisted of a direct comparison to the applicable action level screening criteria. The applicable screening criteria are presented in the RFI analytical data summary tables for the analytes and media of concern. The following sections present the regulatory criteria that was used to evaluate the analytical data generated from this investigation.

2.5.1 Soils

2.5.1.1 VOCs, SVOCs, Pesticides/Herbicides, PCBs, Perchlorate, and TAL Metals

The residential soil screening levels (SSLs) established in NMED's *Technical Background Document for Development of Soil Screening Levels Revision 5.0* (NMED, 2009) were used as the primary action levels for VOCs, SVOCs, pesticides/herbicides (Sub-Basin 4 only), polychlorinated biphenyls (PCBs), perchlorate (Sub-Basin 8 only), and target analyte list (TAL) metals. As per the HAFB Permit, Appendix 4-F V.1 (NMED, 2004b) if a NMED soil cleanup level has not been established for a particular COPC (e.g. 2-methylnapthalene) that constituent was compared to the U.S. Environmental Protection Agency (USEPA) Region 6 *Human Health Medium Specific Screening Level* (HHMSSL). It should be noted that, under an Interagency Agreement as an update of the USEPA Region 3 Risk Based Concentration (RBC) Table, Region 6 HHMSSL Table, and the Region 9 Preliminary Remediation Goal (PRG) Table; the Region 6 HHMSSLs have been combined into the Regional Screening Level (RSL) Table (USEPA, 2011). Additionally, all detected TAL metals were compared their NMED approved HAFB background levels (NMED, 2011).

2.5.1.2 Total Petroleum Hydrocarbons

The action levels for total petroleum hydrocarbons (TPH) were established in the *New Mexico Environment Department TPH Screening Guidelines* (NMED, 2006). However, since it was not known what type of petroleum hydrocarbon contamination was possibly present, the TPH screening guideline (residential direct exposure), for an unknown oil (800 milligrams per kilogram [mg/kg]) (Table 2b, NMED, 2006) were used as the action level for TPH concentrations (combined gasoline range organics [GRO], diesel range organics [DRO], and oil range organics [ORO]).

2.5.1.3 Radionuclides

Table A.1 of USEPA's *Soil Screening Guidance for Radionuclides: Technical Background Document* (USEPA, 2000), provides generic SSLs for 60 radionuclides in units of pico-curies per gram (pCi/g) and mg/kg, respectively. The values listed in the "Inhalation of Fugitive Dust" column of Table A.1 assume that no decay, dilution, or attenuation of contaminants will occur and have been developed assuming future residential land and related exposure scenarios; thus offering the most conservative values for these contaminants.

Given the historical use of radioactive materials at HAFB (Sub-Basins 8 and 9 only), the following isotopes may still be present in the subsurface: tritium, carbon 14, radium 226, and, radium 228. Although iodine 125 is reported to have been used at HAFB, it is likely that this isotope has degraded (via decay) to acceptable levels. This statement is based on the understanding that iodine 125 has not been used in approximately 30 years and that it is known to have a half-life of 60 days.

2.5.1.4 Nitrate, Sulfate, and Chloride

Detections of nitrate in soil samples were compared to the SSL (125,000 mg/kg) established in the NMED *Technical Background Document for Development of Soil Screening Levels* (NMED, 2009). Currently the NMED and USEPA Region 6 have not established soil clean up levels or SSLs for sulfate and chloride.

2.5.2 Groundwater

2.5.2.1 VOCs, SVOCs, Pesticides/Herbicides, PCBs, and TAL Metals

There are two applicable standards for groundwater: the New Mexico Water Quality Control Commission (NMWQCC) groundwater standards for contaminants (New Mexico Administrative Code [NMAC], 20.6.2.3103) and the USEPA's *National Primary Drinking Water Regulations* (USEPA, 2009) Maximum Contaminant Levels (MCLs). The lower of the two standards was used as action levels for VOCs, SVOCs, pesticides/herbicides, PCBs, and TAL metals detected in groundwater. Additionally, all detected TAL metals were compared to their respective NMED approved HAFB background levels (NMED, 2011).

2.5.2.2 Total Petroleum Hydrocarbons

The action levels for TPH were established in the *New Mexico Environment Department TPH Screening Guidelines* (NMED, 2006). The NMED TPH screening guideline for an unknown oil (50.0 milligrams per liter [mg/L]) was the action level to which total TPH concentrations (GRO, DRO, and ORO) detected in groundwater were compared (Table 2b, NMED, 2006).

2.5.2.3 Radionuclides

Table 2.3 of USEPA's *Soil Screening Guidance for Radionuclides: Technical Background Document* (USEPA, 2000), provides the Federal MCLs for 60 radionuclides in groundwater. The MCLs in Table 2.3 were obtained from Drinking Water Regulations and Health Advisories (USEPA, 1995). Note: it was not necessary to sample for radionuclides in groundwater as radionuclides were not detected above action levels in soil samples collected within Sub-Basins 8 and 9.

2.5.2.4 Nitrate, Sulfate, Chloride, and Total Dissolved Solids

There are three applicable standards for nitrate, sulfate, chloride, and total dissolved solids (TDS) detected in groundwater: NMWQCC groundwater standards for contaminants (NMAC 20.6.2.3103), the USEPA's *National Priority Drinking Water Regulations* (USEPA, 2009) MCLs (nitrate), and secondary MCLs (chloride, sulfate, and TDS). The lower of the standards was used as the action levels for nitrate, chloride, sulfate, and TDS. Additionally, sulfate and chloride was compared to their respective NMED approved HAFB background levels (NMED, 2011).

2.5.2.5 Perchlorate

As per the HAFB Hazardous Waste Facility Permit, Section III.1.2, NMED at this time, has adopted the USEPA drinking water reference dose as an interim groundwater clean up level. In December 2008, the USEPA issued an Interim Drinking Water Health Advisory for exposure to perchlorate of 15 micrograms per liter (µg/L) in water (USEPA, 2008), which was the action level for perchlorate detections in groundwater. Note: It was not necessary to sample for perchlorate in groundwater as perchlorate was not detected above the action level in the soil samples collected within Sub-Basin 8.

2.6 Summary of Interim Measures and Past Assessments

A number of past studies and removal actions have been performed in direct relation to SWMU 183 and its tributary systems, including:

- An industrial wastewater pretreatment survey,
- An inflow and infiltration study,
- RCRA Facility Investigation planning,
- An Environmental Assessment (EA) in support of a wastewater utility privatization, and
- OWS removals.

Each of these actions is described below.

2.6.1 Industrial Wastewater Pretreatment Study

An industrial wastewater pretreatment study was conducted on the sewer system in 1997 in support of developing an Industrial Wastewater Pretreatment Management Plan

(IWPMP) and Customer Concept Document (CCD) (Ecology & Environment, Inc, 1998). This study represents the most comprehensive understanding of the nature and likely source of various wastes historically discharged into the sewer, and therefore, served as a substantive guidance for the development of the focus and strategy of this RFI. The scope of the three-phase study was to:

1. Identify wastewater sources and COPCs from industrial activities at the base;
2. Develop a sampling and analysis plan (SAP) and associated Health and Safety Plan (HASP) for the purpose of collecting detailed industrial wastewater and treatment works characterization data, develop a Pollution Prevention Technical Report, and develop a Pretreatment Management Technical Report; and
3. Develop a Pre-Concept Analysis and Design, a CCD technical report, and environmental justification for the project.

Fifty-five industrial facilities, comprising approximately 80 buildings, were surveyed. Table 1-7 located in Appendix A-2 of this Report (Ecology & Environment, 1998) provides a summary of the actual results from the original basewide industrial wastewater pretreatment study.

2.6.2 Infiltration and Inflow Study

An infiltration and inflow (I/I) study was conducted on the HAFB sewer system in 1998 by Radian International, LLC (Radian) (Radian, 1998). Table 2-2 located in Appendix A-1 of this report presents a construction summary of the HAFB sewer system by Sub-Basin (from Radian, 1998). The purpose of the study was to determine if the base sanitary sewer system had excessive groundwater infiltration or stormwater inflow that could potentially cause regulatory noncompliance. Three phases of field work were conducted, including: 1) sewage flow, rainfall monitoring, and manhole inspections; 2) smoke testing, and; 3) TV inspection and dyed-water flooding.

The primary findings of the study were that some of the sewer system exhibited structural and hydraulic problems, but that "the most significant system problem appeared to be an excessive amount of steady inflow into the system." The following are summaries of the primary study findings pertinent to the physical condition of the sewer system as potentially relevant to this RFI:

2.6.2.1 Structural Condition

Although most of the active lines in the sewer system were determined to have been repaired or replaced, there were still a number of lines that were in critical and serious structural condition which needed to be addressed. Some sections of sewer line in the southern portion of the base could have been impacted by hydrogen sulfide generated in the lines and were corroded.

2.6.2.2 Hydraulic Condition

Some of the newer sewer lines were determined to be in good structural condition, but have poor hydraulics. Mismatched inverts, very low slopes, and sagging had all contributed to a buildup of debris in the lines. The majority of lines observed contained debris, some with accumulations of up to 30% of the pipe diameter. Despite this, most of the lines were determined to have sufficient capacity to convey the required flows. A minor number of lines were observed to exceed their capacity as evidenced by in-manhole surcharging (i.e., no surface discharge).

2.6.2.3 Steady Infiltration

Flow monitoring data indicated that approximately 542,000 gpd of steady I/I enters the sewer system. The average base flow measured (sewage generation rates not including I/I) for the facility was approximately 485,000 gpd. These data indicated that I/I volumes exceeded the average base flow, and was also greater than what was generally considered to be excessive. The majority of I/I to the system was determined to be groundwater capture via service lines and laterals located beneath the water table. This situation is most prevalent in the southeastern area of HAFB (main base area) where the depth to groundwater is relatively shallow (5 ft or less).

2.6.2.4 Stormwater Inflow and Infiltration

Radian identified approximately 30 sources of possible stormwater inflow during smoke testing conducted in select portions of the system. It was concluded that stormwater inflow at HAFB is not a significant concern due to the small amount of regional rainfall. Only four lines were found to exceed the line capacity following a large rainfall. Various information and data from these previous programs was used to develop the Initial Conceptual Site Model (CSM) (described in Section 5 of the *Final RCRA Facility Investigation Work Plan SWMU 183 – Basewide Sewer System, Holloman AFB, New Mexico* [NationView, 2009]).

2.6.3 RCRA Facility Investigation Planning

A Phase II RFI Work Plan was prepared in response to a USEPA policy issuance, wherein sewer systems were to be treated and characterized as SWMUs. As stated in the *Federal Register* (p. 30809, U.S. Government Printing Office, 1990), the USEPA defines a SWMU as "any discernible unit at which solid wastes have been placed at any time, irrespective of whether the unit was intended for the management of solid or hazardous waste. Such units include any area at a facility at which solid wastes have been routinely and systematically released." The RFI was intended to comply with the RCRA corrective action process wherein releases or potential releases from SWMUs were to be identified and, as necessary, characterized and remediated. The Phase II RFI Work Plan was developed in April 1995 (Foster Wheeler Environmental Corp., [FWENC]/Radian, 1995a).

In the work plan, HAFB's sanitary and industrial sewer lines that drain to the WWTP were referred to as SWMU 183. The storm sewer lines and the new WWTP, which began operation in July 1996, were not considered part of SWMU 183.

The Work Plan identified lines of concern (LOCs) as sewer line segments that met two criteria:

- Physical condition indicating that they may have leaked; and
- Location downgradient from a potential source of hazardous constituents connected directly to the sewer system.

Based on funding appropriation constraints, the Phase II RFI Work Plan was never implemented.

2.6.4 Environmental Assessment for Wastewater Utilities Privatization

In 2005, the Air Force evaluated the concept of selling the entire HAFB wastewater collection and treatment system to a non-Air Force entity. The purpose of the proposed action was to meet Congressional and Office of the Secretary of Defense (OSD) mandates regarding the privatization of non-combat military activities, including utilities.

The system proposed to be sold included all equipment, fixtures, right-of-way, and other improvements used in connection with the wastewater treatment system. The real property upon, under, or around the utility system was not to be included in the sale. The acquiring entity would have been required to provide all necessary labor, management, supervision, permits, equipment, supplies, materials, transportation, and any other incidental services for the complete ownership, operation, maintenance, repair, upgrades, and improvements to the wastewater treatment system.

The EA analyzed 10 resource areas for both the proposed action and the no action alternative. The resource areas included: physiography, geology, and topography; soils; water resources; biological resources; air quality; land use; socioeconomic conditions; and cultural resources.

The EA analysis concluded that, as long as the functioning of the HAFB wastewater collection and treatment system remained substantially the same, there would be no significant environmental impacts resulting from the proposed action. However, it was determined that the transfer of ownership of the system to a private or public entity might cause complex regulatory, economic, and/or mission impacts with significant and unacceptable levels of regulatory, economic, and technical risk.

Therefore, the No Action Alternative was recommended, and the wastewater utility system to date remains an Air Force asset.

2.6.5 OWS Removals

A series of investigations and corrective actions to remove OWSs have been conducted at HAFB since the mid-1990s. A chronology of the reports for previous OWS investigations and corrective actions conducted at HAFB is presented below:

- *Draft Final Phase I RCRA Facility Investigation Report, Table 2 Solid Waste Management Units, Holloman Air Force Base, New Mexico.* October 1994, Radian Corporation.
- *Draft Final RFI Report, Table 3 RCRA Facility Investigation, Holloman Air Force Base, New Mexico.* July 1995, Foster Wheeler Environmental Corporation and Radian Corporation.
- *Closure Report for Remediation of POL – Contaminated Sites and Oil/Water Separator Removals, Holloman Air Force Base, New Mexico. November 1995,* EBASCO Services, Inc., and Groundwater Technology Government Services, Inc.
- *Final Closure Report for Phase II Remediation of POL-Contaminated Sites and Oil/Water Separator and Waste Oil Tank Removals, Holloman Air Force Base, New Mexico*. July 1997, FWENC.
- *Final Closure Report Addendum for Phase II Remediation of POL-Contaminated Sites and Oil/Water Separator and Waste Oil Tank Removals, Holloman Air Force Base, New Mexico*, December 1997, FWENC.

These corrective actions have included removal of OWS units, removal and/or capping of associated piping, removal of contaminated soils, and replacing select OWS systems or connecting building discharges directly to the sewer system.

Each of the OWS systems are regulated RCRA SWMUs listed in the HAFB RCRA operating permit. Table 2-1 of this Report lists each of the 41 OWS SWMU sites and their current permitted status as per Tables A and B of the HAFB Hazardous Waste Facility Permit No. NM6572124422 (NMED, 2005).

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3 ENVIRONMENTAL SETTING

The following subsections present the environmental setting. This information was obtained primarily from the *Draft Final Remedial Investigation (RI) Report, Investigation, Study and Recommendation for 29 Waste Sites* (Radian, 1992), unless cited otherwise.

3.1 Physiography and Topography

HAFB is located within the Sacramento Mountains Physiographic Province on the western edge of the Sacramento Mountains. HAFB is approximately 60,000 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 within the Tularosa Basin, which is part of a 170 mile long structural depression. The boarding mountains rise abruptly to altitudes of 7,000 to 12,000 ft amsl. The San Andres Mountains bound the basin to the west (about 30 miles) with the Sacramento Mountains approximately 10 miles to the east. At its widest point, the basin is about 60 miles east to west and stretches approximately 150 miles north to south (Figure 2-1).

The Tularosa Basin is a closed basin that contains all of the surface flow within its boundaries. Surface runoff from the surrounding mountains has deposited alluvial fans on the interior of the plain. Around the base, the ground surface is undulating comprised of alluvial fan deposits, eolian dunes, and flat bottomed playas (pan shaped depressions carved by wind erosion). To the west of the Base lie the gypsum sand dune fields of the White Sands National Monument. A topographic map of the base is provided as Figure 3-1.

3.2 Surface Water and Hydrology

Within the boundaries of the Base, surface water runoff is controlled by several arroyos that trend to the southwest (Figure 3-2). Because of the high net evaporation of rainfall, there are no natural perennial streams within the boundary of HAFB. Intermittent streams and arroyos in the basin lowlands are important only during infrequent periods of heavy rainfall. The Tularosa Basin contains all of the surface flow within 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 Lost River Drainage Basin is the main drainage area within the boundaries of HAFB (Figure 3-2).

HAFB is dissected by several other 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 (Figure 3-2). 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.

Potable water is available from municipal wells along the margins of the basin with more saline water towards the center. The principal sources of potable water are located in a long narrow north-south trending area on the upslope sides of Tularosa and Alamogordo 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.

The hydrology of the southern portion of the Base (south of the wastewater treatment plant) is dominated by several manmade features that form a connected hydrologic system. The principal components of this system are: the stormwater drainage canal, Lagoon G, Lake Holloman, and Lake Stinky. In addition, there are both natural and constructed wetlands in this area, some of which are related to and dependent on the manmade surface water features.

HAFB currently generates under 1 million gallons per day (MGD) of wastewater. This effluent is eventually discharged to the stormwater drainage canal southwest of Lagoon G and north of Highway 70. A berm surrounding this lagoon prevents stormwater from flowing into the lagoon. The stormwater drainage canal starts at a point north of Lagoon G, and then extends southwest of the lagoon into Lake Holloman. The canal is about 2 ft wide and 1 mile long with an elevation change of about 5 ft between Lagoon G and Lake Holloman. The canal also receives effluent from Lagoon G.

Lake Holloman was created in 1965 to receive excess flow from the previous sewage treatment lagoon system. It was formed by the construction of a non-engineered earthen dam midway along an existing ephemeral lake (playa) that normally received runoff from HAFB. Lake Holloman receives water from the stormwater drainage canal, Lagoon G, and effluent from the WWTP. The amount of effluent going to Lake Holloman can be adjusted depending on the water requirements of Lagoon G and the constructed wetlands. The lake is in a state of dynamic equilibrium, rising and falling with seasonal and annual variations in runoff, local shallow groundwater, and treated effluent from the WWTP.

Lake Stinky encompasses as much as 35 acres of playa below Lake Holloman. This area represents a remnant of the original playa grassland present in the project area prior to the construction of the lagoon system for the original wastewater treatment system in 1948. Persistent seepage from Lake Holloman is sufficient to maintain a limited surface water expression in Lake Stinky, as well as a substantial growth of wetland vegetation (tamarisk and saltgrass) at the base of the dam separating Lake Stinky and Lake Holloman. During most years, total annual discharge to Lake Holloman is sufficient to result in overflow to Lake Stinky. On these occasions, Lake Stinky extends south from the dam through culverts underneath U.S. Highway 70/82 to encompass as much as 61 acres.

There are approximately 119 acres of jurisdictional wetlands on the main base (United States Air Force [USAF], 1996), the majority of which are located south of the WWTP near Lagoon G and Lake Holloman (79 acres). Some of these areas are fed partly by seepage from artificial impoundments (e.g., north end of Lake Stinky; west and south of Lagoon G). Others may have an independent existence, or be only slightly affected by the impoundments. These latter areas seem to be remnants of the wetlands that existed before the construction of the present system. Many of the wetlands located south of the WWTP are important foraging areas for resident and migrating birds and/or bats.

3.3 Regional Geology

The Tularosa Basin is the easternmost extension of the Basin and Range Providence of the western United States. The Basin and Range was created by Cenozoic extensional (normal) faulting of Precambrian- through Tertiary-age sedimentary and igneous rocks. The basin is a graben, or downthrown block, bounded by the upthrown fault blocks of the San Andres and Sacramento Mountains.

During the Permian period of the Paleozoic era (approximately 270 million years ago), southern New Mexico was covered by a shallow sea. Limestone and sandstone were deposited, forming thick sedimentary units. Toward the end of the Mesozoic era (approximately 70 million years ago), the major mountain building activities that formed the Rocky Mountains took place. During these events, southern New Mexico emerged from the ocean as the earth's crust upwarped gently in this region. During the Cenozoic era (beginning approximately 70 million years ago), basin and range formation was initiated in what is now the southwestern United States. Approximately 10 million years ago, Cenozoic faulting formed the graben structure known as the Tularosa Basin. During this process, arched portions of rock collapsed between large-scale, north-south trending faults. The Tularosa Basin is a central downthrown area, bounded on the east and west by fault block mountains. Bedded Permian strata can be seen along the faces of the Sacramento and San Andres Mountains. Permian limestones also occur west of HAFB in a low bedrock outcrop near Hurtz Spring. 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 limestone, dolomite, gravel, and other matter continue to flow into the basin. A generalized cross-section of the Tularosa Basin is shown in Figure 3-3.

As the Tularosa Basin is a bolson, which is a basin with no surface drainage outlet, sediments carried by surface water into a closed basin are bolson deposits. The overlying alluvium generally consists of unconsolidated gravels, sands, and clays. The bolson sediments within the Tularosa Basin are derived from the adjacent ranges as erosional deposits of limestone, dolomite, and gypsum. Coarser material is deposited at the base of the mountains while finer material is carrier to the basin's interior. The bolson fill deposits thin out from Alamogordo to less than 100 ft near Hurtz Spring. Bolson fill deposits are 8,000 ft thick or more in the central portion of the Tularosa Basin.

Near-surface geologic conditions at HAFB have been established during this and numerous other Environmental Restoration Program (ERP) investigations. The near-surface bolsom deposits at HAFB consist of sediments that are alluvial, eolian, and lacustrine in origin. 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 because the wind simultaneously reworks alluvial fan sediments and deposits gypsum sands resulting in an intermingling of the two sediment types. The playa, or lacustrine deposits, consist of medium to high plastic clay containing gypsum crystals and are contiguous with the alluvial fan and eolian deposits throughout HAFB. There has been the identification of stiff caliche layers, varying in thickness, at different areas of the Base. A generalized near surface cross-section for HAFB is shown on Figure 3-4.

3.4 Soils

The United States Department of Agriculture (USDA) Soil Conservation Service has identified two soil associations in the vicinity of HAFB; the Holloman-Gypsum Land-Yesum complex, and the Mead silty clay loam. The permeability of these horizons ranges from $4x10^{-4}$ to 1 $x10^{-3}$ centimeters per second. The distribution of soils in the vicinity of HAFB is depicted on Figure 3-5 (USDA, 1981).

The Holloman-Gypsum land-Yesum complex, 0 to 5 percent slopes soil consists of large areas of shallow and deep, well drained soils and areas of exposed gypsum. The Holloman soil makes up about 35 percent of the complex. Typically, the surface layer is light brown very fine sandy loam about 3 inches thick. The upper 13 inches of the substratum is pink very fine sandy loam that is very high in gypsum. Below that, the substratum is white gypsum to a depth of more than 60 inches. This soil is calcareous and mildly alkaline to moderately alkaline throughout. Permeability is moderate, and available water capacity is very low.

Gypsum land makes up about 30 percent of the Holloman-Gypsum land-Yesum complex, 0 to 5 percent slopes. Typically, less than 1 inch of very fine sandy loam overlies soft to hard, white gypsum. The deep Yesum very fine sandy loam makes up about 20 percent of the complex. Typically, the surface layer is light brown very fine sandy loam about 3 inches thick. The upper 9 inches of the substratum is light brown fine sandy loam that is very high in gypsum. Below that, the substratum is pink very fine sandy loam to a depth of more than 60 inches. The soil is calcareous throughout and is mildly alkaline. Permeability is moderate, and available water capacity is moderate. Many fine gypsum crystals are found throughout the profile.

The soil type located across the main drainage area for the installation is Mead silty clay loam, 0 to 1 percent slopes. This deep, poorly drained, nearly level soil is on outer fringes of alluvial fans. This soil formed in fine textured alluvium over lacustrine lake sediment. It is very high in salt content because of periodic flooding and poor drainage. Slopes are smooth and concave. Typically, the surface layer is reddish brown silty clay loam and clay loam about 5 inches thick. The substratum, to a depth of 48 inches, is light reddish brown clay that has a high content of salts. Below that, the substratum is lacustrine material of variable texture and color to a depth of more than 60 inches. Included with this soil are areas of Holloman soils and Gypsum land along the margins of the unit of steep, short gully sides and knolls. These inclusions make up about 15 percent of the map unit for this soil type. Individual areas are generally smaller than 10 acres. This soil is moderately calcareous throughout and is moderately to strongly alkaline. It has a layer of salt that is more soluble than gypsum. Permeability is very slow, and available water capacity is low.

3.5 Regional Hydrogeology

The majority (over 70 %) of the ERP Sites, SWMUs, and Areas of Concern (AOC) located across HAFB have groundwater monitoring wells containing water with an average TDS concentration greater than 10,000 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 NMWQCC limit as potable water (NMAC 20.6.2.3103) and thus, the groundwater beneath HAFB has been designated as unfit for human consumption. Likewise, USEPA guidelines (USEPA, 1986) have identified the groundwater as a Class IIIB water source, characterized by TDS concentrations exceeding 10,000 mg/L (therefore, the naturally occurring groundwater at HAFB is not regulated). Figure 3-6 shows the general groundwater flow direction at the Base. 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 (high total dissolved solids) toward the central portion of the basin and discharge areas.

The preponderance 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, the water table ranges from 5 to 50 ft below ground surface (bgs). Flow for the Base is generally towards the southwest with localized influences from the variations in the topography of the Base. The ground surface slopes at a slightly higher rate than the water table such that the depth to groundwater in the northern areas of the Base is comparably greater (25 to 40 ft bgs) than in the southern areas of the Base (less than 10 ft bgs). Near the arroyos, groundwater flows directly toward the surface drainage feature.

In addition, there are no potable water wells on HAFB. Potable water for the Base (Boles, Douglas, and San Andreas well fields) and the city of Alamogordo is derived from the foot of the nearby Sacramento Mountains, just south of Alamogordo.

According to the a groundwater well inventory (Table 3-1) prepared by the New Mexico Office of the State Engineer, there are approximately 25 domestic, 15 commercial, 7 irrigation, and 3 livestock wells located within a 4-mile radius of Holloman AFB (New Mexico Water Rights Reporting System [NMWRRS] database, 2009). As shown on Figure 3-7 these wells are located along HAFB's northern and eastern boundaries (upgradient and cross gradient respectively).

3.6 Site Specific Geology and Hydrogeology

This section presents the site specific geology and hydrogeology for SWMU 183. As the sewer line traverses the majority of the Base, the site-specific geologic and hydrogeologic setting varies somewhat depending on the location of interest anywhere along its length.

3.6.1 SWMU 183 Geology

Site specific geologic information was obtained from the compilation of lithologic data obtained from the 61 soil borings drilled during Phase I and II of this RFI. The site-specific SWMU 183 geology can be generally described as follows:

- Five to six feet of brown or tan silty clays overlying a pink to tan gypsum clayey sand.
- A near surface dry silty sand overlying alternating beds of clayey silts (mottled with laterally discontinuous, dry, and very dense gypsum lenses and microcrystalline gypsum crystals) and thin silty sands to depths of 22 to 27 ft bgs where the capillary fringe is encountered. The clayey silt then continues to a dense silty sand layer at approximately 32 to 35 ft bgs.
- Seven to ten feet of low plasticity silt and silty sand overlying 5 to 15 ft of interbedded highly plastic silt and silty clays, overlying 7 to 15 ft of well sorted, fine grained sand with intermittent gypsum and clay layers. A dense basal silty clay is inconsistently present at approximately 40 to 45 ft bgs.
- Near surface deposits of low to medium plastic silt varying in thickness from 2 to 15 ft thick overlying a well sorted, very fine to fine grained sand interspersed with small clay, silty clay, and caliche lenses with gypsum crystals.
- Silty sands interbedded with clayey sands overlying a dense caliche layer overlying white fine grained sand layers at approximately 20 ft bgs which grades into a clayey silt interbedded with gypsum lenses and extends 20 to 25 ft to a water bearing silty sand at approximately 40 to 45 ft bgs.

Continuous lithologic logging was conducted for each borehole drilled in accordance with the Unified Soil Classification System. The borehole logs from this investigation are included in Appendix B of this Report.

3.6.2 SWMU 183 Hydrogeology

During the SWMU 183 Phase II investigation (July 14-15, 2010), nine monitoring wells (SWMU183-MW01 through SWMU183-MW09) were installed adjacent to the Phase I borehole locations which had soil samples with constituents that exceeded the current NMED soil screening criteria (see Section 2.5). As shown on Plate 2, the nine SWMU 183 monitoring wells are located within Sub-Basins 1, 4, and 10.

To determine the groundwater flow direction, and horizontal hydraulic gradient, groundwater elevations were measured at the nine monitoring wells comprising the SWMU 183 monitoring well network in August 2010. Groundwater onsite occurs in sands and silty sands in a shallow unconfined aquifer generally 3.16 to 10.43 ft bgs. Static water elevations in Sub-Basins 1, 4, and 10 ranged from 4,075.95 ft amsl at SWMU183-MW03 (Sub-Basin 4) to 4,033.28 ft amsl at SWMU183-MW08 (Sub-Basin 1). Tables 3-2 and 3-3 present the August 2010 groundwater elevation data and SWMU 183 monitoring well construction details, respectively. The well construction diagrams for this investigation are included in Appendix C of this report.

A potentiometric surface map of SWMU 183 was developed using the data collected in August 2010 (Figure 3-8). The SWMU 183 groundwater flow direction within Sub-Basins 1, 4 and 10 is generally toward the southwest, which is the general Basewide groundwater flow direction at Holloman AFB. The horizontal hydraulic gradient was calculated along the groundwater flow pattern within the SWMU 183 monitoring well network (within Sub-Basins 1, 4 and 10). The horizontal gradient for SWMU 183 is approximately 3.7×10^{-3} and was calculated using water levels obtained from monitoring wells SWMU183-MW03 (upgradient) and SWMU183-MW09 (downgradient).

3.7 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 are in the 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”. The annual rainfall for Alamogordo is 12 inches per year[1]. Much of the precipitation

[1] http://countrystudies.us/united-states/weather/new-mexico/

falls during the mid-summer monsoonal period (July and August) as brief, yet frequent, intense thunderstorms culminating to 30 to 40% of the annual total rainfall.

3.8 Current and Future Land Use

The land surrounding HAFB consists of residential areas to the east and northeast (City of Alamogordo), rangeland to the south, the White Sands National Monument to the west, and areas where military activities are conducted to the north. The desert terrain of the area immediately surrounding HAFB has limited development, and there are no agricultural operations, residential communities, or large industrial operations located adjacent to the Base. HAFB is an active military installation and is expected to remain active for the foreseeable future. No transfer of military property to the public is anticipated, and public access to the Base is restricted (FWENC, 2002).

Residential development on the Base is limited by environmental and operational constraints imposed by the 100-year floodplain, historic sites, and areas identified under the Installation Restoration Program. Safety and noise zones also limit residential development on HAFB. Future plans for residential development on the Base include renovation of existing structures, replacement of inefficient buildings, and expansion into open areas in the southeast corner of the Base (HAFB, 2000). Future land use is not expected to differ significantly from current land use practices (FWENC, 2002).

3.9 Current and Future Water Use

At present, the primary fresh water resource for the City of Alamogordo and HAFB is Lake Bonita, 60 miles northeast of the Tularosa Basin. Currently, there are no potable supplies of groundwater or surface water located on the Base. HAFB obtains its water supply from the City of Alamogordo and the HAFB wells in the Boles, San Andreas, and Douglas well fields at the base of the Sacramento Mountains. No water supply wells are located on or near the Base because of poor groundwater quality (TDS greater than 10,000 mg/L).

4 CONCEPTUAL SITE MODEL

4.1 CSM Development

The previous sections have presented a summary of the previous assessments conducted on the HAFB sewer system (SWMU 183), the environmental setting, and COPCs. A conceptual site model provides a convenient format to compile all the relevant data and provides an overall understanding of the site. It is an important communication tool for regulators, responsible parties, and stakeholders. The Initial CSM development efforts were used to create the following summary description, as well as Figure 4-1, a detailed 3-dimensional representation of the CSM.

4.2 CSM Summary Description

SWMU 183 is a subsurface sewer system that serves the developed portions of the approximately 60,000-acre property comprising HAFB. The system is comprised of:

- Approximately 165,000 linear feet of sewer line constructed of various materials,
- 715 active and 131 inactive (abandoned/removed) manholes,
- 24 lift (pumping) stations and force mains,
- 17 wash racks,
- 18 active and 23 inactive oil/water separators (as shown in Table 2-1),
- WWTP, and
- Hundreds of variably contributing sources distributed throughout the entire Base, including discharges from 55 operational facilities as well as domestic structures.

Although the WWTP is part of the sewer system, it is regulated under a separate NPDES permit, and therefore, is not part of SWMU 183. The WWTP was designed for flows of 1.5 MGD and has experienced actual flows of approximately 1.0 MGD. The operations-related contribution to the sewer is estimated at 58,000 gpd or 6% of the total flow. Flows attributable to the permanent and commuter populations (sanitary waste) is estimated at 427,000 gpd or 42% of the total. Steady infiltration and inflow is estimated at 542,000 gpd or 52% of the total (Radian International, 1998).

4.3 The HAFB Sanitary Sewer System and Wastewater Treatment Plant

The HAFB sewer system was constructed in 1947 and serves both residential and industrial facilities. The system consists of approximately 165,000 linear ft of sewer lines that, on average, are located approximately 6 ft bgs. Based on groundwater and sewer invert elevations, the SWMU 183 sewer line is expected to be below the water table in the southern portion of the Base. While the HAFB systems also include stormwater lines and a WWTP located at the central-southern boundary of HAFB, SWMU 183 consists only of the sewer lines. SWMU 183 is a unique solid waste management unit because it is large, laterally extensive, and receives wastes from numerous sources.

Wastewater collection and treatment for HAFB is provided for most of the base facilities. The sewer collection system contains a series of gravity collection mains, lift stations, and force mains which route the wastewater to WWTP. Septic systems serve the remaining base population. It is estimated that approximately 30 septic tanks remain in remote areas of the base.

Prior to the construction of the current WWTP in 1996, waste flowed into a collection box and was ground and screened before being pumped into treatment lagoons. The waste now enters the WWTP, which carries out screening, grit removal, flow measurement, aeration, secondary clarification, chlorine contact for effluent disinfection, dechlorination (through the use of sulfur dioxide [SO_2]), and effluent flow measurement. Solids handling facilities include aerobic sludge digesters and paved sludge drying beds. A septage disposal basin for the acceptance of waste from pumped septic tanks and/or portable toilets on the installation is also located at the WWTP. The wastewater treatment facility was designed for an average flow of 1.5 MGD. Treated effluent is discharged into Lake Holloman or nearby constructed wetlands.

4.4 SWMU 183 Soil and Groundwater Conditions

As the sewer system traverses the majority of HAFB, the site-specific geologic and hydrogeologic setting varies along its course. Site-specific discussion of soil and groundwater conditions present throughout the entire length of SWMU 183 are presented in Section 3.6 of this Report. Subsurface soil conditions along the sewer system generally consist of well sorted sands interbedded with silty sands and clays, with the occasional presence of caliche lenses. Depth to groundwater along the sewer system can be as great as 30 to 40 ft bgs in the northern areas of HAFB, and less than 5 ft bgs in the Main Base area. Groundwater flow direction 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.

4.5 Physical Condition of the Sewer System

Some sections of the SWMU 183 sewer lines remain from the original construction, but the majority of the sections have been lined, replaced, or abandoned within the past 20 years. The newer sewer lines consist of polyvinyl chloride (PVC) pipes, while the older sections consist of clay, concrete, or asbestos cement pipe. In addition to the replaced sections, still other sections have been added or modified in response to changes in the base population or use. The type and status of the sewer lines are shown on Plates 1 and 2.

4.6 Waste Characteristics

The HAFB sanitary sewer system and WWTP receive and treat domestic and industrial waste streams being discharged to the system. The sewer system has historically received a variety of chemical compounds from a diverse number of industrial and operational activities.

Table 4-1 provides a list of the chemicals known and or suspected to have been discharged to the sewer system based on the previous industrial pretreatment study (Ecology & Environment, 1998).

Table 4-2 provides a list of the types of wastewater generating processes known to have discharged COPCs into the sewer system (Ecology & Environment, 1998).

Table 1-7 in Appendix A-2 of this Report is the actual summary of results list from the industrial pretreatment study (Ecology & Environment, 1998). It lists the number and name of the 55 specific industrial buildings known to have discharged COPCs, their waste generation activities/processes, their average and maximum daily flow contributions (in gpd), the specific COPCs associated with each building, as well as the then existing pretreatment practices in use at each site. Each of the 55 buildings is also shown on Plates 1 and 2.

Some pretreatment practices are in place to minimize the hazardous waste entering the sewer system. These include OWSs, aqueous film-forming foam (AFFF) ponds, grit and sediment traps, and screens.

4.7 Suspected Sewer Release Locations

There are currently three areas within the HAFB sewer system where suspected releases are thought to have occurred due to reported breaks in the sewer line (shown on Plates 1 and 2).

The current and former Primate Research Institutes are located in Sub-Basins 8 and 9 of the HAFB sewer system respectively. Two sewer line collapses have been reported, downgradient of the facilities, along the main north-south trending sewer lines conveying effluent from both facilities. These sewer line collapse areas are presented on Plate 1 as Suspected Sewage Release Areas #1 and #2. COPCs which have historically been used at the current and former Primate Research Institutes include carbon-14, iodine-125, radium 226 and 228, tritium tracers, and solvents. These COPCs may have entered the sewer system at either or both facilities in the past (over 30 years ago), and subsequently been released into the subsurface at the collapsed sections.

Additionally, a third sewer line break reportedly occurred within the central portion of Sub-Basin 5 of the HAFB sewer system. This potential release location is labeled as the Suspected Sewer/Natural Gas Release Area on Plate 2. It is unknown what specific COPCs may have been discharged from this reported break.

4.8 Contaminants of Potential Concern

Common industrial/commercial activities (generating 6% of the total flows) which generate wastes discharged to the sewer system include:

- Vehicle, aircraft, equipment, and floor washing;
- Vehicle, aircraft, and equipment maintenance,
- X-ray and photo processing, and
- Fuel canister rinsing.

Many of the facilities generating the waste used pretreatment features such as grit chambers, grease traps, holding ponds, and OWSs before wastes were discharged into the sewer system. Classes of COPCs discharged to the sewer system include:

- VOCs
- SVOCs
- POLs
- Oil and grease
- Metals
- Herbicides and pesticides (Sub-Basin 4 only)
- Nitrate, sulfate, and chloride
- Radionuclides (Sub-Basins 8 and 9 only)
- Perchlorate (Sub-Basin 8 only)

Building 374, located in HAFB sewer system Sub-Basin 4 (Plate 2) was historically utilized as a pesticide and herbicide storage area. Past use of radionuclides (as tracers) has been documented at both the former and current Primate Research Institutes, located in HAFB sewer system Sub-Basins 8 and 9 respectively (Plate 1). Historical use of perchlorate has been documented at the Early Missile Test Site, Test Sled Maintenance Area, and the Test Sled Track located in the northern portion of HAFB within Sub-Basin 8 (Plate 1). As these COPCs are Sub-Basin specific (not basewide COPCs) the soil and groundwater samples collected from these Sub-Basins were tailored to include these additional analyses for their Sub-Basin specific suite of analyses (see Section 5.0 of this report for Sub-Basin specific sampling details).

4.8.1 Release Mechanisms

The contaminants listed above could be released from the sewer system through any of the following scenarios where the sewer line is above the elevation of the water table:

- Broken/cracked pipes in services, laterals, and/or mains;
- Corroded pipes in services, laterals, and/or mains;
- Defective joints in services, laterals, and/or mains;

- Defective connections in services, laterals, and/or mains;
- Defective OWS connections; and/or
- Defective manhole casings.

Where the sewer line is below the elevation of the water table, the gradient is inward from the aquifer to the sewer line and the contents of the sewer are not released to the environment. This condition results in the high degree of infiltration which characterizes the overall system in which 54% of the total flow results from infiltration. The infiltration occurs primarily in the southern part of the Base, particularly in the vicinity of the golf course and the Military Family Housing (MFH) area (Sub-Basins 1, 2, 4, 5, 6, and 10 [see Plate 2]). The depth to the water table is as little as 3 feet bgs in this area. In the northern portions of the base, the depth to the water table may be as great as 30 to 40 feet bgs.

Where the sewer line and associated features are located above the water table, liquids in the line may have leaked, or be currently leaking, out into soils and/or groundwater. These may be episodic events such as manholes being surcharged during storm events or pumping station failures; or they may be continual releases such as those occurring from cracked pipes. To the extent that the liquid in the sewer line contains COPCs, they will be released into the unsaturated zone soils at and below the elevation of the leak.

Any releases from the sewer system occur in the context of their location in the Tularosa Basin, which is geologically described as a bolson (an extensive, flat, alluvium-floored depression) into which drainage from the surrounding mountains flows toward a central playa. Water carrying eroded gypsum, limestone, dolomite, gravel, and other alluvial matter continues to flow into the basin with no route of exit.

4.8.2 Contaminant Fate and Transport

The nature of the subsequent fate and transport of COPCs is dependent on environmental conditions and the nature of the COPC. The most significant COPCs in terms of likely mass are VOCs, SVOCs, and inorganic compounds such as nitrate. VOCs are likely to be the most mobile COPCs and may travel further than other classes of COPCs. Metals, SVOCs, POLs, and oil and grease have a low degree of mobility in the subsurface. The presence of these classes of COPCs is likely to be limited to the soils in the vicinity of the leak.

The leaked liquids and the COPCs may reach groundwater, dependent on the size and duration of the release and the depth to groundwater. Once in groundwater the COPCs will travel in the direction of groundwater flow by advection and dispersion. The resultant plumes may be spread laterally and vertically only very slightly by dispersion. Plumes may migrate along the sewer line in a preferred pathway formed by the gravel pack and/or disturbed soils underlying the sewer. The plumes are very likely to be found near the water table, though they may plunge downward with distance from the source in response to displacement by infiltrating water and downward components of the hydraulic gradients where they occur.

Soil-gas contamination may result from the release of VOCs to the subsurface, both from the unsaturated zone and from groundwater plumes that occur within a few feet of the water table. These soil-gas plumes would then spread by diffusion and in response to pressure, temperature, and density gradients. Soil gas plumes, if they exist, would only pose a potential risk if they enter occupied structures.

4.8.3 Potential Exposure Pathways and Receptors

Potential exposure pathways which may be present onsite include dermal contact, and soil vapor inhalation to indoor air (via vapor intrusion) into occupied structures within close proximity to a release location. Potential human receptors include current and future; residents (child and adult), military/civilian workers, construction workers performing intrusive activities in the vicinity of the HAFB sewer system, vendors and service providers, and transient visitors. While groundwater is not locally extracted for use, human exposure to contaminants could result from inhalation of vapors from contaminated subsurface soil or groundwater.

4.9 Initial CSM Summary

This Section has presented a current conceptual understanding of the HAFB sewer system along with decision information requirements, status of information gathering, and actions required to obtain information. Figure 4-1 provides a 3-dimensional block diagram of the CSM as described in the previous paragraphs. The diagram presents a generalized rendering of the Site; examples of key Site features; local geology/hydrogeology; and inferred contaminant type, pathways, and distributions. The diagram is not to scale, nor does it fully or accurately depict actual Site features and conditions.

It is important to re-emphasize that the CSM provides an informed hypothesis or set of hypotheses about the Site, thus, actual conditions at the Site may vary significantly from those depicted in the block diagram.

5 RFI FIELD ACTIVITIES

The primary objectives of the SWMU 183 Basewide Sewer System RFI were threefold:

1. Identify potential releases to the subsurface soil at the most probable sewer line (below invert) locations (major junctions, pipeline material/diameter changes, and downgradient from known releases),
2. Identify potential releases to the groundwater by installing and sampling monitoring wells where COPCs were detected in soil samples which exceeded the applicable soil screening criteria (described in Section 2.5.1 of this report) to determine if the water quality has been impacted,
3. Collect sufficient analytical data to support a site-specific human health and ecological risk assessment (if required).

To meet these objectives, the SMWU 183 RFI was conducted in two Phases. The following Phase I and Phase II sampling activities were performed by NationView from April through August 2010.

5.1 Phase I Soil Borings – Sewer Release Determination

The Phase I investigation was conducted from April 20 through 26, 2010, and consisted of advancing 52 direct push technology (DPT) boreholes (SWMU183-DP01 through SWMU183-DP52) to collect subsurface soil samples. The soil borings were located throughout the entire HAFB sewer system (Sub-Basins 1 through 10). The locations of the Phase I soil borings are illustrated on Plates 1 and 2. In order to maximize the detection of COPCs, soil samples were collected immediately below the sewer line invert (9.4 ft bgs was the average depth) from each soil boring. As shown on Plates 1 and 2, the 52 DPT borehole locations were selected to provide a spatial distribution which encompassed the entire HAFB sewer system for each of the 10 Sub-Basins. The DPT borehole sampling locations were selected based on the following criteria:

- Major sewer pipe junctions
- Downgradient from suspected releases
- Downgradient from SWMUs with suspected or known releases
- Locations where two sewer lines with different diameters and/or construction material connect

Table 5-1 provides the sampling rationale for each of the 52 DPT borehole locations and indicates the historical condition of the sewer line throughout HAFB. The depth of the sewer line invert was determined by opening the nearest manhole and measuring the depth to the bottom of the sewer line. Phase I soil samples were analyzed by TestAmerica Laboratories, Inc., Arvada, Colorado for the following analyses:

- VOCs
- SVOCs

- TPH
- TAL Metals
- PCBs
- Nitrate
- Sulfate
- Chloride
- Moisture Content

Furthermore, Sub-Basins 4, 8, and 9 have unique COPCs that required additional sampling parameters. In addition to the analyses listed above the following analyses were included for Sub-Basins 4, 8, and 9:

- Pesticides and Herbicides (Sub-Basin 4 only)
- Radionuclides (Carbon-14, Tritium, Radium 226 and 228) (Sub-Basins 8 and 9 only) [analysis performed by TestAmerica Laboratories, Inc. in St. Louis, Missouri]
- Perchlorate (Sub-Basin 8 only)

A variance for relocating four DPT boreholes (SWMU183-DP11, SWMU183-DP17, SWMU183-DP42, and SWMU183-DP50) was executed during the performance of the Phase I SWMU 183 RFI. The following narrative provides the rationale for relocating these four boreholes. Soil boring SWMU183-DP11 was relocated as this borehole was originally located within the secured perimeter fence surrounding the 4th Space Control Squadron. Access within the secured perimeter is not possible; therefore the boring was moved to the nearest downgradient sewer pipe junction (MH478D) located outside of the secured perimeter. Borehole SWMU183-17 was relocated to the nearest downgradient manhole (MH405A) as the original location was located within the secured area of the West Ramp. Soil boring SWMU183-DP42 was relocated due to the close proximity of natural gas and water utility lines in the vicinity of MH281. For safety reasons the boring could not be drilled and sampled at this location. Therefore, SWMU183-DP42 was moved to the nearest downgradient sewer pipe junction (MH280) in order to satisfy the rationale established in Table 3-1 of the *Final RCRA Facility Investigation Work Plan SWMU 183 – Basewide Sewer System, Holloman Air Force Base, New Mexico* (NationView, 2009). Soil boring SWMU183-DP50 was relocated due to an active construction work zone along Bong Street. The active construction work zone prevented access to the original borehole location, therefore the boring was moved to the nearest accessible manhole (113532) outside the construction zone. A variance form for these four borehole relocations was completed on April 21, 2010, and is included in Attachment B of this report.

5.2 Phase II Monitoring Well Installation – Groundwater Impact Determination

The Phase II SWMU 183 RFI was conducted from July 14 through August 13, 2010. The Phase II investigation consisted of advancing nine DPT boreholes (SWMU183-DP53 through SWMU183-DP61) adjacent to the Phase I DPT borehole locations containing contaminant concentrations which exceeded the applicable soil screening criteria (DP-17, -18, -27, -30, -34, -35, -48, -51, and -52). As shown on Plate 2, the Phase II boreholes are located within Sub-Basins 1, 4, and 10. In order to determine the vertical extent of soil contamination, a soil sample was collected from the saturated zone in each Phase II borehole.

Additionally, each of the nine Phase II soil borings was converted into a permanent monitoring well (SWMU183-MW01 through SWMU183-MW09) to determine if there were any impacts to groundwater quality. All of the Phase II soil and groundwater samples were analyzed by Accutest Laboratories, Southeast, Orlando, Florida for the following analyses:

- VOCs
- SVOCs
- TPH
- TAL Metals
- PCBs
- Nitrate
- Sulfate
- Chloride
- Percent Solids (soil only)
- Pesticides and Herbicides (Sub-Basin 4 only)
- TDS (groundwater only)

Prior to sampling activities, a Base Dig Permit (AF Fm 103) with a utility clearance, was submitted and approved by the proper HAFB offices. All completed field and waste handling activities during the SWMU 183 investigation were performed in accordance with HAFB Standard Operating Procedures (SOPs), provided in the *Basewide Quality Assurance Project Plan* (Basewide QAPP) (Bhate Environmental Associates, Inc. [Bhate], 2003), as outlined in the *Final RCRA Facility Investigation Work Plan, SWMU 183 – Basewide Sewer System, Holloman Air Force Base, New Mexico* (NationView, 2009). Drilling procedures, subsurface soil sampling, monitoring well installation, development, and groundwater sampling are discussed in the following sections.

5.3 Subsurface Soil Sampling

During the Phase I investigation, 52 soil borings (SWMU183-DP01 through SWMU183-DP52) were advanced at critical junctions along 165,000 linear ft of sewer line within the

10 sub basins that comprise the HAFB sewer system (Plates 1 and 2). During the Phase II investigation, nine soil borings (SWMU183-DP53 through SWMU183-DP61) were advanced at the Phase I DPT borehole locations containing COPCs which exceeded the applicable soil screening criteria (Plate 2). All soil borings were advanced using a Geoprobe Systems® DT325 Dual Tube Sampling System (coring tool) in accordance with the Standard Operating Procedure *Geoprobe Systems® Technical Bulletin MK3138* (Geoprobe Systems®, 2006). Samples were collected from the DT325 tool for offsite laboratory analysis. The DT325 coring tool was advanced to a depth of approximately 2 ft below the sewer line invert (typically 8 to 10 ft bgs) to collect the Phase I soil samples for analysis. Additionally, the Phase II soil samples were collected from the saturated zone for analysis. One soil sample for chemical analysis was collected from each borehole during both the Phase I and Phase II investigations.

During soil sampling, the DT325 tool was removed from the ground and the clear PVC liner removed from the liner sheath at the ground surface. The liner was capped and marked with the depth on the top and bottom of the liner using an indelible pen. The borehole number was also written on the liner. The liner was then opened with a cutting tool and the samples were obtained for the lithologic log, headspace readings with a photoionization detector (PID), and offsite chemical analysis. Soil samples were placed in the appropriate containers, packed on ice at 4 degrees Celsius (ºC), and delivered under chain-of-custody to the designated laboratories. The soil boring logs for this RFI are included in Appendix B of this report. Table 5-2 presents a summary of the Phase I and II soil boring locations, sample intervals, and the soil samples (including the associated duplicate samples) which were collected for offsite analysis.

Additionally, the nine Phase II borings (SWMU183-DP53 through SWMU183-DP61) were converted into permanent monitoring wells (SWMU183-MW01 through SWMU183-MW09) following soil sampling activities (Plate 2). These soil borings were advanced to depths of 8.5 to 16 ft bgs. Soils from these borings were lithologically logged and screened with a PID via headspace analysis by a geologist.

5.4 Monitoring Well Installation and Development

As shown on Plate 2, nine soil borings were converted into permanent 1-inch diameter PVC monitoring wells (SWMU183-MW01 through SWMU183-MW09). Upon completion of soil sampling a 5 or 10 foot section of 0.010-inch slot pre-packed PVC well screen threaded to 1-inch PVC riser was lowered into the outer casing of the DPT tool string. As the DPT tool string was retracted from the borehole, 10/20 mesh silica sand was tremmied into the boring to a height of 2-ft above the top of the well screen to provide an additional sand filter pack for the monitoring well. Following placement of the sand filter pack, a 2-ft granular bentonite seal was installed above the sand filter pack and hydrated with potable water. Portland cement grout was then gravity fed into the borehole for the remaining well seal, extending to a height of 1-ft bgs. Monitoring wells SWMU183-MW01 through SWMU183-MW09 were completed at the ground surface with an 8-inch protective flush mount cover, and a 1-inch locking cap at the well head.

Monitoring well construction diagrams are provided in Appendix C and a summary of monitoring well construction details is included in Table 3-3.

Monitoring wells SWMU183-MW01 through SWMU183-MW09 were developed using a combination of surging and pumping. Prior to well development, a water-level measurement was taken at each well using an electronic water-level probe. This information, in addition to well depth, and well diameter, was used to calculate the volume of water in each well. Each newly installed monitoring well was surged in 2-to-3 foot intervals from the bottom of the screened interval to agitate and remove the fine grained sediment from the filter pack. At the completion of surging the groundwater was removed using a Geotech Geopump® Peristaltic Pump attached to ¼-inch polyethylene tubing. Development was performed by over-pumping the well until at least five well volumes had been removed, and the potential of Hydrogen (pH), turbidity, dissolved oxygen, specific conductivity, and temperature had stabilized by +/- 10 percent for at least three consecutive readings with a multi-parameter groundwater meter. Monitoring well development forms for each of the SWMU 183 monitoring wells are provided in Appendix D of this report.

5.5 Groundwater Sampling

In August 2010, groundwater samples were collected from the nine newly installed wells (SWMU183-MW01 through SWMU183-MW09) which are shown on Plate 2. Prior to sampling, groundwater levels were collected from each monitoring well and then the wells were purged using low flow purging techniques using a Peristaltic Pump, new dedicated ¼-inch polyethylene tubing, and a flow-thru cell. Field parameters were recorded for every well volume of groundwater removed. Field parameters were considered stable when the pH measurements remained constant within 0.1 units; specific conductivity, dissolved oxygen and temperature varied by no more than 10 percent, and turbidity by no more than 5 nephelometric turbidity units (NTU). Groundwater samples were not collected until three consecutive field parameter measurements met stabilization criteria. Appendix E provides monitoring well sample collection forms which contain the groundwater purging data recorded prior sample collection. Groundwater samples collected for VOC analysis were collected prior to other analytes, using a new disposable Teflon® bailer. Following the collection of samples for VOC analysis, groundwater samples for the remaining analytes (SVOCs, TPH, TAL Metal PCBs, Nitrate, Sulfate, Chloride, TDS, Pesticides and Herbicides [Sub-Basin 4 only]) were collected using a peristaltic pump and low-flow sampling techniques. Samples collected for TAL metals analysis were field filtered using dedicated 0.45 micron disposable filters. Groundwater samples were placed in the appropriate containers, packed on ice at 4 ºC, and delivered under chain-of-custody to Accutest Laboratories located Orlando, Florida.

5.5.1 Surveying

All of SWMU 183 RFI boreholes and monitoring wells were surveyed using a Trimble® Geometrics Pro XR global positioning system (GPS) in accordance with the methods described in the Basewide QAPP (Bhate, 2003). The horizontal locations (northing and easting coordinates) are relative to the State Plane Coordinate System New Mexico Central and surveyed to an accuracy of +/- 1.0 ft. Vertical elevations or orthometric heights (approximate heights amsl) were referenced to the National Geospatial-Intelligence Agency (NGA) geoid model (Earth Gravitational Model [EGM] 96). The top of casing (vertical control) was used to determine the depth and elevation of the groundwater and surveyed to an accuracy of +/- 0.01 ft. Table 3-2 summarizes the survey data and the depth to groundwater measurements and groundwater elevations collected in August 2010.

5.5.2 Equipment Decontamination

All drilling equipment associated with soil sampling (Geoprobe rod and tooling) was decontaminated in accordance with the HAFB SOPs provided in the Basewide QAPP (Bhate, 2003).

5.5.3 Waste Handling

All investigation derived waste (IDW) produced during the investigation process was handled in accordance with the HAFB SOPs provided in the Basewide QAPP (Bhate, 2003).

6 LABORATORY ANALYSIS AND DATA VALIDATION SUMMARY

This section presents the data validation summaries for the soil sampling and analysis of the SWMU 183 Sub-Basins conducted by NationView (April 2010) and the SWMU 183 Sub-Basins groundwater sampling and Phase II soil sampling completed by Nation View (August 2010).

6.1 SWMU 183 Sub-Basins RFI Investigation (April 2010)

The analysis of soil samples collected during the SWMU 183 investigation conducted in April 2010 followed the proposed methodologies presented in the *Final RCRA Facility Investigation Work Plan SWMU 183 – Basewide Sewer System, Holloman Air Force Base, New Mexico* (NationView, 2009). All analytical procedures followed the USEPA SW-846 protocol with the soil samples being analyzed in various combinations for the following:

- VOCs by USEPA Method 8260B
- SVOCs by USEPA Method 8270C
- TPH-GRO, DRO, and ORO by USEPA Method 8015B
- TAL Metals by USEPA Method 6010B/7471A
- PCBs by USEPA Method 8082
- Nitrate, Chloride, and Sulfate by USEPA Method 9056
- Pesticides by USEPA Method 8081A
- Herbicides by USEPA Method 8151A

And the following radiological analyses:

- Radium 226 by USEPA Method 903
- Radium 228 by USEPA Method 904
- Carbon 14 by Method EERF C-01-1
- Tritium by Method USEPA 906

All of the laboratory data generated as part of this project was validated by the project chemist. Field Quality Assurance (QA)/ Quality Control (QC) samples, including trip blanks, equipment blank, matrix spikes, and matrix spike duplicates were collected to document field and laboratory QA/QC. The analytical data packages are provided in Appendix F (on CD only) and the Data Validation Reports are provided in Appendix G of this report. TestAmerica in Arvada, Colorado performed the analysis of all samples collected with the exception of the radiological anlysese which was performed by TestAmerica in St. Louis, Missouri.

Overall, only minor QC issues were identified during the data validation of the laboratory results and the laboratory took all necessary corrective actions. All of the data were determined to be usable with only minor qualifications. Information regarding the precision, accuracy, representativeness, and completeness is provided in the validation reports (Appendix G) with the following sections providing a synopsis of each analyte group.

6.1.1 Volatile Organic Compounds

In laboratory package (280-2776-1), the initial calibration verification (ICV) exceeded control limits for acetone and was below control limits for 1,2,3-trichloropropane. 1,2,3-Trichloropropane was not detected in any of the associated samples and required no qualification. Acetone was detected in SWMU183-DP38-10 and the data was considered biased high. Therefore, it was qualified as estimated, "J".

Multiple samples were prepared outside hold time for the volatile analysis. Methylene chloride was detected in samples SWMU183-DP10-9, SWMU183-DP01-5, and SWMU183-DP20-14 and was qualified as estimated, "J".

The volatile surrogate 4-bromofluorobenzene yielded a percent recovery (%R) below QC limits for sample SWMU183-DP01-5. Using professional judgment, only the positive detection of methylene chloride was qualified as estimated, "J".

Methylene chloride was detected in various blanks between the method detection limit (MDL) and reporting limit (RL). Those samples that yielded detections greater than the RL were qualified as estimated, "J".

All the volatile surrogates in sample SWMU183-DP48-5 yielded %Rs below QC limits. Two volatile surrogates, toluene-d8 and 4-bromofluorobenzene, yielded %Rs below QC limits for the duplicate sample SWMU183-DP48-5-A. Therefore, all non-detected compounds were qualified as estimated non-detected, "UJ", and all positive detections were qualified as estimated, "J", in both samples.

The field duplicate and sample (SWMU183-DP38-10) yielded relative percent differences (RPDs) outside project defined control limits for carbon disulfide, cis-1,2-dichloroethene, and trans-1,2-dichloroethene. In addition, sec-butylbenzene yielded an RPD outside project specific control limits for sample SWMU183-DP48-5 and its duplicate. These compounds were qualified as estimated, "J", in both the sample and duplicate.

6.1.2 Semi-Volatile Organic Compounds

The RPD for bis(2-ethylhexyl)phthalate was outside project specific control limits for sample SWMU183-DP01-5 and its duplicate. This compound was qualified as estimated, "J", in the two samples.

Bis(2-ethylhexyl)phthalate was detected in multiple method blanks. All associated samples that yielded positive detections were qualified as estimated, “J”.

The LCS/LCSD, associated with various samples (in data package 280-2709-1), exhibited recoveries for 2,4-dinitrophenol and 4,6-dinitro-2-methylphenol below QC limits. The batch was re-extracted and re-analyzed outside hold time but with the LCS/LCSD recoveries in control. Both data sets were reported. For the purpose of validation, the first set of data was considered. Therefore, 2,4-dinitrophenol and 4,6-dinitro-2-methylphenol were qualified as estimated non-detected, “UJ”, in all samples.

Due to the similar retention time of benzo[b]fluoranthene and benzo[k]fluoranthene the two compounds could not be discerned in sample SWMU183-DP22-12. Therefore, the reported result of benzo[b]fluoranthene was likely a combination of the two compounds.

6.1.3 Total Petroleum Hydrocarbons

TPH-GRO and TPH-ORO were detected in various method blanks. Those associated samples which yielded positive detections were qualified as estimated, “J”.

The TPH-GRO surrogate recovery for a,a,a-trifluorotoluene was below QC limits in multiple samples. This compound was qualified as estimated, “J” or estimated non-detected, “UJ”.

The TPH-DRO & ORO surrogate recovery for o-terphenyl was below QC limits for sample SWMU183-DP13-8. These compounds were qualified as estimated non-detected, “UJ”, or estimated, “J”. This surrogate recovery was above QC limits for sample SWMU183-DP48-5-A. TPH-DRO and TPH-ORO yielded positive detections and were qualified as estimated, “J”.

The field duplicate and sample (SWMU183-DP38-10) yielded an RPD for TPH-ORO outside project defined control limits. TPH-GRO and TPH-DRO yielded RPDs outside project specific control limits for sample SWMU183-DP48-5 and its duplicate. These compounds were qualified as estimated, “J”, in both sample and duplicate.

6.1.4 TAL Metals

Various metals were detected in multiple method blanks. Those compounds greater than the RL were qualified as estimated, “J”.

The serial dilution for calcium yielded a percent difference (%D) outside control limits associated with multiple samples. Those samples with a calcium concentration >50 times the MDL were qualified as estimated, “J”.

For all samples, the cobalt, copper, manganese, nickel, vanadium, and zinc results were flagged by the laboratory and a comment was inserted in the case narrative to indicate that these compounds were >2 times the MDL in the interference check sample (ICS) due to trace impurities derived from the manufacturing process. The method blank associated with the majority of samples yielded detections for copper and/or manganese. Therefore, positive sample results for these two analytes were affected and subsequently qualified as estimated, “J” in the associated samples.

The field duplicate and sample (SWMU183-DP05-7.5) yielded RPDs for aluminum, beryllium, molybdenum, potassium, and zinc outside project defined control limits. The field duplicate and sample (SWMU183-DP38-10) yielded RPDs for aluminum, calcium, chromium, copper, iron, lead, magnesium, molybdenum, nickel, vanadium, zinc, barium, and mercury outside project defined control limits. Finally, aluminum, barium, chromium, cobalt, copper, iron, magnesium, manganese, molybdenum, nickel, potassium, vanadium, and zinc yielded RPDs outside project defined control limits for sample SWMU183-DP11-7 and its duplicate. These compounds were qualified as estimated, “J”, in both the sample and its duplicate.

6.1.5 Polychlorinated Biphenyls

No QC deficiencies warranted PCB data qualification.

6.1.6 Nitrate, Chloride, Sulfate

The hold time for the nitrate analysis of all soil samples was exceeded and all positive results were qualified as estimated, “J”.

The RPD for sulfate was outside project specific control limits for sample SWMU183-DP48-5 and its duplicate as well as for sample SWMU183-DP05-7.5 and its duplicate. The RPD for nitrate was outside project specific control limits for sample SWMU183-DP01-5 and its duplicate. These compounds were qualified as estimated, “J”, in both samples.

6.1.7 Pesticides

No QC deficiencies warranted pesticide data qualification.

6.1.8 Herbicides

No QC deficiencies warranted herbicide data qualification.

6.1.9 Radium 226/228

Radium 226 was detected in one method blank at a concentration greater than its minimum detectable concentration (MDC). Since all associated samples yielded activity greater than their respective MDCs the normalized absolute difference between the method blank and sample results was calculated. For samples SWMU183-DP06-11.5 and SWMU183-DP07-12, the normalized absolute difference indicated the method blank affected the sample results and Radium 226 was qualified as estimated, “J”.

6.1.10 Carbon 14

No QC deficiencies warranted Carbon 14 data qualification.

6.1.11 Tritium

No QC deficiencies warranted Tritium data qualification.

6.2 SWMU 183 Phase II Investigation (July/August 2010)

The analysis of soil and groundwater samples collected during the SWMU 183 Phase II soil sampling investigation and groundwater sampling and analysis conducted in July and August 2010 followed the proposed methodologies presented in the *Final RCRA Facility Investigation Work Plan SWMU 183 – Basewide Sewer System, Holloman Air Force Base, New Mexico* (NationView, 2009). All analytical procedures followed the USEPA SW-846 protocol with the groundwater and soil samples being analyzed in various combinations for the following:

- VOCs by USEPA Method 8260B
- SVOCs by USEPA Method 8270C
- TPH-GRO, -DRO, and -ORO by USEPA Method 8015
- TAL Metals by USEPA Method 6010B/7471A and 200.7/245.1
- PCBs by USEPA Method 8082
- Nitrate, Chloride, and Sulfate by USEPA Method 9056
- Pesticides by USEPA Method 8081A
- Herbicides by USEPA Method 8151A

The groundwater samples were also analyzed for:

- TDS by Method 2540C

All of the laboratory data generated as part SWMU183 Phase II was validated by the project chemist. Field QA/QC samples, including trip blanks, matrix spikes, and matrix spike duplicates were collected to document field and laboratory QA/QC. The analytical data is provided in Appendix F of this report (on CD only). The Data Validation Reports are provided in Appendix G of this report. Accutest Laboratories in Orlando, Florida performed the analysis of all samples collected.

Overall, only minor QC issues were identified during the data validation of the laboratory results and the laboratory took all necessary corrective actions. All of the data were determined to be usable with only minor qualifications. Information regarding the precision, accuracy, representativeness, and completeness is provided in the validation reports (Appendix G) with the following sections providing a synopsis of each analyte group.

6.2.1 Volatile Organic Compounds

Methylene chloride was detected in various soil method blanks. Where this common laboratory contaminant was detected it was qualified as estimated, “J”.

For samples SWMU183-DP58-10, SWMU183-DP59-3, and SWMU183-DP60-6 the volatile analysis was not preserved within 48 hours. Those compounds with positive detections were qualified as estimated, “J” in the associated samples.

The ICV was outside control limits for carbon disulfide in sample SWMU183-DP60-6. This compound was qualified as estimated, “J”.

6.2.2 Semi-Volatile Organic Compounds

No QC deficiencies warranted SVOC data qualification.

6.2.3 Total Petroleum Hydrocarbons

No QC deficiencies warranted TPH data qualification.

6.2.4 TAL Metals

Sample SWMU183-DP55-10 and its duplicate yielded RPDs for calcium and sodium outside project defined control limits. The RPD for selenium was outside project defined control limits for sample SWMU183-MW03 and its duplicate. These compounds were qualified as estimated, “J”, in both samples.

The serial dilution of multiple metals yielded percent differences (%Ds) outside control limits. Those compounds that yielded a concentration >50 times the MDL were qualified as estimated, “J”.

In some soil samples, the post digestate spike (PDS) for aluminum, barium, cadmium, iron, magnesium, manganese, and vanadium were outside recovery limits due to high levels in the sample relative to the spike amount. A PDS is not required to confirm matrix interference because a serial dilution analysis was performed to confirm matrix effect. Therefore, no additional qualification was necessary.

6.2.5 Polychlorinated Biphenyls

No QC deficiencies warranted PCB data qualification.

6.2.6 Nitrate, Chloride, Sulfate

Sulfate yielded an RPD outside project defined control limits for sample SWMU183-DP55-10 and its duplicate. This compound was qualified as estimated, “J”, in both samples.

The nitrate analysis, of SWMU183-DP58-10, SWMU183-DP59-3, SWMU183-DP60-6, SWMU183-DP56-4, SWMU183-DP61-4, SWMU183-DP53-4, and SWMU183-DP54-9, was not performed within 48 hours. This compound, when positively identified, was qualified as estimated, “J”.

6.2.7 Pesticides

No QC deficiencies warranted pesticide data qualification.

6.2.8 Herbicides

No QC deficiencies warranted herbicide data qualification.

6.2.9 Total Dissolved Solids

No QC deficiencies warranted TDS data qualification.

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7 NATURE AND EXTENT OF CONTAMINATION

This section presents the soil and groundwater analytical results for the RFI Phase I and II field activities completed at SWMU 183 by NationView in 2010. This section also presents the nature and extent of contamination identified in the soil and groundwater during this investigation. The soil and groundwater sampling locations from this investigation are shown on Plates 1 and 2 respectively.

The primary objectives of the subsurface soil and groundwater sampling conducted during the SWMU 183 RFI were to identify locations where releases to the environment from the sewer system have occurred and to characterize the nature and extent of contaminants of concern in identified releases to soil and/or groundwater (i.e., detections above screening criteria). Subsurface soil and groundwater analytical results collected during this RFI (Phases I and II) are summarized in Tables 7-1 through 7-8. Complete laboratory analytical results for the RFI soil and groundwater sampling are included in Appendix F of this report.

7.1 Phase I Soil Analytical Results

A total of 59 soil samples (including seven duplicates) were collected from the Phase I soil borings (SWMU183-DP01 through SWMU183-DP52) advanced in April 2010. The 52 DPT soil borings were strategically located within each of the 10 Sub-Basins that comprise the entire HAFB sewer system (Plates 1 and 2). The Phase I SWMU 183 soil analytical results are summarized in Tables 7-1 through 7-4 and the DPT soil boring locations with select results are shown on Figures 7-1 through 7-3 of this report. The following sections summarize the Phase I subsurface soil analytical results for each of the 10 HAFB sewer system Sub-Basins.

7.1.1 Sub-Basin 1

Sub-Basin 1 is located within the south-central portion of HAFB near the WWTP (Plate 2). The seven subsurface soil samples (including one duplicate) collected from six Sub-Basin 1, Phase I soil borings (SWMU183-DP47 through SWMU183-DP52) were analyzed for VOCs, SVOCs, TAL metals, PCBs, anions (nitrate, chloride, and sulfate), and TPH (DRO, GRO, and ORO). The seven Sub-Basin 1 soil samples were collected from 5 to 11 ft bgs, immediately below the sewer line invert. The last digit of the sample identification number indicates the bottom depth of the sample interval. Sub-Basin 1 analytical results for soil samples collected during Phase I are summarized in Table 7-1 and the DPT borehole locations are presented on Plate 2.

Seven VOCs were detected above the MDL in five Sub-Basin 1 soil samples. However, each of the detected VOCs was below its respective NMED SSL and/or USEPA RSL. Estimated concentrations of two SVOCs were detected above the MDL but below their respective screening criteria in six samples. Table 7-1 summarizes the VOC and SVOC soil analytical results for Sub-Basin 1. Additionally, PCB compounds were not detected in any of the soil samples collected within Sub-Basin 1.

TPH fractions GRO (C_6 – C_{10}), DRO (C_{10} – C_{22}), and/or ORO (C_{22} – C_{36}) were detected above the MDLs in each of the Sub-Basin 1 soil samples (Table 7-1). Individually the concentrations of TPH-GRO, -DRO, and –ORO were all below the NMED TPH Screening Guideline (Residential Direct Exposure) for an unknown oil (800 mg/kg). However, the combined concentration of TPH-GRO, -DRO, and –ORO (803 mg/kg) detected in the duplicate soil sample SWMU183-DP48-5-A was slightly above the TPH Screening Guideline for an unknown oil. However, the primary sample (SWMU183-DP48-5) only had a combined TPH concentration of 326.8 mg/kg. The remaining Sub-Basin 1 samples (up and downgradient of DP48) had combined TPH concentrations well below 800 mg/kg. Figure 7-1 presents the TPH-GRO, -DRO, and -ORO data for the soil sample collected from boring SWMU183-DP48 which, when combined, exceeded the NMED TPH Screening Guideline for unknown oil.

Eighteen TAL metals were detected above the MDL (Table 7-1). With the exception of arsenic, all TAL metals were below their respective SSLs (NMED, 2009) or USEPA RSLs (USEPA, 2011). Arsenic was detected slightly above the SSL (3.9 mg/kg) and NMED approved HAFB background level ([3.7 mg/kg] NMED, 2011) in soil samples SWMU183-DP51-8 (4 mg/kg) and SWMU183-DP52-6 (4 mg/kg). These slight arsenic exceedences are most likely due to the natural variability of soil geochemistry and are not related to a release from the sewer. Figure 7-1 also presents the two arsenic concentrations which exceeded the NMED SSL within Sub-Basin 1. Furthermore magnesium was detected in one soil sample (SWMU183-DP51-8) above the NMED approved HAFB background level (16,991 mg/kg), however currently there is not a NMED SSL or USEPA RSL for magnesium. All other TAL metals were detected at concentrations below their respective NMED approved HAFB background values.

Nitrate was detected above the MDL with estimated concentrations of 1.6 J mg/kg and 2.9 J mg/kg in soil samples SWMU183-DP49-6 and SWMU183-DP50-7 respectively. However, each of these nitrate detections is well below the current NMED SSL (125,000 mg/kg) (NMED, 2009). Chloride and sulfate were detected above the MDL in each of the Sub-Basin 1 soil samples. Chloride concentrations ranged from 680 to 3,600 mg/kg and sulfate from 2,400 to 22,000 mg/kg. Currently, there are no applicable screening criteria (NMED or USEPA) or HAFB background levels for chloride or sulfate for comparison. The results for the nitrate, chloride, and sulfate analyses are presented in Table 7-1.

7.1.2 Sub-Basin 2

Sub-Basin 2 which comprises most of the HAFB single family housing is located within the southeastern portion of HAFB (Plate 2). The three subsurface soil samples collected from the Sub-Basin 2, Phase I soil borings (SWMU183-DP44 through SWMU183-DP46) were analyzed for VOCs, SVOCs, TAL metals, PCBs, anions (nitrate, chloride, and sulfate), and TPH (DRO, GRO, and ORO). The Sub-Basin 2 soil samples were collected immediately below the sewer line invert, from 7 to 11 ft bgs. The last digit of the sample identification number indicates the bottom depth of the sample interval. The analytical results for Sub-Basin 2 Phase I soil samples collected are summarized in Table 7-1 and the borehole locations are illustrated on Plate 2.

Only one VOC and one SVOC were detected above the MDL in the soil sample collected from soil boring SWMU183-DP46 at concentrations below current NMED SSLs (Table 7-1). VOCs and SVOCs were not detected in the other two Sub-Basin 2 soil samples. Low detections of TPH-ORO were reported in each of the three Sub-Basin 2 samples at concentrations well below the NMED TPH Screening Guideline for unknown oil (800 mg/kg). TPH-DRO and TPH-GRO were not detected in any of the three Sub-Basin 2 soil samples. Furthermore, PCBs were not detected in any of the soil samples collected in Sub-Basin 2.

Eighteen TAL metals were detected above the MDL in the three Sub-Basin 2 soil samples (Table 7-1). With the exception of lead (in one sample), all detected TAL metals were below their respective SSLs (NMED, 2009), USEPA RSLs (USEPA, 2011), and NMED approved HAFB background levels (NMED, 2011). Lead was detected slightly above the NMED approved background level (10.9 mg/kg) but below the NMED SSL (400 mg/kg) in soil sample SWMU183-DP44-10 at 11 mg/kg.

Nitrate was not detected in the Sub-Basin 2 soil samples. Chloride and sulfate were detected above the MDL in each of the three Sub-Basin 2 soil samples. Chloride concentrations ranged from 20 J to 760 mg/kg and sulfate from 15,000 to 20,000 mg/kg. Currently, there are no applicable screening criteria (NMED or USEPA) or HAFB background levels for chloride or sulfate for comparison. The results for the nitrate, chloride, and sulfate analyses are presented in Table 7-1.

7.1.3 Sub-Basin 3

Sub-Basin 3, which comprises the eastern portion of the single family housing, is also located in the southeastern portion of HAFB (Plate 2). One soil boring (SWMU183-DP43) was advanced within Sub-Basin 3 during the Phase I investigation. Soil sample SWMU183-SB43-12 was analyzed for VOCs, SVOCs, TAL metals, PCBs, anions (nitrate, chloride, and sulfate), and TPH (DRO, GRO, and ORO). This soil sample was collected at 12 ft bgs, immediately below the sewer line invert. The last digit of the sample identification number indicates the bottom depth of the sample interval. The Sub-Basin 3 soil analytical results for Phase I are summarized in Table 7-1 and the DP43 borehole location is shown on Plate 2.

Low estimated concentrations of two VOCs and one SVOC were detected above the MDL in soil sample SWMU183-DP43-12 at concentrations that are below current NMED SSLs (Table 7-1). An estimated concentration of TPH-ORO (5 JM [manually integrated compound] mg/kg) was detected below the NMED TPH Screening Guideline for unknown oil (800 mg/kg). TPH-DRO and -GRO were not detected. Additionally, all PCBs were not detected in the soil sample collected from soil boring SWMU183-DP43.

Fifteen TAL metals were detected above the MDL. All of the TAL metals were detected below their respective SSLs (NMED, 2009), USEPA RSLs (USEPA, 2011), and their NMED approved HAFB background levels (NMED, 2011). Nitrate was not detected in SWMU183-DP43-12; however chloride and sulfate were detected at concentrations of 28 mg/kg and 18,000 mg/kg, respectively. Currently, there are no applicable screening criteria (NMED or USEPA) or HAFB background levels for chloride or sulfate for comparison. The complete results for TAL metals, nitrate, chloride, and sulfate for the Sub-Basin 3 soil sample are presented in Table 7-1.

7.1.4 Sub-Basin 4

Sub-Basin 4 is located within eastern portion of the Main Base industrial area (Plate 2). The 11 subsurface soil samples (including one duplicate) collected from 10 Sub-Basin 4, Phase I soil borings (SWMU183-DP26 through SWMU183-DP35) were analyzed for VOCs, SVOCs, TAL metals, PCBs, anions (nitrate, chloride, and sulfate), TPH (DRO, GRO, and ORO), herbicides, and pesticides. The Sub-Basin 4 soil samples were collected immediately below the sewer line invert from 6 to 14 ft bgs. The last digit of the sample identification number indicates the bottom depth of the sample interval. Sub-Basin 4 analytical results for soil samples collected during Phase I are summarized in Table 7-2 and the DPT borehole locations are presented on Plate 2.

Low concentrations of two VOCs and two SVOCs were detected above the MDL in eight of the Sub-Basin 4 soil samples at concentrations that are below their respective NMED SSLs (Table 7-2). Low detections of TPH-ORO were reported in each of the 11 samples at concentrations well below the NMED TPH Screening Guideline for unknown oil (800 mg/kg). A low detection of TPH-GRO was reported in one sample and TPH-DRO was not detected in any of the Sub-Basin 4 soil samples. Additionally, the combined concentration of TPH-GRO, and –ORO was below the TPH Screening Guideline for unknown oil in each of the 11 samples. Furthermore, PCB, herbicide, and pesticide compounds were not detected in any of the Sub-Basin 4 soil samples. The complete results for TPH, PCBs, herbicides, and pesticides are also presented in Table 7-2.

Nineteen TAL metals were detected above the MDL (Table 7-2). With the exception of arsenic, all TAL metals were below their respective SSLs (NMED, 2009) or USEPA RSLs (USEPA, 2011). Arsenic was detected slightly above the SSL (3.9 mg/kg) and NMED approved HAFB background level (3.7 mg/kg) in soil samples SWMU183-DP27-7 (4 mg/kg), SWMU183-DP30-8 (4.3 mg/kg), SWMU183-DP34-13-A (4.4 mg/kg), and SWMU183-DP35-14 (5.7 mg/kg). Additionally, arsenic was detected in sample SWMU183-DP34-13 (3.8 mg/kg) above the NMED approved HAFB background level but below the SSL. Figure 7-2 illustrates the arsenic detections which exceeded the NMED SSL within Sub-Basin 4. These slight exceedences of arsenic are most likely due to the natural variability of soil geochemistry and are not related to a release from the sewer system. Furthermore, the Phase II subsurface soil results for arsenic at these same locations were all below the NMED SSL and approved background levels (see below in Section 7.2.2). Magnesium was detected above the NMED approved background level (16,991 mg/kg) in soil sample SWMU183-DP34-13 and its corresponding duplicate SWMU183-DP34-13-A with concentrations of 22,000 mg/kg and 19,000 mg/kg respectively. Aluminum was also detected above the NMED approved background level (13,722 mg/kg) in soil samples SWMU183-DP34-13 and SWMU183-DP35-14 with concentrations of 14,000 mg/kg and 17,000 mg/kg respectively. All other detected TAL metals were below their respective NMED approved background values (NMED, 2011).

Estimated concentrations of nitrate were detected above the MDL in four soil samples with concentrations ranging from 1.4 J mg/kg to 7.9 J mg/kg. However, each of these nitrate detections is well below the current NMED SSL (125,000 mg/kg) (NMED, 2009). Chloride and sulfate were detected above the MDL in all of the Sub-Basin 4 soil samples. Chloride concentrations ranged from 28 J to 250 mg/kg and sulfate ranged from 15,000 to 22,000 mg/kg. Currently, there are no applicable screening criteria (NMED or USEPA) or HAFB background levels for chloride or sulfate for comparison. The complete results for the nitrate, chloride, and sulfate analyses are presented in Table 7-2.

7.1.5 Sub-Basin 5

Sub-Basin 5 is located within the western portion of the Main Base industrial area (Plate 2). The 8 subsurface soil samples (including one duplicate) collected from seven Sub-Basin 5 Phase I soil borings (SWMU183-DP36 through SWMU183-DP42), were analyzed for VOCs, SVOCs, TAL metals, PCBs, anions (nitrate, chloride, and sulfate), and TPH (DRO, GRO, and ORO). These soil samples were collected from immediately below the sewer line invert from 7 to 12 ft bgs. The last digit of the sample identification number indicates the bottom depth of the sample interval. Analytical results for Phase I soil samples collected in Sub-Basin 7 are presented in Table 7-1 and the DPT borehole locations are depicted on Plate 2.

Six VOCs and two SVOCs were detected above the MDL in three of the Sub-Basin 5 soil samples at concentrations which are below their respective NMED SSLs. Low estimated detections of TPH-GRO and/or TPH-ORO were observed in seven samples at concentrations that are well below the NMED TPH Screening Guideline for unknown oil (800 mg/kg). TPH-DRO was not detected in any of the Sub-Basin 5 soil samples. Additionally, the combined concentration of TPH-GRO and –ORO was below the TPH Screening Guideline for unknown oil in each of the seven samples. Furthermore, PCB compounds were not detected in any of the Sub-Basin 5 soil samples. The complete results for VOCs, SVOCs, TPH, and PCBs are also presented in Table 7-1.

Twenty one TAL metals were detected above the MDL but at concentrations below their respective SSLs (NMED, 2009) or USEPA RSLs (USEPA, 2011). Additionally, there were seven metals (barium, cadmium, chromium, copper, silver, zinc, and lead) that were detected above their respective NMED approved HAFB background levels (NMED, 2011) but below the NMED SSLs in soil sample SWMU183-DP38-10-A.

Barium was also detected in soil sample SMWU183-DP37-12 above the NMED approved HAFB background level (Table 7-1).

Estimated concentrations of nitrate were detected above the MDL in two soil samples with concentrations of 1.4 J and 4 J mg/kg. However, each of these nitrate detections is well below the current NMED SSL (125,000 mg/kg). Chloride and sulfate were detected above the MDL all of the Sub-Basin 5 soil samples. Chloride concentrations ranged from 48 to 650 mg/kg and sulfate ranged from 14,000 to 20,000 mg/kg. Currently, there are no applicable screening criteria (NMED or USEPA) or HAFB background levels for chloride or sulfate for comparison. The complete results for the nitrate, chloride, and sulfate analyses are presented in Table 7-1.

7.1.6 Sub-Basin 6

Sub-Basin 6 is located within the west ramp support area of HAFB (Plate 2). The two subsurface soil samples collected from two Sub-Basin 6, Phase I soil borings (SWMU183-DP15 and SWMU183-DP16) were analyzed for VOCs, SVOCs, TAL metals, PCBs, anions (nitrate, chloride, and sulfate), and TPH (DRO, GRO, and ORO). These two soil samples were collected at eight ft bgs, immediately below the sewer line invert. The last digit of the sample identification number indicates the bottom depth of the sample interval. Sub-Basin 6 analytical results for soil samples collected during Phase I are summarized in Table 7-1 and the DPT borehole locations are presented on Plate 2.

VOCs were not detected and only an estimated concentration of one SVOC was detected above the MDL but below the NMED SSL in the two Sub-Basin 6 soil samples. Total petroleum hydrocarbons TPH-GRO, -DRO and –ORO were not detected in the two Sub-Basin 6 soil samples. Furthermore, PCBs were also not detected in either sample. The results for VOCs, SVOCs, TPH (GRO, DRO, and ORO), and PCBs are included in Table 7-1.

Fifteen TAL metals were detected above the MDL but below their respective SSLs (NMED, 2009), USEPA RSLs (USEPA, 2011), and NMED approved HAFB background levels (NMED, 2011). Nitrate was not detected in the Sub-Basin 6 soil samples. Chloride and sulfate were detected above the MDL in each of the two Sub-Basin 6 soil samples with concentrations of 540 and 1,700 mg/kg for chloride and 19,000 and 20,000 mg/kg for sulfate. Currently, there are no applicable screening criteria (NMED or USEPA) or HAFB background levels for chloride or sulfate for comparison. The results for the TAL metals nitrate, chloride, and sulfate analyses are also summarized in Table 7-1.

7.1.7 Sub-Basin 7

Sub-Basin 7 is located in the vicinity of the north ramp industrial area of HAFB (Plates 1 and 2). The five subsurface soil samples (including one duplicate) collected from the four Sub-Basin 7, Phase I soil borings (SWMU183-DP11 through SWMU183-DP14) were analyzed for VOCs, SVOCs, TAL metals, PCBs, anions (nitrate, chloride, and sulfate), and TPH (DRO, GRO, and ORO). These five soil samples were collected from 6 to 8 ft bgs, immediately below the sewer line invert. The last digit of the sample identification number indicates the bottom depth of the sample interval. The analytical results for Phase I Sub-Basin 7 soil samples are summarized in Table 7-1 and the DPT borehole locations are presented on Plates 1 and 2.

All VOCs were undetected and only an estimated concentration of one SVOC was detected above the MDL in three of the Sub-Basin 7 soil samples at concentrations that are below its respective NMED SSL. Total petroleum hydrocarbons -DRO and ORO were detected above the MDL in three Sub-Basin 7 samples at concentrations that are well below the NMED TPH Screening Guideline for unknown oil (800 mg/kg). TPH-GRO was not detected in any of the Sub-Basin 7 soil samples. Furthermore, PCBs were not detected in any of the Sub-Basin 7 soil samples. Table 7-1 includes a summary of the Sub-Basin 7 analytical results for VOCs, SVOCs, TPH (GRO, DRO, and ORO), and PCBs.

Eighteen TAL metals were detected above the MDL in the five Sub-Basin 7 soil samples (Table 7-1). With the exception aluminum (one sample), all detected TAL metals were below their respective SSLs (NMED, 2009), USEPA RSLs (USEPA, 2011), and NMED approved HAFB background levels (NMED, 2011). Aluminum was detected above the NMED approved background (13,722 mg/kg) but below the NMED SSL (78,100 mg/kg) in the duplicate soil sample SWMU183-DP11-7-A at 14,000 mg/kg.

Estimated concentrations of nitrate were detected above the MDL in three samples with concentrations ranging from 1.6 J mg/kg to 39 J mg/kg. However, each of these nitrate detections is well below the current NMED SSL (125,000 mg/kg). Chloride and sulfate were detected above the MDL each of the Sub-Basin 5 soil samples. Chloride concentrations ranged from 12 J to 2,400 mg/kg and sulfate from 17,000 to 23,000 mg/kg. Currently, there are no applicable screening criteria (NMED or USEPA) or HAFB background levels for chloride or sulfate for comparison. The complete results for the nitrate, chloride, and sulfate analyses are summarized in Table 7-1.

7.1.8 Sub-Basin 8

Sub-Basin 8 is located in the test track industrial area within the northern developed portion of HAFB (Plate 1). The seven subsurface soil samples (including one duplicate) collected from the six Sub-Basin 8, Phase I soil borings (SWMU183-DP05 through SWMU183-DP10) were analyzed for VOCs, SVOCs, TAL metals, PCBs, perchlorate, anions (nitrate, chloride, and sulfate), TPH (DRO, GRO, and ORO), and radionuclides. The seven soil samples were collected from 6.5 to 12 ft bgs, immediately below the sewer line invert. The last digit of the sample identification number indicates the bottom depth of the sample interval. The Sub-Basin 8 analytical results for Phase I soil samples are summarized in Table 7-3 and the DPT borehole locations are presented on Plate 1.

Four VOCs were detected above the MDL in three of the Sub-Basin 8 soil samples at concentrations that are below their respective NMED SSLs. Estimated concentrations of one SVOC were detected above the MDL in each sample but below the SSL. Low concentrations of TPH-DRO and ORO were detected above the MDL in one Sub-Basin 8 sample at concentrations that are each well below the NMED TPH Screening Guideline for unknown oil (800 mg/kg). TPH-GRO was not detected in any of the Sub-Basin 8 soil samples. Furthermore, the combined concentration of TPH-DRO and –ORO was well below the TPH Screening Guideline for unknown oil in the soil sample SWMU183-DP08-11. TPH-DRO and –ORO were not detected in any of the other Sub-Basin 8 samples. Additionally, PCBs were not detected in any of the Sub-Basin 8 soil samples. Table 7-3 summarizes the VOC, SVOC, TPH (GRO, DRO, and ORO), and PCB soil analytical results for Sub-Basin 8.

Nineteen TAL metals were detected above the MDL but at concentrations below their respective SSLs (NMED, 2009). Additionally, there were four metals (aluminum, cadmium, magnesium, and selenium) which were detected above their respective NMED approved HAFB background levels (NMED, 2011) but below the NMED SSLs in sample SMWU183-DP05-7.5. Magnesium was also detected above the approved NMED HAFB background level in soil sample SWMU183-DP05-7.5A. Aluminum was also detected at a concentration above the approved NMED HAFB background level in soil sample SWMU183-DP08-11. All other detected TAL metals were below their respective background values. All metals detected during this sampling event are listed in Table 7-3.

Estimated concentrations of nitrate were detected above the MDL in each Sub-Basin 8 soil sample with concentrations ranging from 1.2 J mg/kg to 23 J mg/kg. However, each of these nitrate detections is well below the current NMED SSL (125,000 mg/kg). Chloride and sulfate were detected above the MDL each of the Sub-Basin 8 soil samples. Chloride concentrations ranged from 11 J to 2,300 mg/kg and sulfate ranged from 190 to 22,000 mg/kg. Currently, there are no applicable screening criteria (NMED or USEPA) or HAFB background levels for chloride or sulfate for comparison. The complete results for the nitrate, chloride, and sulfate analyses are summarized in Table 7-3.

Low concentrations of perchlorate were detected in two Sub-Basin 8 soil samples (SWMU183-DP06-11.5 and SWMU183-DP10-9) above the MDL but well below the NMED SSL (54.8 mg/kg). Perchlorate was not detected in any of the other Sub-Basin 8 soil samples. Additionally, three radionuclides (tritium, radium 226, and radium 228) were detected at low concentrations above the minimum detectable concentration (MDC) in the Sub-Basin 8 soil samples. All detected radionuclides were well below their respective USEPA SSLs (USEPA, 2000). However, radium 228 was detected slightly above the NMED approved background level (0.95 pCi/g) (NMED, 2011) in two samples SWMU183-DP07-12 (1.31 pCi/g) and SWMU183-DP08-11 (1.11 pCi/g). Table 7-3 presents a summary of the perchlorate and radionuclide soil analyses for Sub-Basin 8.

7.1.9 Sub-Basin 9

Sub-Basin 9 is located in the vicinity of the Primate Research Institute facilities within the northern portion of HAFB (Plate 1). The five subsurface soil samples (including one duplicate) collected from four Sub-Basin 9, Phase I soil borings (SWMU183-DP01 through SWMU183-DP04) were analyzed for VOCs, SVOCs, TAL metals, PCBs, anions (nitrate, chloride, and sulfate), TPH (DRO, GRO, and ORO), and radionuclides. The five soil samples were collected from 5 to 13 ft bgs, immediately below the sewer line invert. The last digit of the sample identification number indicates the bottom depth of the sample interval. The Sub-Basin 9 analytical results for Phase I soil samples are summarized in Table 7-4 and the DPT borehole locations are presented on Plate 1.

Estimated concentrations of one VOC and one SVOC were detected above the MDL in four of the Sub-Basin 9 soil samples at concentrations which are below their respective NMED SSLs. TPH (GRO, DRO, and ORO) and PCBs were not detected in any of the Sub-Basin 9 soil samples. Table 7-4 summarizes the Sub-Basin 9 analytical results for VOCs, SVOCs, TPH (GRO, DRO, and ORO), and PCBs.

Nineteen TAL metals were detected above the MDL in the five Sub-Basin 9 soil samples (Table 7-4). With the exception of aluminum (in one sample), all detected TAL metals were below their respective SSLs (NMED, 2009), USEPA RSLs (USEPA, 2011), and NMED approved HAFB background levels (NMED, 2011). Aluminum was detected slightly above the NMED approved background level (13,722 mg/kg) but below the NMED SSL (78,100 mg/kg) in soil sample SWMU183-DP01-5-A at a concentration of 14,000 J mg/kg.

Nitrate was detected above the MDL in four samples with concentrations ranging from 4.4 J mg/kg to 67 J mg/kg. However, each of these nitrate detections is well below the current NMED SSL (125,000 mg/kg). Chloride was detected above the MDL in four samples with concentrations ranging from 36 to 300 mg/kg and sulfate was detected above the MDL in all of the Sub-Basin 9 soil samples with concentrations ranging from 15,000 to 18,000 mg/kg. Currently, there are no applicable screening criteria (NMED or USEPA) or HAFB background levels for chloride or sulfate for comparison. The complete results for the nitrate, chloride, and sulfate analyses are summarized in Table 7-4.

Two radionuclides (radium 226 and radium 228) were detected at low concentrations above the MDC in three of the Sub-Basin 9 soil samples. However each of these detections was well below their respective USEPA SSLs (USEPA, 2000) and NMED approved background levels (NMED, 2011). Radionuclide detections are presented in Table 7-4.

7.1.10 Sub-Basin 10

Sub-Basin 10 is located in the vicinity of the west ramp and the industrial areas (49th Material Maintenance Group) of HAFB (Plate 2). The 10 subsurface soil samples (including one duplicate) were collected from 9 Sub-Basin 10, Phase I soil borings (SWMU183-DP17 through SWMU183-DP25), and were analyzed for VOCs, SVOCs, TAL metals, PCBs, anions (nitrate, chloride, and sulfate), and TPH (DRO, GRO, and ORO). The 10 soil samples were collected from 5 to 18 ft bgs, immediately below the sewer line invert. The last digit of the sample identification number indicates the bottom depth of the sample interval. The Sub-Basin 10 analytical results for Phase I soil samples are summarized in Table 7-1 and the DPT borehole locations are presented on Plate 2.

Low concentrations of 4 VOCs and/or 11 SVOCs were detected above the MDL in the Sub-Basin 10 soil samples at concentrations which are below their respective NMED SSLs (Table 7-1). Low detections of TPH-GRO and/or TPH-ORO were detected in eight of the Sub-Basin 10 soil samples at concentrations that are well below the NMED TPH Screening Guideline for unknown oil (800 mg/kg). TPH-DRO was not detected in any of the Sub-Basin 10 soil samples. Additionally, the combined concentration of TPH-GRO and –ORO was below the TPH Screening Guideline for unknown oil in each of the eight samples. Furthermore, all PCB compounds were not detected in any of the Sub-Basin 10 soil samples. A summary of the TPH and PCB analytical results are presented in Table 7-1.

Nineteen TAL metals were detected above the MDL (Table 7-1). With the exception of arsenic (detected in two samples), all TAL metals were below their respective SSLs (NMED, 2009) or USEPA RSLs (USEPA, 2011). Arsenic was detected above the SSL (3.9 mg/kg) and NMED approved HAFB background level (3.7 mg/kg) in soil samples SWMU183-DP17-8 (5.3 mg/kg) and SWMU183-DP18-12 (27 mg/kg). Figure 7-3 presents the two arsenic detections which exceeded the NMED SSL in Sub-Basin 10. These exceedences of arsenic are most likely due to the natural variability of soil geochemistry and are not related to a release from the sewer system. Furthermore, the Phase II subsurface soil result for arsenic for sample SWMU183-DP54-9 (same location as soil boring SWMU183-DP18) was detected below the NMED SSL and approved background levels at a concentration of 2.6 J mg/kg (see below in Section 7.2.3). Additionally, cadmium, magnesium, and vanadium were detected in soil samples SWMU183-DP22-12, SWMU183-DP20-14, and SWMU183-DP18-12 respectively, above their respective NMED approved HAFB background levels (NMED, 2011). All other TAL metals were detected below their respective background values.

Estimated concentrations of nitrate were detected above the MDL in three Sub-Basin 10 soil samples with concentrations ranging from 2.3 J mg/kg to 8.1 J mg/kg. However, each of these nitrate detections is well below the current NMED SSL (125,000 mg/kg). Chloride and sulfate were detected above the MDL each of the Sub-Basin 10 soil samples. Chloride concentrations ranged from 30 J to 3,100 mg/kg and sulfate ranged from 6,600 to 26,000 mg/kg. Currently, there are no applicable screening criteria (NMED or USEPA) or HAFB background levels for chloride or sulfate for comparison. The complete results for the nitrate, chloride, and sulfate analyses are also summarized in Table 7-1.

7.2 Phase II Soil Analytical Results

A total 10 soil samples (including 1 duplicate) were collected from the 9 Phase II soil borings SWMU183-DP53 through SWMU183-DP61 that were drilled in Sub-Basins 1, 4 and 10 (Plate 2) during July 2010. The nine Phase II DPT soil borings were located adjacent to the Phase I DPT borehole locations which had arsenic and TPH concentrations that exceeded the applicable soil screening criteria (DP-17, -18, -27, -30, -34, -35, -48, -51, and -52). The Phase II SWMU 183 soil analytical results are summarized in Tables 7-5 and 7-6 and the DPT soil boring locations with selected results are shown on Figures 7-1and 7-3. The following sections summarize the Phase II subsurface soil analytical results for Sub-Basins 1, 4, and 10.

7.2.1 Sub-Basin 1

Sub-Basin 1 is located within the south-central portion of HAFB near the WWTP (Plate 2). The three subsurface soil samples collected from three Sub-Basin 1, Phase II soil borings (SWMU183-DP59 through SWMU183-DP61) were analyzed for VOCs, SVOCs, TAL metals, PCBs, anions (nitrate, chloride, and sulfate), and TPH (DRO, GRO, and ORO). The three Sub-Basin 1 soil samples were collected from 3 to 6 ft bgs at the capillary fringe/saturated zone interface. The last digit of the sample identification number indicates the bottom depth of the sample interval. Sub-Basin 1 analytical results for soil samples collected during Phase II are summarized in Table 7-5 and the DPT borehole locations are presented on Figure 7-1.

Three VOCs were detected above the MDL in two of the Sub-Basin 1, Phase II soil samples. However, each of the detected VOCs was below its respective NMED SSL and/or USEPA RSL. SVOCs, PCBs, and TPH fractions (-GRO, -DRO, -ORO) were not detected in any of the Sub-Basin 1 soil samples collected during Phase II. Furthermore, TPH-GRO, DRO, and ORO were not detected in the soil sample SWMU183-DP59 which was collected from the same location as SWMU183-DP48 which had a combined TPH exceedance (803 mg/kg) during the Phase I investigation. Eighteen TAL metals were detected above the MDL (Table 7-5). With the exception of arsenic (detected in one sample), all TAL metals were below their respective SSLs (NMED, 2009) or USEPA RSLs (USEPA, 20011). Arsenic was detected at the SSL (3.9 mg/kg) and slightly above the NMED approved HAFB background level (3.7 mg/kg) in soil sample SWMU183-DP60-6 at a concentration of 3.9 mg/kg). Figure 7-1 also presents the arsenic concentration which exceeded the NMED SSL in soil boring DP60. Additionally, magnesium and silver were detected in soil sample SWMU183-DP60-6 above the NMED approved HAFB background levels, however all other TAL metals were detected at concentrations below their respective HAFB background levels (NMED, 2011).

Nitrate was detected above the MDL in two soil samples with concentrations of 0.90 J mg/kg and 3.5 J mg/kg. However, each of these nitrate detections is well below the current NMED SSL (125,000 mg/kg) (NMED, 2009). Chloride and sulfate were detected above the MDL in each of the Sub-Basin 1 Phase II soil samples. Chloride concentrations ranged from 826 to 4,840 mg/kg and sulfate ranged from 7,400 to

18,800 mg/kg. Currently, there are no applicable screening criteria (NMED or USEPA) or HAFB background levels for chloride or sulfate for comparison. The results for the nitrate, chloride, and sulfate analyses are presented in Table 7-5.

7.2.2 Sub-Basin 4

Sub-Basin 4 is located within the eastern portion of the Main Base industrial area (Plate 2). The five subsurface soil samples (including one duplicate) collected from four Sub-Basin 4, Phase II soil borings (SWMU183-DP55 through SWMU183-DP58) were analyzed for VOCs, SVOCs, TAL metals, PCBs, anions (nitrate, chloride, and sulfate), TPH (DRO, GRO, and ORO), herbicides, and pesticides. The Phase II soil samples were collected at the capillary fringe/saturated zone interface 4 to 10 ft bgs. The last digit of the sample identification number indicates the bottom depth of the sample interval. Sub-Basin 4 analytical results for soil samples collected during Phase II are summarized in Table 7-6 and the DPT borehole locations are presented on Figure 7-2.

Low concentrations of methylene chloride were detected above the MDL in each of the Sub-Basin 4 Phase II soil borings at concentrations that are below the NMED SSL (Table 7-6). All other VOCs, SVOCs, PCBs, TPH fractions (-GRO, -DRO, -ORO), herbicides, and pesticides were not detected in any of the Sub-Basin 4 soil samples collected during the Phase II sampling.

Nineteen TAL metals were detected above the MDL but below their respective SSLs (NMED, 2009) or USEPA RSLs (USEPA, 2011) and NMED approved HAFB background levels (NMED, 2011). Furthermore, only estimated and non-detected concentrations of arsenic were observed in the four Phase II soil samples that were collected at the same Phase I locations that had arsenic concentrations which slightly exceeded the SSL during the Phase I investigation.

Low and estimated concentrations of nitrate were detected above the MDL in four soil samples with concentrations ranging from 0.81 J mg/kg to 3.9 mg/kg. However, each of these nitrate detections is well below the current NMED SSL (125,000 mg/kg) (NMED, 2009). Chloride and sulfate were detected above the MDL in each of the Sub-Basin 4 Phase II soil samples. Chloride concentrations ranged from 24.2 to 121 mg/kg and sulfate ranged from 4,740 to 19,700 mg/kg. Currently, there are no applicable screening criteria (NMED or USEPA) or HAFB background levels for chloride or sulfate for comparison. The complete results for the nitrate, chloride, and sulfate analyses are presented in Table 7-6.

7.2.3 Sub-Basin 10

Sub-Basin 10 is located in the vicinity of the west ramp and the industrial areas (49th Material Maintenance Group) of HAFB (Plate 2). The two Phase II subsurface soil samples collected from two Sub-Basin 10 soil borings (SWMU183-DP53 and SWMU183-DP54) were analyzed for VOCs, SVOCs, TAL metals, PCBs, anions (nitrate, chloride, and sulfate), and TPH (DRO, GRO, and ORO). The two soil samples were collected at the capillary fringe/saturated zone interface at 4 and 9 ft bgs. The last digit of the sample identification number indicates the bottom depth of the sample interval. The Sub-Basin 10 analytical results for Phase II soil samples are summarized in Table 7-5 and the DPT borehole locations are presented on Plate 2 and Figure 7-3.

VOCs, SVOCs, PCBs, and, TPH fractions (-GRO, -DRO, -ORO) were not detected in either of the Sub-Basin 10 soil samples collected during Phase II (Table 7-5). Fifteen TAL metals were detected above the MDL (Table 7-5). With the exception of arsenic (detected in one sample), all TAL metals were below their respective SSLs (NMED, 2009) or USEPA RSLs (USEPA, 2011). Arsenic was detected slightly above the SSL (3.9 mg/kg) and NMED approved HAFB background level (3.7 mg/kg) in soil sample SWMU183-DP53-4 at a concentration of 4.0 mg/kg. Figure 7-3 also illustrates the Phase II arsenic detection which exceeded the NMED SSL in Sub-Basin 10. Additionally, barium and zinc were each detected in sample SWMU183-DP53-4 above their respective NMED approved HAFB background levels (NMED, 2011) but below the SSL. All other TAL metals were detected below their respective background values.

An estimated concentration of nitrate (1.5 J mg/kg) was detected above the MDL in Phase II soil sample SWMU183-DP53-4. However this detection of nitrate is well below the current NMED SSL (125,000 mg/kg). Nitrate was not detected in the other sample (SWMU183-DP54-9). Chloride and sulfate were detected above the MDL in each of the two Phase II Sub-Basin 10 soil samples. Chloride concentrations were 29.5 and 58.6 mg/kg and sulfate was 14,700 and 19,300 mg/kg. Currently, there are no applicable screening criteria (NMED or USEPA) or HAFB background levels for chloride or sulfate for comparison. The complete results for the nitrate, chloride, and sulfate analyses are also summarized in Table 7-5.

7.3 Phase II Groundwater Analytical Results

As per the *Final RCRA Facility Investigation Work Plan SWMU 183* (NationView, 2009) each of the nine Phase II soil borings was converted into a permanent 1-inch diameter monitoring well (SWMU183–MW01 through SWMU183-MW09) to determine if there were any impacts to groundwater quality (Plate 2). A total of 10 groundwater samples (including 1 duplicate) were collected during the August 2010 sampling event. Due to poor recharge, monitoring well SMU183-MW08 was also sampled in October 2010 (fo TDS, nitrate, chloride, and sulfate) and in December 2010 (for TPH-DRO and –ORO). Phase II SWMU 183 groundwater analytical results are summarized in Tables 7-7 and 7-8 and the monitoring well locations with selected results are shown on Figures 7-4, 7-5, and 7-6. The following sections summarize the groundwater data collected from Sub-Basins 1, 4, and 10, during Phase II.

7.3.1 Sub-Basin 1

The groundwater samples collected from monitoring wells SWMU183-MW07 through SWMU183-MW09 were analyzed for VOCs, SVOCs, TAL metals, PCBs, TPH (DRO, GRO, and ORO), anions (nitrate, chloride, and sulfate), and TDS. The Sub-Basin 1 groundwater analytical results for Phase II are summarized in Table 7-7 and the monitoring well locations with groundwater results above action levels are shown on Figure 7-4.

Two VOCs (cis-1,2-dichloroethylene and trichloroethylene [TCE]) were detected above the MDL in monitoring well SWMU183-MW08. An estimated concentration of cis-1,2-dichloroethylene (0.90 J µg/L) was well below the USEPA MCL (70 µg/L) (USEPA, 2009). Trichloroethylene was detected in SWMU183-MW08, at a concentration of 5.2 µg/L which slightly exceeds the USEPA MCL (5 µg/L) (Figure 7-4). As shown on Figure 7-4, monitoring well SWMU183-MW08 is located within the footprint of Sewage Lagoon B (part of ERP Site WP-49, the Sewage Lagoons which is a closed ERP site listed in Table B of the HAFB Hazardous Waste Facility Permit [NMED, 2005]). In addition, as shown on Figure 3-8, the groundwater flow direction within Sub-Basin 1 is to the southwest, therefore SWMU183-MW08 is also located approximately 200 ft downgradient from ERP Site OT-20 (a site with known VOC groundwater contamination, currently under investigation). As the sewer line is located below the water table within Sub-Basin 1 the hydraulic gradient (flow direction) is from the aquifer into the sewer line (i.e., the sewer line is gaining water from the aquifer by infiltration [Figure 4-1]). Therefore, the detections of these two VOCs are probably not due to a release to the groundwater from the sewer line but represent contamination from either site OT-20 or residual contamination from the closed Sewage Lagoon B site (SWMU 149). Furthermore, VOCs were not detected in groundwater samples collected from Sub-Basin 1 monitoring wells SWMU183-MW07 and –MW09. In addition, an estimated concentration of di-n-butyl phthalate (1.2 J µg/L) detected in groundwater sample SWMU183-MW09 was the only SVOC detected above the MDL, currently there are no applicable action levels (USWEPA MCL or NMWQCC) for this compound.

Estimated concentrations of the TPH fractions DRO and ORO were detected above the MDL in the groundwater sample collected from monitoring well SWMU183-MW09 (Table 7-7). GRO was not detected in any of the Sub-Basin 1 groundwater samples. The combined TPH-GRO, -DRO and –ORO concentration was 0.234 mg/L, which is well below the NMED TPH Screening Guideline for an Unknown Oil of 50 mg/L (NMED, 2006). Furthermore, PCBs were not detected in any of the Sub-Basin 1 groundwater samples.

Fourteen of the twenty three TAL metals were detected above the MDL. Detections of barium, calcium, cobalt, manganese, nickel, and potassium exceeded their respective NMED approved HAFB Background levels for filtered (dissolved) groundwater (NMED, 2011). However, with the exception of manganese each of these detections were below their respective NMWQCC groundwater standards (NMAC 20.6.2.3103) and/or USEPA MCLs (USEPA, 2009). Manganese was detected in all three wells above the USEPA Secondary MCL (50 µg/L) and the NMED approved HAFB Background level (50 µg/L). Manganese concentrations ranged from 238 µg/L (SWMU183-MW07) to 1,790 µg/L (SWMU183-MW08) (Figure 7-4). These detections of manganese are most likely due to the natural variability of groundwater geochemistry and are not related to a release from the sewer as the sewer line is below the water table in this area of HAFB.

Additionally, the National Secondary Drinking Water Regulations are non-enforceable guidelines regarding contaminants that may cause aesthetic effects (such as taste, odor, or color) in drinking water (USEPA, 2009).

Total dissolved solids concentrations ranged from 11,200 mg/L (SWMU183-MW07) to 41,500 mg/L (SWMU183-MW08) and exceeded the NMWQCC groundwater standard of 1,000 mg/L and the USEPA Secondary MCL (500 mg/L). Furthermore, each of the Sub-Basin 1 monitoring wells had TDS concentrations above 10,000 mg/L and exceeded the USEPA guidelines for potable water (USEPA, 1986).

Chloride concentrations ranged from 4,130 mg/L (SWMU183-MW07) to 14,600 mg/L (SWMU183-MW08) and exceeded the NMWQCC groundwater standard and the USEPA Secondary MCL (250 mg/L) but were below the NMED approved HAFB Background level for unfiltered (total) groundwater (35,040 mg/L [NMED, 2011]). Sulfate concentrations ranged from 1,980 mg/L (SWMU183-MW07) to 3,530 mg/L (SWMU183-M08) and exceeded the NMWQCC groundwater standard of 600 mg/L and the USEPA Secondary MCL (250 mg/L) but were below the NMED approved HAFB Background level for unfiltered (total) groundwater (17,419 mg/L [NMED, 2011]). Nitrate was not detected in any of the three monitoring wells located in Sub-Basin 1.

7.3.2 Sub-Basin 4

Five groundwater samples (including one duplicate) were collected from four monitoring wells (SWMU183-MW03 through SWMU183-MW06) in Sub-Basin 4. The Sub-Basin 4 groundwater samples were analyzed for VOCs, SVOCs, TAL metals, PCBs, TPH (DRO, GRO, and ORO), pesticides, herbicides, anions (nitrate, chloride, and sulfate), and TDS. The Sub-Basin 4 groundwater analytical results for Phase II are summarized in Table 7-8 and the monitoring well locations with groundwater results above action levels are shown on Figure 7-5.

Chloroform was the only VOC detected above the MDL in the five groundwater samples collected. Low estimated concentrations of chloroform were detected in the primary and duplicate sample collected from monitoring well SWMU183-MW03, and was well below the NMWQCC groundwater standard of 100 µg/L (NMAC 20.6.2.3103) (Table 7-8). SVOCs were not detected in any of the Sub-Basin 4 RFI groundwater samples.

TPH fractions GRO and DRO were not detected in any of the five RFI groundwater samples collected in Sub-Basin 4. ORO was detected above the MDL in the groundwater samples collected from monitoring wells SWMU183-MW05 and –MW06. The maximum TPH-ORO concentration of 0.127 J mg/L (SWMU183-MW06), is well below the NMED TPH Screening Guideline for an Unknown Oil of 50 mg/L (NMED, 2006). Furthermore, PCBs were not detected in Sub-Basin 4 groundwater samples.

Herbicides and pesticides were not detected above the MDL in RFI groundwater samples collected in Sub-Basin 4 during this sampling event.

Seventeen of the twenty three TAL metals were detected above the MDL. Maximum detections of barium, cobalt, manganese, nickel, and vanadium exceeded their respective NMED approved HAFB Background levels for filtered (dissolved) groundwater (NMED, 2011). However, with the exception of manganese, each of these detections were below their respective NMWQCC standards for groundwater (NMAC 20.6.2.3103) and or USEPA MCLs (USEPA, 2009). Manganese was detected in all four wells above the USEPA Secondary Drinking Water Standard (50 µg/L) and the NMED approved HAFB Background level (50 µg/L). Manganese concentrations ranged from 339 µg/L (SWMU183-MW04) to 1,450 µg/L (SWMU183-MW06) (Figure 7-5). These detections of manganese are most likely due to the natural variability of groundwater geochemistry and are not related to a release from the sewer as the sewer line is below the water table in this area of HAFB. Additionally, the National Secondary Drinking Water Regulations are non-enforceable guidelines regarding contaminants that may cause aesthetic effects (such as taste, odor, or color) in drinking water (USEPA, 2009).

TDS concentrations ranged from 3,750 mg/L (SWMU183-MW03) to 5,130 mg/L (SWMU183-MW06) and exceeded the NMWQCC groundwater standard of 1,000 mg/L and the USEPA Secondary MCL (500 mg/L) for each of Sub-Basin 4 groundwater samples. As Sub-Basin 4 is centrally located within the most developed portion of HAFB (with numerous underground water lines) these low TDS concentrations (less than 10,000 mg/L) are most likely due to anthropogenic influences (i.e., leaking water lines) as the HAFB unfiltered (total) groundwater upper tolerance limit (UTL) is 65,956.58 mg/L (NationViewIBhate JV III, July 2011).

Chloride concentrations ranged from 312 mg/L (SWMU183-MW04) to 1,280 mg/L (SWMU183-MW06) and exceeded the NMWQCC groundwater standard of 250 mg/L and the USEPA Secondary MCL (250 mg/L) but were below the NMED approved HAFB Background level for unfiltered (total) groundwater (35,040 mg/L) (NMED, 2011). Sulfate concentrations ranged from 1,520 mg/L (SWMU183-MW04) to 2,760 mg/L (SWMU183-MW05) and exceeded the NMWQCC groundwater standard of 600 mg/L and the USEPA Secondary MCL (250 mg/L) but were below the NMED approved HAFB Background level for unfiltered (total) constituents in groundwater (17,419 mg/L) (NMED, 2011).

Nitrate was detected in each of the groundwater samples collected from Sub-Basin 4. Nitrate concentrations ranged from 3.2 mg/L (SWMU183-MW04) to 78.1 mg/L (SWMU183-MW03-A, duplicate sample) and exceeded the NMWQCC groundwater standard and USEPA MCL (10 mg/L) in monitoring wells SWMU183-MW03 (78.1 mg/L) and -MW05 (15.7).

7.3.3 Sub-Basin 10

Two groundwater samples were collected from monitoring wells SWMU183-MW01 and SWMU183-MW02 in Sub-Basin 10. The Sub-Basin 10 groundwater samples were analyzed for VOCs, SVOCs, TAL metals, PCBs, TPH (DRO, GRO, and ORO), anions (nitrate, chloride, and sulfate), and TDS. The Sub-Basin 10 groundwater analytical results for Phase II are summarized in Table 7-7 and the monitoring well locations with groundwater results above action levels are shown on Figure 7-6.

Three VOCs (chloroform, methyl chloride, and TCE) were detected above the MDL in the two Sub-Basin 10 groundwater samples. With the exception of one TCE detection, each detected VOC was below its respective USEPA MCL and/or NMWQCC groundwater standard. (Note: Currently there are no applicable action levels [USEPA MCL or NMWQCC] for methyl chloride). TCE was detected in the groundwater sample collected from SWMU183-MW02 at the USEPA MCL of 5.0 µg/L. As the sewer line is located below the water table within Sub-Basin 10, the hydraulic gradient (flow direction) is from the aquifer into the sewer line (i.e., the sewer line is gaining water from the aquifer by infiltration [Figure 4-1]). As shown on Figure 3-8, the groundwater flow direction within Sub-Basin 10 is to the southwest, therefore, as shown on Figure 7-6, monitoring well SWMU183-MW02 is located downgradient of ERP Site SS-69 (Flight Wing Flight Line Spill), a site with known TCE groundwater contamination, currently under investigation. Therefore, this detection of TCE is probably not due to a groundwater release from the sewer line but is contamination which has migrated downgradient from site SS-69. In addition, TCE was not detected in the groundwater sample collected from SWMU183-MW01 which is located downgradient from SWMU183-MW02. Furthermore, SVOCs and THP fractions (GRO/DRO/ORO) were not detected in either of the two Sub-Basin 10 groundwater samples.

Thirteen of the twenty three TAL metals were detected above the MDL. Maximum concentrations of barium (39.6 µg/L) and cobalt (3.9 µg/L) were detected above their respective NMED approved HAFB background levels for filtered (dissolved) groundwater (NMED, 2011), but were below their respective NMWQCC groundwater standards. Arsenic was detected at 13.3 µg/L in monitoring well SWMU183-MW02 above the USEPA MCL (10 µg/L) and NMED approved background level but was below the HAFB Basewide Background UTL (28.53 µg/L [NationViewIBhate JV III, 2011]), and therefore, most likely represents the natural variability of groundwater geochemistry at HAFB. Manganese was detected in SWMU183-MW02 (860 µg/L), above the USEPA secondary drinking water standard (50 µg/L), and the NMED approved background level HAFB (NMED, 2011).

TDS concentrations were 3,140 mg/L in SWMU183-MW01 and 4,440 mg/L in SWMU183-MW02 and exceeded the NMWQCC groundwater standard of 1,000 mg/L and the USEPA Secondary MCL (500 mg/L). As Sub-Basin 10 is located with the developed portion of HAFB (with numerous underground water lines), these low TDS concentrations (less than 10,000 mg/L) are most likely due to anthropogenic influences (i.e., leaking water lines) as the HAFB unfiltered (total) UTL is 65,956.58 mg/L (NationView|Bhate JV III, 20011).

Chloride concentrations were 158 mg/L in SWMU183-MW01 and 474 mg/L in SWMU183-MW02, and exceeded the NMWQCC groundwater standard of 250 mg/L and the USEPA Secondary MCL (250 mg/L) in SWMU183-MW02. However, this detection of chloride is well below the NMED approved HAFB background level for unfiltered (total) groundwater of 35,040 mg/L (NMED, 2011). Sulfate concentrations were 1,280 mg/L in SWMU183-MW01 and 1,630 mg/L in SWMU183-MW02 and exceeded the NMWQCC groundwater standard of 600 mg/L and the USEPA Secondary MCL (250 mg/L) in both wells but were below the NMED approved HAFB Background level for unfiltered (total) groundwater of 17,419 mg/L (NMED, 2011).

Nitrate was detected in both of the groundwater samples collected from Sub-Basin 10. Nitrate concentrations were to 4.2 mg/L in SWMU183-MW01 and 3.0 mg/L in SWMU183-MW02. Both of these nitrate concentrations were below the NMWQCC groundwater standard (10 mg/L) and the USEPA MCL (10 mg/L).

8 CONCLUSIONS AND RECOMMENDATIONS

The SWMU 183 – Basewide Sewer System is a subsurface feature comprised of approximately 165,000 linear feet of sewer that serves the entire developed portions of the HAFB. The sewer system is divided into 10 Sub-Basins and includes 715 active and 131 inactive (abandoned and removed) manholes, 24 lift (pumping) stations, and hundreds of variably contributing sources distributed throughout the entire Base. During the Phase I investigation, 52 soil borings (SWMU183-DP01 through SWMU183-DP52) were advanced at critical junctions along 165,000 linear feet of sewer line within the 10 Sub-Basins that comprise the HAFB sewer system (Plates 1 and 2). During the Phase II investigation, nine soil borings (SWMU183-DP53 through SWMU183-DP61) were advanced at the Phase I DPT borehole locations containing COPCs which exceeded the applicable soil screening criteria (Plate 2).

A total of 59 soil samples (including duplicates) were collected from the Phase I soil borings. The Phase I soil samples were analyzed for Sub-Basin specific COPCs specified in Section 5.1 of this report. With the exception of eight arsenic detections (Sub-Basins 1, 4, and 10) and one detection of combined TPH-GRO, - DRO and –ORO (Sub-Basin 1), all detections of VOCs, SVOCs, TPH, TAL metals, PCBs, nitrate, sulfate chloride, pesticides, herbicides, radionuclides, and perchlorate were below their applicable Residential NMED SSLs/USEPA RSLs or NMED TPH Screening Guidelines. Arsenic concentrations for 8 of the 9 samples were above the NMED SSL (3.9 mg/kg) and the approved NMED background level (3.7 mg/kg). The concentrations for these samples ranged from 4 to 5.7 mg/kg, and one sample (SWMU183-DP18-12) had an arsenic detection of 27 mg/kg. However, the Phase II subsurface soil sample result for arsenic for soil sample SWMU183-DP54-9 (same soil boring location as SWMU183-DP18) was detected below the NMED SSL at a concentration of 2.6J mg/kg. Therefore, this data suggests that these exceedences are most likely due to the natural variability of soil geochemistry and are not due to a release from the sewer. Furthermore, the singular combined concentration of TPH-GRO, -DRO, and –ORO (803 mg/kg) detected in the duplicate soil sample SWMU183-DP48-5-A has a combined TPH concentration of 326.8 mg/kg in the primary sample (SWMU183-DP48-5) which is well below the TPH Screening Guideline for and unknown oil (800 mg/kg).

During the Phase II investigation a total of 10 soil samples were collected from nine soil borings (SWMU183-DP53 through SWMU183-DP61) advanced in Sub-Basins 1, 4 and 10 (Plate 2). The Phase II soil samples were analyzed for Sub-Basin specific COPCs specified in Section 5.1 of this report. These soil borings were drilled adjacent to the Phase I boreholes which had arsenic and TPH detections that exceeded their applicable screening criteria (DP-17, -18, -27, -30, -34, -35, -48, -51, and -52). With the exception of two detections of arsenic (Sub-Basins 1 and 10), all detections of VOCs, SVOCs, TPH, TAL metals, PCBs, nitrate, sulfate, chloride, pesticides, and herbicides were below their applicable Residential NMED SSLs/USEPA RSLs or NMED TPH Screening Guidelines. The two detections of arsenic (3.9 mg/kg and 4.0 mg/kg) were slightly above the NMED SSL (3.9 mg/kg) and the approved NMED background level (3.7

mg/kg) and most likely represent the natural variability of soil geochemistry and are not due to a release from the sewer.

Each of the nine Phase II soil borings was converted into a permanent 1-inch diameter monitoring well (SWMU183-MW01 through SWMU183-MW09) to determine if there were any impacts to groundwater quality. The Phase II groundwater samples were analyzed for Sub-Basin specific COPCs specified in Section 5.2 of this report. In summary, all detected concentrations of SVOCs, TPH fractions, and PCBs were well below their respective water quality action levels. With the exception of TCE, all VOCs were not detected or were below the USEPA MCLs. TCE was detected at and slightly above the USEPA MCL (5 µg/L) in SWMU183-MW02 (Sub-Basin 10) and SWMU183-MW08 (Sub-Basin 1) with concentrations of 5.0 µg/L and 5.2 µg/L, respectively. As the sewer line is below the water table in Sub-Basins 1 and 10 it is unlikely that these detections represent a release from the sewer line as the gradient is inward from the aquifer into the sewer (Figure 4-1). Therefore, these two detections of TCE are most likely due to the adjacent ERP sites (OT-20 [located upgradient of SWMU183-MW08] and SS-69 [located upgradient of SWMU183-MW02]) with known existing TCE groundwater contamination. As stated previously, the portion of the HAFB sewer system located within Sub-Basins 1 and 10 is below the water table. Therefore, low levels of TCE groundwater contamination may be infiltrating the sewer line in the vicinity of ERP Sites OT-20 (Sub-Basin 1) and SS-69 (Sub-Basin 10) which is further diluted by the average 1.0 MGD flow to the HAFB WWTP which is located adjacent to Sub-Basins 1 and 10 within the southern portion of HAFB (Figure 2-2). Furthermore, the HAFB WWTP is meeting the discharge requirements as specified by the National Pollutant Discharge Elimination System (NPDES) Permit No. NM0029971 (USEPA, 2006) in compliance with the provisions of the Clean Water Act.

In addition, arsenic and/or manganese were detected above their applicable USEPA MCL (arsenic, 10 µg/L) or USEPA Secondary MCL (manganese, 50 µg/L) in Sub-Basin 1, 4, and 10 groundwater samples. Arsenic was detected in one groundwater sample (SWMU183-MW02 [Sub-Basin 10]) at 13.3 µg/L above the USEPA MCL (10 µg/L) but below the HAFB Basewide Background UTL (28.53 µg/L) which indicates that this exceedence most likely represents the natural variability of groundwater geochemistry at HAFB. Eight monitoring wells had manganese concentrations above the USEPA Secondary MCL. These detections of manganese are most likely due to the natural variability of groundwater geochemistry and are not related to a release from the sewer as the sewer line is below the water table within Sub-Basins1, 4, and 10. Additionally, the National Secondary Drinking Water Regulations are non-enforceable guidelines regarding contaminants that may cause aesthetic effects (such as taste, odor, or color) in drinking water (USEPA, 2009).

TDS concentrations within Sub-Basins 1, 4, and 10 ranged from 3,140 mg/L to 41,500 mg/L. As previously discussed, TDS concentrations below 10,000 mg/L are due to anthropogenic influences (i.e., leaking underground water lines) as Sub-Basins 1, 4, and 10 are located within the developed portion of HAFB which contains numerous water lines. Furthermore, groundwater with TDS concentrations greater than 10,000 mg/L is classified by the USEPA as a Class III B aquifer which is designated as unfit for human consumption (USEPA, 1986).

Therefore, HAFB will submit a Statement of Basis requesting No Further Action for the HAFB Basewide Sewer System (SWMU 183) based upon Criterion #5 listed in Appendix 4-B of the HAFB Hazardous Waste Permit (NMED, 2004) which states:

> *"The site was characterized or remediated in accordance with applicable state and/or federal regulations, and the available data indicate that contaminants pose an acceptable level of risk under current and projected future land use."*

This criterion was accomplished by conducting additional characterization activities (soil and groundwater sampling). It was determined by the RFI that a source area above the current NMED SSLs was not detected at the site. Therefore, excavation of contaminated soil is not required for SWMU 183 site closure.

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FIGURES

PLATES

TABLES

Table 2-1
Status of Oil/Water Seperator Sites
SWMU 183 RFI Report
Holloman AFB, New Mexico
NationView Project No. 8080014

SWMU No.	Unit Name	RCRA Permit Status	OWS Status
Table A - Sites Requiring Corrective Action			
SWMU 4	Building 131 OWS	Remedial action planned for 2008	Removed 7/20/1995 [1]
SWMU 8	Building 231 OWS	Remedial action planned for 2008	Removed 8/08/1995 [1]
SWMU 19	Building 638 OWS	SS-59 remedial action (ongoing)	Removed 1996 [2]
SWMU 20	Building 639 OWS	SS-59 remedial action (ongoing)	Abandoned
SWMU 39	Building 1092 OWS	FT-31 site remediation	Removed 1996 [2]
Table B - Sites Requiring No Further Action			
SWMU 1	Building 55 OWS	Site NFAd in February 2001	Active (1996) [2]
SWMU 2	Building 121 OWS	Site NFAd in February 2001	Removed 1996 [2]
SWMU 3	Building 130 OWS	Site NFAd in February 2001	Removed 7/27/1995 [1]
SWMU 5	Building 137 OWS	Site NFAd in February 2001	Active (as of July 1995) [4]
SWMU 6	Building 193 OWS	Site NFAd in February 2001	Active (as of July 1995) [4]
SWMU 7	Building 198 OWS	Site NFAd in February 2001	Removed 1996 [2]
SWMU 9	Building 282 OWS	Site NFAd in February 2001	In use as sediment trap (1995) [4]
SWMU 10	Building 283 OWS	Site NFAd in February 2001	Active
SWMU 11	Building 300 OWS	Site NFAd in February 2001	Active (as of 1996) [2]
SWMU 12	Building 304 OWS	Site NFAd in February 2001	Removed 1993 [4] replaced with new OWS
SWMU 13	Building 304A OWS	Site NFAd in February 2001	Removed 1993 [4] replaced with new OWS
SWMU 14	Building 306 OWS	Site NFAd in February 2001	Active (left in place) June 1997 [3]
SWMU 15	Building 309 OWS	Site NFAd in February 2001	Active (as of Oct 1994) [5]
SWMU 16	Building 315 OWS	Site NFAd in February 2001	Active (as of July 1995) [4]
SWMU 17	Building 316 OWS	Site NFAd in February 2001	Removed April 1996 [3]
SWMU 18	Building 500 OWS	Site NFAd in February 2001	Removed 7/26/1995 [1]
SWMU 21	Building 702 OWS	Site NFAd in February 2001	Removed 1996 [2]
SWMU 22	Building 704 OWS	Site NFAd in February 2001	Removed 1996 [2]
SWMU 23	Building 800 OWS	Site NFAd in February 2001	Removed January 1996 [3]
SWMU 24	Building 801 OWS	Site NFAd in February 2001	In use as sediment trap [4]
SWMU 25	Building 805 OWS	Site NFAd in February 2001	Not found (1996) [2]
SWMU 26	Building 809 OWS	Site NFAd in February 2001	Active (as of July 1995) [4]
SWMU 27	Building 810 OWS	Site NFAd in February 2001	Removed 1996 [2]
SWMU 28	Building 822 OWS	Site NFAd in February 2001	Removed and replaced with a new OWS 1996 [3]
SWMU 29	Building 827 OWS	Site NFAd in February 2001	Removed 1996 [2]
SWMU 30	Building 830 OWS	Site NFAd in February 2001	Active (as of July 1995) [4]
SWMU 31	Building 855 OWS	Site NFAd in February 2001	Removed 1996 [2]
SWMU 32	Building 868 OWS	Site NFAd in February 2001	Active (as of Oct 1994) [5]
SWMU 33	Building 869 OWS	Site NFAd in February 2001	Active (as of July 1995) [4]
SWMU 34	Building 902 OWS	Site NFAd in February 2001	In use as sediment trap (1995) [4]
SWMU 35	Building 903 OWS	Site NFAd in February 2001	Removed and replaced 1993 [4]
SWMU 36	Building 1000 OWS	Site NFAd in February 2001	Removed 7/19/1995 [1]
SWMU 37	Building 1080 OWS	Site NFAd in February 2001	Active (as of July 1995) [4]
SWMU 38	Building 1080A OWS	Site NFAd in February 2001	Active (as of July 1995) [4]
SWMU 40	Building 1166 OWS	Site NFAd in February 2001	Not found (1996) [2]
SWMU 41	Building 1266 OWS	Site NFAd in February 2001	Active (1996) [2]

Notes:
SWMU = Solid Waste Management Unit
ERP = Environmental Restoration Program
RCRA = Resource Conservation & Recovery Act of 1976
OWS = Oil/Water Separator
NFA = No Further Action
POL = Petroleum Oil and Lubricants
[1] Closure Report for Remediation of POL - Contaminated Sites and OWS Removals, HAFB, NM (EBASCO, Nov 1995)
[2] Final Closure Report for Phase II Remediation of POL - Contaminated Sites and OWS Removals and Waste Oil Tank Removals (FWENC, July 199
[3] Final Closure Report Addendum for Phase II Remediation of POL - Contaminated Sites and OWS Removals and Waste Oil Tank Removals (FWEN
[4] Draft Final, RCRA Facility Investigation Report, Table 3 SWMUs (FWENC, July 1995)
[5] Draft Final, Phase I, RCRA Facility Investigation Report, Table 2 SWMUs (Radian, Oct 1994)

Table 3-1
Groundwater Wells
Located within a 4-Mile Radius
of Holloman Air Force Base
SWMU-183 RFI Report
Holloman AFB, New Mexico
NationView Project No.: 8080014

Well Identification Number	Use	NAD 83 UTM (meters)		Well Depth (feet)
		Northing	Easting	
T 00078	Commercial	398468	3648755	428
T 00868	Domestic	400972	3650377	215
T 03794	Irrigation	403280	3651057	250
T 04855	Domestic	403784	3651965	235
T 04967	Domestic	403480	3652067	200
T 00518	Domestic	405819	3646323	305
T 00518 S	Domestic	405819	3646323	220
T 00614	Domestic	404503	3646838	245
T 00995	Domestic	405824	3646730	308
T 01868	Domestic	405824	3646730	280
T 02650	Domestic	405619	3646523	265
T 03230	Domestic	403699	3647252	160
T 04728	Domestic	404503	3646838	216
T 05079 POD1	Domestic	401365	3646757	406
T 01167	Livestock	404993	3644302	170
T 01235	Irrigation	404995	3644706	200
T 03062	Commercial	403678	3644412	295
T 03455	Domestic	403365	3644318	150
T 03483	Domestic	402565	3644318	140
T 03934	Commercial	403578	3644915	160
T 05201 POD1	Irrigation	403380	3644374	295
T 05202 POD1	Irrigation	403381	3644374	250
T 00146	Livestock	402960	3642700	110
T 03245	Commercial	406609	3643887	190
T 04228	Domestic	405295	3643589	180
T 04386 S-6	Commercial	404903	3640666	290
T 04386 S-9	Commercial	404895	3640673	320
T 00172 S	Irrigation	406088	3640755	125
T 00776	Irrigation	406391	3640650	120
T 00782	Domestic	406187	3640854	120
T 00818	Irrigation	406391	3640650	125
T 02431	Domestic	405987	3640654	152
T 03909	Livestock	404765	3639453	140
T 04386 S	Commercial	404886	3638830	290
T 04386 S-2	Commercial	404888	3638830	310
T 04386 S-3	Commercial	404886	3638837	300
T 04386 S-4	Commercial	404886	3638841	295
T 04386 S-5	Commercial	404903	3640661	310
T 03147	Domestic	406380	3638633	135
T 04080	Domestic	406481	3638734	170
T 03228	Domestic	404290	3637226	160
T 00347	Domestic	403131	3634704	182
T 00972	Domestic	404882	3636009	150
T 01602	Domestic	406510	3635592	135
T 05041 POD1	Domestic	406205	3635697	200
T 01012	Commercial	401072	3634316	72
T 01277	Commercial	404434	3633172	104
T 01327	Commercial	400958	3633604	90
T 01526	Commercial	401368	3633601	152
T 01623	Domestic	400743	3633202	260

Source: New Mexico Water Rights Reporting System database, 2009
Notes:
NAD - North American Datum
UTM - Universal Transverse Mercator

Table 3-2
Survey Data and Groundwater Elevation Summary (August 2010)
SWMU 183 RFI Report
Holloman Air Force Base, New Mexico
NationView Project No.: 8080014

Well Identification	Sub-Basin	Northing (NAD 83)	Easting (NAD 83)	TOC Elevation (ft above msl)	DTW from TOC (ft below TOC)	Groundwater Elevation August 9, 2010 (NGA EGM96) (ft above msl)
SWMU183-MW01	10	668663.005	1683333.886	4,047.444	6.23	4,041.214
SWMU183-MW02	10	669164.595	1683291.853	4,048.339	7.89	4,040.449
SWMU183-MW03	4	672154.344	1694954.286	4,086.381	10.43	4,075.951
SWMU183-MW04	4	670417.386	1693486.187	4,076.471	4.93	4,071.541
SWMU183-MW05	4	669239.151	1692643.619	4,073.058	8.15	4,064.908
SWMU183-MW06	4	668357.796	1691653.146	4,070.134	5.88	4,064.254
SWMU183-MW07	1	665628.120	1688656.488	4,044.655	3.95	4,040.705
SWMU183-MW08	1	665236.666	1685802.820	4,039.159	5.88	4,033.279
SWMU183-MW09	1	665855.822	1685712.241	4,039.043	3.16	4,035.883

Notes:
NAD 83 = North American Datum 1983
TOC = Top of Casing
DTW = Depth to Water
ft = feet
msl = mean sea level
NGA = National Geospatial-Intelligence Agency
EGM = Earth Gravitational Model

Table 3-3
Monitoring Well Construction Details
SWMU 183 RFI Report
Holloman Air Force Base, New Mexico
NationView Project No.: 8080014

Well Identification	Sub-Basin	Installation Date	Sampled 2010	Diameter (inches)	Screen Interval (ft bgs)	Depth to Water (ft below TOC)	Total depth (feet)	Status
SWMU183-MW01	10	18-Jul-2010	1	1	3.75 - 13.75	6.23	14.0	Active
SWMU183-MW02	10	18-Jul-2010	1	1	3.75 - 13.75	7.89	14.0	Active
SWMU183-MW03	4	17-Jul-2010	1	1	5.75 - 15.75	10.43	16.0	Active
SWMU183-MW04	4	17-Jul-2010	1	1	4.25 - 14.25	4.93	14.5	Active
SWMU183-MW05	4	17-Jul-2010	1	1	4.75 - 14.75	8.15	15.0	Active
SWMU183-MW06	4	17-Jul-2010	1	1	2.75 - 12.75	5.88	13.0	Active
SWMU183-MW07	1	18-Jul-2010	1	1	4.75 - 9.75	3.95	10.0	Active
SWMU183-MW08	1	18-Jul-2010	1	1	3.75 - 8.75	5.88	9.0	Active
SWMU183-MW09	1	18-Jul-2010	1	1	3.25 - 8.25	3.16	8.5	Active

Notes:
ft bgs = Feet below ground surface
ft below TOC = Feet below top of casing (based on August 9, 2010, groundwater elevation)
SWMU183 = Solid Waste Management Unit 183 (Basewide Sewer System)
MW = Monitoring Well

Table 4-1
Contaminants of Potential Concern Discharged to the Sewer System
SWMU 183 RFI Report
Holloman AFB, New Mexico
NationView Project No. 8080014

Name of Contaminant
Petroleum, Oils, and Lubricants (POL)
Metals / Heavy Metals
Volatile Organic Compounds (VOCs)
Semi-Volatile Organic Compounds (SVOCs)
Surfactants
Oil & Grease (O&G)
Process / Developer Chemicals
Herbicides / Pesticides
Antifreeze
Phosphates
Sulfates
Chlorides
Phenol
Radionuclides (Carbon-14, Tritium, Iodine 125, Radium 226 and 228)

Table 4-2
Types of Waste-Generating Processes
SWMU 183 RFI Report
Holloman AFB, New Mexico
NationView Project No. 8080014

Unique Process Activities/Disharge Points
X-ray Processing
Hospital Sterilization
Hospital Sinks
Hospital Boiler/Chiller Systems
Radiator test tanks
Glass grinding coolant
Aqueous Film-Forming Foam (AFFF)
Photoprocessing
Laboratory Canister Rinsing
Glassware Rinsing
Non-Destructive Inspection (NDI) – Liquid Fluorescent Penetrant
Tungsten inert gas (TIG) Welder coolant
Heat Treatment Furnace Coolant
Fuel-Contaminated Groundwater
Reverse Osmosis Water Purification Unit (ROWPU) Purging
Bulk Washing Activities
Rack Washing
Floor washing
Vehicle Washing
Equipment Washing
Aircraft Washing
Ground Equipment Washing
Engine Washing
Trench Drain Flushing
Trailer Washing
Mop Rinsing

Table 5-1
Borehole Location / Sampling Rationale
SWMU 183 RFI Report
Holloman AFB, New Mexico
NationView Project No. 8080014

Borehole Location ID Number	Phase	Sub-Basin ID Number	Upgradient Manhole ID Number	Line Type / Condition	Upgradient/Nearby SWMUs/AOCs/ERP Sites	Borehole/Sampling Location Rationale
1	I	9	MH510	PVC / Good Condition	Upgradient ERP Sites: PRI-2 and PRI-5 (OT-35)	Pipe junction; downgradient of two ERP sites
2	I	9	MH507	PVC / Good Condition	Upgradient ERP Sites: PRI-2 and PRI-5 (OT-35)	Pipe junction; downgradient of two ERP sites
3	I	9	MH504	PVC / Good Condition	No nearby ugradient sites	Within Suspected Sewage Release Area #2
4	I	9	113713	PVC, Concrete / Good Condition	Downgradient (Nearby ERP Site) PRI-A (OT-32)	Pipe junction; sewer line material type change
5	I	8	MH523B	Concrete / Unknown Condition	No nearby sites	Pipe junction
6	I	8	MH493Q	PVC (Force Main) / Good Condition	Upgradient SWMUs: 165, 177, 179, 181 (SS-39), and 137 (OT-38)	Pipe junction; several upgradient SWMUs
7	I	8	LS493C	PVC (Force Main) / Unknown Condition	No nearby sites	Pipe junction/lift station
8	I	8	MH494	PVC, Concrete, Vitrified Clay / Good Condition	Upgradient ERP site PRI-A (OT-32)	Pipe junction; sewer line material type change; downgradient of PRI-A
9	I	8	113715	Unknown Type / Unknown Condition	Upgradient ERP site PRI-A (OT-32)	Pipe junction (unknown pipe type and condition); downgradient of PRI-A within Suspected Sewage Release Area
10	I	8	MH490	PVC / Good Condition	Upgradient ERP site PRI-A (OT-32)	Downgradient of PRI-A; within the Suspected Sewage Release Area #1
11	I	7	MH478D	PVC, Concrete / Good Condition	No nearby sites	Pipe junction; sewer line material type change
12	I	7	MH474	Unknown Type / Unknown Condition	Upgradient ERP sites: AOC-1001 (SS-61) and SWMU 104 (LF-29)	Pipe junction (unknown pipe type and condition); downgradient of AOC-1001 and SWMU 104
13	I	7	MH463	PVC, Unknown / Good Condition	No nearby sites	Pipe junction; sewer line material type change
14	I	7	MH459	Unknown, Abandoned / Unknown Condition	No nearby sites	Pipe junction; sewer line material type change
15	I	6	MH449	PVC / Good Condition	No nearby sites	Pipe junction; sewer line material type change
16	I	6	MH443	PVC / Good Condition	Upgradient ERP site: AOC-4 (WPOL)	Pipe junction; downgradient of AOC-4
17	I	10	MH405A	PVC / Unknown Condition	Upgradient ERP site: AOC-I (SS-69) Downgradient (nearby) ERP site: AOC-B (SS-65)	Pipe junction; downgradient of AOC-I
18	I	10	MH404	PVC / Unknown Condition	Upgradient ERP Site: AOC-C (SS-66)	Pipe junction; downgradient of AOC-C
19	I	10	MH415	PVC / Good Condition	No nearby sites	Pipe junction
20	I	10	MH418	PVC, Concrete / Unknown Condition	No nearby sites	Pipe junction
21	I	10	MH422	PVC, Concrete Cast In-situ / Good Condition	No nearby upgradient sites	Pipe junction
22	I	10	MH426	PVC / Good Condition	Upgradient ERP Site: AOC-E (SS-67)	Pipe junction; downgradient of AOC-E

Table 5-1
Borehole Location / Sampling Rationale
SWMU 183 RFI Report
Holloman AFB, New Mexico
NationView Project No. 8080014

Borehole Location ID Number	Phase	Sub-Basin ID Number	Upgradient Manhole ID Number	Line Type / Condition	Upgradient/Nearby SWMUs/AOCs/ERP Sites	Borehole/Sampling Location Rationale
23	I	10	MH430	PVC / Poor Condition	No nearby sites	Pipe junction
24	I	10	MH431	PVC, Abandoned Line / Good Condition	No nearby sites	Pipe junction with an abandoned line
25	I	10	LS463A	PVC, Concrete (Force Main) / Good Condition	Upgradient (nearby) SWMUs: 108 (LF-23), 115 (LF-22), and 116 (LF-21)	Pipe junction/lift station, downgradient of three SWMUs
26	I	4	MH321D	PVC, Concrete / Good Condition	Upgradient ERP sites: SWMUs 122 and 123, 114 (OT-03), and AOC-T (SS-02/05)	Pipe junction; sewer line material type change; downgradient of 4 ERP sites
27	I	4	MH321	PVC (Force Main) / Good Condition	Adjacent (nearby) ERP site: SWMU 82 (SD-08)	Pipe junction; nearby ERP site SD-08
28	I	4	MH316	PVC / Unknown Condition	Upgradient ERP Sites: SWMU 4, AOC-J (SS-13), and SD-08	Pipe junction; downgradient of three ERP Sites
29	I	4	MH327	PVC / Good Condition	No upgradient sites	Pipe junction
30	I	4	MH314	PVC / Unknown Condition	Upgradient ERP sites: AOC-N (SS-48) and SWMU 197 (OT-14)	Pipe junction; downgradient of two ERP sites
31	I	4	MH309	PVC, Vitrified Clay / Unknown Condition	No nearby ugradient sites	Pipe junction; sewer line material type change
32	I	4	MH334B	PVC, Concrete / Good Condition	Upgradient ERP site: SWMU 130 (SS-46)	Pipe junction; sewer line material change; downgradient of an ERP site
33	I	4	MH343	PVC, Concrete, Vitrified Clay / Unknown Condition	Upgradient ERP sites: SWMU 8, AOC-P (OT-44), and AOC-H (SS-18)	Pipe junction; sewer line material change (3-way change); downgradient of three ERP sites
34	I	4	MH301A	PVC, Concrete / Unknown Condition	No nearby ugradient sites	Pipe junction; sewer line material change
35	I	4	MH292	PVC, Abandoned Line / Good Condition	No nearby ugradient sites	Pipe junction
36	I	5	MH347	PVC, Concrete, Vitrified Clay / Unknown Condition	Upgradient ERP Sites: SWMUs 229, 19, and 20 (SS-59), AOC-O (OT-45), AOC-P (OT-44)	Pipe junction; multiple sewer line material type changes; downgradient of 4 ERP sites
37	I	5	MH366	PVC / Unknown Condition	Upgradient AOC: AOC-O (OT-45)	Pipe junction; downgradient of AOC-O
38	I	5	MH351	PVC, Vitrified Clay, Unknown Material / Good Condition	No nearby ERP sites	Pipe junction; multiple sewer line material type changes; within the Suspected Sewer/Natural Gas Release Area
39	I	5	MH355	PVC, Concrete / Unknown Condition	No nearby ERP sites	Pipe junction; sewer line material type change
40	I	5	MH356	PVC, Unknown / Poor Condition	No nearby ERP sites	Pipe junction; sewer line material type change
41	I	5	MH286	PVC, Vitrified Clay / Unknown Condition	Upgradient AOC: AOC-V	Pipe junction; sewer line material type change; downgradient of AOC-V
42	I	5	MH280	PVC / Good Condition	No nearby ERP sites	Pipe junction
43	I	3	MH213	Unknown Type / Unknown Condition	Upgradient ERP site: AOC-K (SS-12)	Pipe junction; downgradient of AOC-K
44	I	2	MH34	Concrete, Asbestos Concrete/ Fair condition	No nearby ERP sites	Pipe junction; sewer line material type change

Table 5-1
Borehole Location / Sampling Rationale
SWMU 183 RFI Report
Holloman AFB, New Mexico
NationView Project No. 8080014

Borehole Location ID Number	Phase	Sub-Basin ID Number	Upgradient Manhole ID Number	Line Type / Condition	Upgradient/Nearby SWMUs/AOCs/ERP Sites	Borehole/Sampling Location Rationale
45	I	2	MH25	Concrete, Unknown Material Type / Fair Condition	No nearby ERP sites	Pipe junction; sewer line material type change
46	I	2	MH17	PVC (Force Main) / Good Condition	No nearby ERP sites	Pipe junction
47	I	1	MH9	PVC / Good Condition	No nearby ERP sites	Pipe junction
48	I	1	113559	Abandoned Line	No nearby ERP sites	Pipe junction; abandoned sewer line
49	I	1	LS395A	PVC (Force Main) / Good Condition	No nearby ERP sites	Pipe junction (Force Main)
50	I	1	113532	PVC / Good Condition	No nearby ERP sites	Pipe junction
51	I	1	MHX9X	PVC, Unknown / Good Condition	Upgradient SWMU: SWMU 113A (OT-20)	Pipe junction; sewer line material type change; downgradient of SWMU 113A
52	I	1	LSX9X1	PVC, Unknown line / PVC in Good Condition	Upgradient sites: Lift Station, infrastructure	Pipe junctions/terminous; Water Treatment System
53	II	10	MH405A	PVC / Unknown Condition	Upgradient ERP site: AOC-I (SS-69) Downgradient (nearby) ERP site: AOC-B (SS-65)	Arsenic exceedance at sample location SWMU183-DP17
54	II	10	MH404	PVC / Unknown Condition	Upgradient ERP Site: AOC-C (SS-66)	Arsenic exceedance at sample location SWMU183-DP18
55	II	4	MH321	PVC (Force Main) / Good Condition	Adjacent (nearby) ERP site: SWMU 82 (SD-08)	Arsenic exceedance at sample location SWMU183-DP27
56	II	4	MH314	PVC / Unknown Condition	Upgradient ERP sites: AOC-N (SS-48) and SWMU 197 (OT-14)	Arsenic exceedance at sample location SWMU183-DP30
57	II	4	MH301A	PVC, Concrete / Unknown Condition	No nearby ugradient sites	Arsenic exceedance at sample location SWMU183-DP34
58	II	4	MH292	PVC, Abandoned Line / Good Condition	No nearby ugradient sites	Arsenic exceedance at sample location SWMU183-DP35
59	II	1	113559	Abandoned Line	No nearby ERP sites	Total Petroleum Hydrocarbon exceedance at sample location SWMU183-DP48
60	II	1	MHX9X	PVC, Unknown / Good Condition	Upgradient SWMU: SWMU 113A (OT-20)	Arsenic exceedance at sample location SWMU183-DP51
61	II	1	LSX9X1	PVC, Unknown line / PVC in Good Condition	Upgradient sites: Lift Station, infrastructure	Arsenic exceedance at sample location SWMU183-DP52

Notes:
AOC = Area of Concern
ERP = Environmental Restoration Program
ID = Identification
SWMU = Soild Waste Management Unit
PVC = Polyvinyl chloride
MH = Manhole
LS = Lift Station

Table 5-2
Sampling and Analysis Summary (2010)
SWMU-183 RFI Report
Holloman Air Force Base, New Mexico
NationView Project No. 8080014

Sample Identification	Phase	Sub-Basin	Sample Depth (ft bgs)	Collection Date	Moisture Content (USEPA Method 160.3)	TDS (SM 19 Method 2540C)	VOCs (USEPA SW846 Method 8260B)	SVOCs (USEPA SW846 Method 8270C)	TPH (USEPA SW846 Method 8015B)	TAL Metals (USEPA SW846 Methods 6010B/7471A/7470A and 200.7/245.1)	PCBs (USEPA SW846 Method 8082)	Nitrate (USEPA 300/SW846 Method 9056)	Sulfate (USEPA 300/SW846 Method 9056)	Chloride (USEPA 300/SW846 Method 9056)	Pesticides (USEPA SW846 Method 8081A)	Herbicides (USEPA SW846 Method 8151A)	Perchlorate (USEPA SW846 Method 6860)	Carbon-14 (EERF C-01-1)	Tritium (USEPA Method 906.0 MOD)	Radium 226 (USEPA Method 903.0 MOD)	Radium 228 (USEPA SW846 904 MOD)
Soil Samples																					
SWMU183-DP01	I	9	5.0	20-Apr-2010	X		X	X	X	X	X	X	X	X				X	X	X	X
SWMU183-DP01-A	I	9	5.0	20-Apr-2010	X		X	X	X	X	X	X	X	X				X	X	X	X
SWMU183-DP02	I	9	9.5	20-Apr-2010	X		X	X	X	X	X	X	X	X				X	X	X	X
SWMU183-DP03	I	9	13.0	21-Apr-2010	X		X	X	X	X	X	X	X	X				X	X	X	X
SWMU183-DP04	I	9	11.0	21-Apr-2010	X		X	X	X	X	X	X	X	X				X	X	X	X
SWMU183-DP05	I	8	7.5	20-Apr-2010	X		X	X	X	X	X	X	X	X			X	X	X	X	X
SWMU183-DP05-A	I	8	7.5	20-Apr-2010	X		X	X	X	X	X	X	X	X			X	X	X	X	X
SWMU183-DP06	I	8	11.5	20-Apr-2010	X		X	X	X	X	X	X	X	X			X	X	X	X	X
SWMU183-DP07	I	8	12.0	20-Apr-2010	X		X	X	X	X	X	X	X	X			X	X	X	X	X
SWMU183-DP08	I	8	11.0	20-Apr-2010	X		X	X	X	X	X	X	X	X			X	X	X	X	X
SWMU183-DP09	I	8	6.5	20-Apr-2010	X		X	X	X	X	X	X	X	X			X	X	X	X	X
SWMU183-DP10	I	8	9.0	20-Apr-2010	X		X	X	X	X	X	X	X	X			X	X	X	X	X
SWMU183-DP11	I	7	7.0	21-Apr-2010	X		X	X	X	X	X	X	X	X							
SWMU183-DP11-A	I	7	7.0	21-Apr-2010	X		X	X	X	X	X	X	X	X							
SWMU183-DP12	I	7	8.0	25-Apr-2010	X		X	X	X	X	X	X	X	X							
SWMU183-DP13	I	7	8.0	25-Apr-2010	X		X	X	X	X	X	X	X	X							
SWMU183-DP14	I	7	6.0	25-Apr-2010	X		X	X	X	X	X	X	X	X							
SWMU183-DP15	I	6	8.0	21-Apr-2010	X		X	X	X	X	X	X	X	X							
SWMU183-DP16	I	6	8.0	21-Apr-2010	X		X	X	X	X	X	X	X	X							
SWMU183-DP17	I	10	8.0	21-Apr-2010	X		X	X	X	X	X	X	X	X							
SWMU183-DP18	I	10	12.0	21-Apr-2010	X		X	X	X	X	X	X	X	X							
SWMU183-DP19	I	10	10.0	25-Apr-2010	X		X	X	X	X	X	X	X	X							
SWMU183-DP20	I	10	14.0	21-Apr-2010	X		X	X	X	X	X	X	X	X							
SWMU183-DP21	I	10	11.0	26-Apr-2010	X		X	X	X	X	X	X	X	X							
SWMU183-DP22	I	10	12.0	26-Apr-2010	X		X	X	X	X	X	X	X	X							
SWMU183-DP23	I	10	18.0	26-Apr-2010	X		X	X	X	X	X	X	X	X							
SWMU183-DP24	I	10	11.0	26-Apr-2010	X		X	X	X	X	X	X	X	X							
SWMU183-DP25	I	10	5.0	21-Apr-2010	X		X	X	X	X	X	X	X	X							
SWMU183-DP25-A	I	10	5.0	21-Apr-2010	X		X	X	X	X	X	X	X	X							
SWMU183-DP26	I	4	10.0	24-Apr-2010	X		X	X	X	X	X	X	X	X	X	X					
SWMU183-DP27	I	4	7.0	23-Apr-2010	X		X	X	X	X	X	X	X	X	X	X					
SWMU183-DP28	I	4	7.0	23-Apr-2010	X		X	X	X	X	X	X	X	X	X	X					
SWMU183-DP29	I	4	7.0	23-Apr-2010	X		X	X	X	X	X	X	X	X	X	X					
SWMU183-DP30	I	4	8.0	24-Apr-2010	X		X	X	X	X	X	X	X	X	X	X					
SWMU183-DP31	I	4	12.0	24-Apr-2010	X		X	X	X	X	X	X	X	X	X	X					
SWMU183-DP32	I	4	6.0	24-Apr-2010	X		X	X	X	X	X	X	X	X	X	X					
SWMU183-DP33	I	4	8.0	23-Apr-2010	X		X	X	X	X	X	X	X	X	X	X					
SWMU183-DP34	I	4	13.0	24-Apr-2010	X		X	X	X	X	X	X	X	X	X	X					
SWMU183-DP34-A	I	4	13.0	24-Apr-2010	X		X	X	X	X	X	X	X	X	X	X					
SWMU183-DP35	I	4	14.0	24-Apr-2010	X		X	X	X	X	X	X	X	X	X	X					
SWMU183-DP36	I	5	9.0	23-Apr-2010	X		X	X	X	X	X	X	X	X							
SWMU183-DP37	I	5	12.0	23-Apr-2010	X		X	X	X	X	X	X	X	X							
SWMU183-DP38	I	5	10.0	23-Apr-2010	X		X	X	X	X	X	X	X	X							
SWMU183-DP38-A	I	5	10.0	23-Apr-2010	X		X	X	X	X	X	X	X	X							
SWMU183-DP39	I	5	7.0	22-Apr-2010	X		X	X	X	X	X	X	X	X							
SWMU183-DP40	I	5	9.0	22-Apr-2010	X		X	X	X	X	X	X	X	X							
SWMU183-DP41	I	5	10.0	23-Apr-2010	X		X	X	X	X	X	X	X	X							
SWMU183-DP42	I	5	12.0	26-Apr-2010	X		X	X	X	X	X	X	X	X							
SWMU183-DP43	I	3	12.0	24-Apr-2010	X		X	X	X	X	X	X	X	X							

Table 5-2
Sampling and Analysis Summary (2010)
SWMU-183 RFI Report
Holloman Air Force Base, New Mexico
NationView Project No. 8080014

Sample Identification	Phase	Sub-Basin	Sample Depth (ft bgs)	Collection Date	Moisture Content (USEPA Method 160.3)	TDS (SM 19 Method 2540C)	VOCs (USEPA SW846 Method 8260B)	SVOCs (USEPA SW846 Method 8270C)	TPH (USEPA SW846 Method 8015B)	TAL Metals (USEPA SW846 Methods 6010B/7471A/7470 A and 200.7/245.1)	PCBs (USEPA SW846 Method 8082)	Nitrate (USEPA 300/SW846 Method 9056)	Sulfate (USEPA 300/SW846 Method 9056)	Chloride (USEPA 300/SW846 Method 9056)	Pesticides (USEPA SW846 Method 8081A)	Herbicides (USEPA SW846 Method 8151A)	Perchlorate (USEPA SW846 Method 6860)	Carbon-14 (EERF C-01-1)	Tritium (USEPA Method 906.0 MOD)	Radium 226 (USEPA Method 903.0 MOD)	Radium 228 (USEPA SW846 904 MOD)
Soil Samples																					
SWMU183-DP44	I	2	10.0	24-Apr-2010	X		X	X	X	X	X	X	X	X							
SWMU183-DP45	I	2	11.0	22-Apr-2010	X		X	X	X	X	X	X	X	X							
SWMU183-DP46	I	2	7.0	22-Apr-2010	X		X	X	X	X	X	X	X	X							
SWMU183-DP47	I	1	11.0	24-Apr-2010	X		X	X	X	X	X	X	X	X							
SWMU183-DP48	I	1	5.0	22-Apr-2010	X		X	X	X	X	X	X	X	X							
SWMU183-DP48-A	I	1	5.0	22-Apr-2010	X		X	X	X	X	X	X	X	X							
SWMU183-DP49	I	1	6.0	22-Apr-2010	X		X	X	X	X	X	X	X	X							
SWMU183-DP50	I	1	7.0	22-Apr-2010	X		X	X	X	X	X	X	X	X							
SWMU183-DP51	I	1	8.0	22-Apr-2010	X		X	X	X	X	X	X	X	X							
SWMU183-DP52	I	1	6.0	21-Apr-2010	X		X	X	X	X	X	X	X	X							
SWMU183-DP53	II	10	4.0	15-Jul-2010	X		X	X	X	X	X	X	X	X							
SWMU183-DP54	II	10	9.0	15-Jul-2010	X		X	X	X	X	X	X	X	X							
SWMU183-DP55	II	4	10.0	14-Jul-2010	X		X	X	X	X	X	X	X	X	X	X					
SWMU183-DP56	II	4	4.0	15-Jul-2010	X		X	X	X	X	X	X	X	X	X	X					
SWMU183-DP57	II	4	6.0	14-Jul-2010	X		X	X	X	X	X	X	X	X	X	X					
SWMU183-DP58	II	4	10.0	14-Jul-2010	X		X	X	X	X	X	X	X	X	X	X					
SWMU183-DP59	II	1	3.0	14-Jul-2010	X		X	X	X	X	X	X	X	X							
SWMU183-DP60	II	1	6.0	14-Jul-2010	X		X	X	X	X	X	X	X	X							
SWMU183-DP61	II	1	4.0	15-Jul-2010	X		X	X	X	X	X	X	X	X							
Groundwater Samples																					
SWMU183-MW01	II	10	NA	11-Aug-2010		X	X	X	X	X	X	X	X	X							
SWMU183-MW02	II	10	NA	12-Aug-2010		X	X	X	X	X	X	X	X	X							
SWMU183-MW03	II	4	NA	11-Aug-2010		X	X	X	X	X	X	X	X	X	X	X					
SWMU183-MW04	II	4	NA	11-Aug-2010		X	X	X	X	X	X	X	X	X	X	X					
SWMU183-MW05	II	4	NA	13-Aug-2010		X	X	X	X	X	X	X	X	X	X	X					
SWMU183-MW06	II	4	NA	13-Aug-2010		X	X	X	X	X	X	X	X	X	X	X					
SWMU183-MW07	II	1	NA	12-Aug-2010		X	X	X	X	X	X	X	X	X							
SWMU183-MW08	II	1	NA	13-Aug-2010		X	X	X	X	X	X	X	X	X							
SWMU183-MW09	II	1	NA	13-Aug-2010		X	X	X	X	X	X	X	X	X							

Notes:
ft bgs = feet below ground surface
VOC = Volatile Organic Compound
SVOC = Semi-Volatile Organic Compound
TPH = Total Petroleum Hydrocarbons
TAL = Target Analyte List
PCB = Polychlorinated Biphenyls
USEPA = U.S. Environmental Protection Agency
SW846 = USEPA Office of Solid Waste
EERF = Eastern Environmental Radiation Facilities
MOD = Modified
SWMU183 = Basewide Sewer System
DP = Direct Push Soil Sample
MW = Monitoring well
A = Sample suffix denoting a duplicate sample
NA = Not Applicable

Table 7-1
Sub-Basins 1, 2, 3, 5, 6, 7, and 10 Soil Analytical Results, Phase I (April 2010)
SWMU 183, RFI Report
Holloman Air Force Base, New Mexico

Client Sample Identification:	Soil Screening Levels	Basewide Background Levels		SWMU183-DP11-7			SWMU183-DP11-7-A			SWMU183-DP12-8			SWMU183-DP13-8			SWMU183-DP14-6			SWMU183-DP15-8			SWMU183-DP16-8		
Lab Sample Identification:	NMED Residential[1]	NMED Approved Background Level[2]	Combined Soil Background Level[3]	280-2652-9			280-2652-10			280-2838-6			280-2838-5			280-2838-4			280-2652-11			280-2652-12		
Date Sampled:				4/21/2010			4/21/2010			4/25/2010			4/25/2010			4/25/2010			4/21/2010			4/21/2010		
Sub-Basin:				7			7			7			7			7			6			6		
Analyte (Method)				Result	LQ	CQ	Result	LQ	CQ	Result	LQ	CQ	Result	LQ	CQ	Result	LQ	CQ	Result	LQ	CQ	Result	LQ	CQ
VOCs (SW846 8260B)	**mg/kg**	**mg/kg**	**mg/kg**	**µg/kg**			**µg/kg**			**µg/kg**			**µg/kg**			**µg/kg**			**µg/kg**			**µg/kg**		
1,2,3-Trichloropropane	0.915	NV	NV	1.4	UJ		1.4	U		1.3	UH		1.4	UH		1.4	UH		1.5	U		1.4	U	
1,1,2,2-Tetrachloroethane	7.98	NV	NV	1.4	U		1.4	U		1.3	UH		1.4	UH		1.4	UH		1.5	U		1.4	U	
1,2,4-Trimethylbenzene	62 [5]	NV	NV	1.4	UQ		1.4	UQ		1.3	UH		1.4	UH		1.4	UH		1.5	UQ		1.4	UQ	
1,4-Dichlorobenzene	32.2	NV	NV	1.4	U		1.4	U		1.3	UH		1.4	UH		1.4	UH		1.5	U		1.4	U	
Acetone	67,500	NV	NV	13.6	U		14.4	U		13.3	UH		14.4	UH		14.1	UH		14.6	U		14.2	U	
Carbon disulfide	1,940	NV	NV	1.4	U		1.4	U		1.3	UH		1.4	UH		1.4	UH		1.5	U		1.4	U	
Chloroform	5.72	NV	NV	1.4	U		1.4	U		1.3	UH		1.4	UH		1.4	UH		1.5	U		1.4	U	
cis-1,2-Dichloroethene	782	NV	NV	1.4	U		1.4	U		1.3	UH		1.4	UH		1.4	UH		1.5	U		1.4	U	
Methylene Chloride	199	NV	NV	1.4	U		1.4	U		1.3	UH		1.4	UH		1.4	UH		1.5	U		1.4	U	
sec-Butylbenzene	NV [4]	NV	NV	1.4	U		1.4	U		1.3	UH		1.4	UH		1.4	UH		1.5	U		1.4	U	
tert-Butylbenzene	NV [4]	NV	NV	1.4	U		1.4	U		1.3	UH		1.4	UH		1.4	UH		1.5	U		1.4	U	
trans-1,2-Dichloroethene	273	NV	NV	1.4	U		1.4	U		1.3	UH		1.4	UH		1.4	UH		1.5	U		1.4	U	
Trichloroethene	45.7	NV	NV	1.4	U		1.4	U		1.3	UH		1.4	UH		1.4	UH		1.5	U		1.4	U	
SVOCs (SW846 8270C)	**mg/kg**	**mg/kg**	**mg/kg**	**µg/kg**			**µg/kg**			**µg/kg**			**µg/kg**			**µg/kg**			**µg/kg**			**µg/kg**		
Acenaphthene	3,440	NV	NV	20	U		20.1	U		21.7	U		21.2	U		24.3	U		23	U		23.5	U	
Benzo(a)anthracene	6.21	NV	NV	40	U		40	U		40	U		40	U		50	U		40	U		50	U	
Benzo(b)fluoranthene	6.21	NV	NV	38.7	U		39	U		42.1	U		41.1	U		47.2	U		44.6	U		45.7	U	
Dimethyl phthalate	611,000	NV	NV	39	U		39	U		42	U		41	U		47	U		45	U		46	U	
Fluoranthene	2,290	NV	NV	77	U		78	U		84	U		82	U		94	U		89	U		91	U	
Chrysene	621	NV	NV	39	U		39	U		42	U		41	U		47	U		45	U		46	U	
Benzo(g,h,i)perylene	NV [4]	NV	NV	39	U		39	U		42	U		41	U		47	U		45	U		46	U	
Benzo(a)pyrene	0.621	NV	NV	40	U		40	U		40	U		40	U		50	U		40	U		50	U	
Indeno(1,2,3-cd)pyrene	6.21	NV	NV	39	U		39	U		42	U		41	U		47	U		45	U		46	U	
Pyrene	1,720	NV	NV	38.7	U		39	U		42.1	U		41.1	U		47.2	U		44.6	U		45.7	U	
Phenanthrene	1,830	NV	NV	39	U		39	U		42	U		41	U		47	U		45	U		46	U	
bis(2-Ethylhexyl)phthalate	347	NV	NV	77	J		78	U		110	J	J	100	J	J	94	U		160	J		94	J	
TAL Metals (SW846 6010B/7471A)[7]	**mg/kg**	**mg/kg**	**mg/kg**	**mg/kg [7]**			**mg/kg [7]**			**mg/kg [7]**			**mg/kg [7]**			**mg/kg [7]**			**mg/kg [7]**			**mg/kg [7]**		
Aluminum	78,100	13,722	13,722.27	2,000	J	J	14,000		J	8,200			5,700			2,500			2,200		J	2,500		J
Arsenic	3.9	3.7	3.66	2.4	U		2.5	J		2.7	U		2.4	U		2.7	U		2.4	U		2.7	U	
Barium	15,600	169.3	169.25	15		J	140		J	62			35			25			17			20		
Beryllium	156	1.6	1.53	0.0359	U		0.37	J		0.25	J		0.074	J		0.0404	U		0.0359	U		0.0408	U	
Cadmium	77.9	0.3	0.28	0.144	U		0.143	U		0.163	U		0.146	U		0.162	U		0.144	U		0.163	U	
Calcium	NV [4]	317,332	317,331.59	200,000	J	J	140,000	J	J	220,000			150,000			210,000			210,000	J	J	260,000	J	J
Chromium	219	25	24.95	2	J	J	12		J	9.6			5.1			2.6	J		2.3	J		2.5	J	
Cobalt	23 [5]	7.7	7.70	0.61	JQ	J	3.7	Q	J	2.6	Q		1.7	Q		1.3	Q		0.8	JQ		0.73	JQ	
Copper	3,130	13	12.96	1.4	JQ	J	10	Q	J	3.9	JQ		3.5	JQ		1.8	JQ		1.6	JQ	J	1.6	JQ	J
Iron	54,800	23,049	23,049.48	1,800	J	J	10,000		J	7,700			4,500			2,500			1,700			2,400		
Lead	400	10.9	10.87	0.96	U		7			2.9			1.9			1.1	U		0.96	U		1.1	U	
Magnesium	NV [4]	16,991	16,990.65	1,100		J	5,200		J	4,800		J	4,400		J	1,500		J	1,900			1,200		
Manganese	10,700	393	393.47	25	Q	J	220	Q	J	93	Q		85	Q		35	Q		29	Q	J	30	Q	J
Molybdenum	391	NV	NV	0.21	J	J	0.67	J	J	0.14	J		0.69	J		1	J		0.18	J		0.29	J	
Nickel	1,560	17.4	17.34	1.3	JQ	J	8.7	Q	J	7.1	Q		3.9	JQ		2.6	JQ		1.7	JQ		1.5	JQ	
Potassium	NV [4]	5,077	5,077.12	590		J	3,600		J	2,100			1,700			720			620			730		
Silver	391	1.1	1.1	0.48	U		0.48	U		0.54	U		0.49	U		0.54	U		0.48	U		0.54	U	
Sodium	NV [4]	5,196	5,195.97	630			400	J		270	J		2,200			360	J		1,400			550	J	
Vanadium	391	42.6	42.53	4.3	Q	J	20	Q	J	18	Q		11	Q		6.4	Q		5.2	Q		5.7	Q	
Zinc	23,500	54.6	54.53	4.8	JQ	J	33	Q	J	19	Q		14	Q		17	Q		4.6	JQ		5.6	JQ	
Mercury (µg/kg) [7]	7.71	10.8	10.76	9.97	U		8.64	U		11.3	U		9.76	U		12.1	U		12	U		11.4	U	
PCBs (SW846 8082)	**mg/kg**	**mg/kg**	**mg/kg**	**µg/kg**			**µg/kg**			**µg/kg**			**µg/kg**			**µg/kg**			**µg/kg**			**µg/kg**		
All PCBs	NV	NV	NV	ND			ND			ND			ND			ND			ND			ND		
Anions (EPA 300/SW846 9056)	**mg/kg**	**mg/kg**	**mg/kg**	**mg/kg**			**mg/kg**			**mg/kg**			**mg/kg**			**mg/kg**			**mg/kg**			**mg/kg**		
Nitrate as N	125,000	NV	NV	1.7	J	J	1.6	J	J	1.35	U		1.25	U		39		J	1.38	U		1.33	U	
Chloride	NV [4]	NV	NV	330			270			12	J		1,300			2,400			1,700			540		
Sulfate	NV [4]	NV	NV	18,000			17,000			22,000			21,000			23,000			20,000			19,000		
TPH (SW846 8015 M)	**mg/kg**	**mg/kg**	**mg/kg**	**mg/kg**			**mg/kg**			**mg/kg**			**mg/kg**			**mg/kg**			**mg/kg**			**mg/kg**		
Gasoline Range Organics (C6 -C10)	800 [6]	NV	NV	0.773	U		0.798	U		0.731	UH		0.658	UH		0.765	UH		0.768	UQ		0.718	UQ	
Diesel Range Organics (C10-C22)	800 [6]	NV	NV	2.27	U		2.31	U		2.64	U		2.47	UMQ	UJ	19	M		2.81	U		2.8	U	
Oil Range Organics (>C22-C36)	800 [6]	NV	NV	2.27	UM		2.31	U		4.2	J	J	4.2	JMQ	J	66	M		2.81	U		2.8	U	
General Chemistry (SM19 2540B M)	**%**	**%**	**%**	**%**			**%**			**%**			**%**			**%**			**%**			**%**		
Percent Moisture	NV	NV	NV	16			16			26			20			31			30			29		

Notes:

NMED = New Mexico Environment Department
VOC = Volatile Organic Compounds
SVOC = Semi-Volatile Organic Compounds
TPH = Total Petroleum Hydrocarbons
TAL = Target Analyte List
PCB = Polychlorinated Biphenyls
EPA = Environmental Protection Agency

µg/kg = Micrograms per kilogram
mg/kg = Milligrams per kilogram
ND = Not Detected
NV = No Value
% = percent
LQ = Laboratory Qualifier
CQ = Validating Chemist Qualifier

Qualifiers
J = Estimated result. Result is between the method detection limit and the reporting limit.
Q = One or more quality control criteria failed
M = Manually integrated compound
U = Undetected. Value set at the limit of detection.
H = Sample prepped or analyzed beyond the specified holding time
K = Benzo(b&k)fluoranthene are unresolved due to matrix, result is reported as Benzo(b)fluoranthene.

[1] NMED, December 2009. Technical Background Document for Development of Soil Screening Levels, Revision 5.0.
[2] Table 1, Conditional Approval Letter, *Basewide Background Study Report, Holloman Air Force Base, New Mexico* (NMED, December 2011)
[3] Table 5-18, *Basewide Background Study Report, Holloman Air Force Base, New Mexico* (NationView|Bhate JV III, July 2011)
[4] No Value established for NMED Residential SSL (December 2009) and USEPA Region 3, 6, and 9 Regional Screening Levels (RSLs) (November 2011)
[5] USEPA Regions 3, 6, and 9 RSLs (November 2011)
[6] NMED TPH Screening Guidelines for Unknown Oil, Residential Direct Exposure, Table 2b (October 2006)
[7] Mercury analytical results are reported in µg/kg, while all other TAL metals are reported in mg/kg.
Bold value indicates analytes above NMED SSLs (Rev 5.0, December 2009) or TPH results above NMED TPH Screening Guidelines (October 2006)
Indicates that the combined TPH-GRO/DRO/ORO results exceed the NMED TPH Screening Guidelines (Unknown Oil, Residential Direct Exposure)
Indicates analytical results above the NMED Approved Basewide Background Levels, but below the NMED Residential SSL and/or USEPA RSL

Client Sample Nomenclature
SWMU183 = Soild Waste Management Unit 183 (Basewide Sewer System)
DP = Direct Push
A = Denotes a duplicate sample
Final digit(s) equal the sample interval depth in feet below ground surface

Table 7-1
Sub-Basins 1, 2, 3, 5, 6, 7, and 10 Soil Analytical Results, Phase I (April 2010)
SWMU 183, RFI Report
Holloman Air Force Base, New Mexico

Client Sample Identification:	Soil Screening Levels	Basewide Background Levels		SWMU183-DP17-8			SWMU183-DP18-12			SWMU183-DP19-10			SWMU183-DP20-14			SWMU183-DP21-11			SWMU183-DP22-12			SWMU183-DP23-18		
Lab Sample Identification:	NMED Residential[1]	NMED Approved Background Level[2]	Combined Soil Background Level[3]	280-2709-2			280-2709-3			280-2838-7			280-2709-1			280-2838-19			280-2838-20			280-2838-21		
Date Sampled:				4/21/2010			4/21/2010			4/25/2010			4/21/2010			4/26/2010			4/26/2010			4/26/2010		
Sub-Basin:				10			10			10			10			10			10			10		
Analyte (Method)				Result	LQ	CQ	Result	LQ	CQ	Result	LQ	CQ	Result	LQ	CQ	Result	LQ	CQ	Result	LQ	CQ	Result	LQ	CQ
VOCs (SW846 8260B)	**mg/kg**	**mg/kg**	**mg/kg**	**µg/kg**			**µg/kg**			**µg/kg**			**µg/kg**			**µg/kg**			**µg/kg**			**µg/kg**		
1,2,3-Trichloropropane	0.915	NV	NV	1.1	U		1.1	U		1.1	UH		1.2	UH		1.4	U		1.2	U		1.2	U	
1,1,2,2-Tetrachloroethane	7.98	NV	NV	1.1	U		1.1	U		1.1	UH		1.2	UH		1.4	U		1.2	U		1.2	U	
1,2,4-Trimethylbenzene	62 [5]	NV	NV	1.1	U		1.1	U		1.1	UH		1.2	UH		1.4	U		1.2	U		1.2	U	
1,4-Dichlorobenzene	32.2	NV	NV	1.1	U		1.1	U		1.1	UH		1.2	UH		1.4	U		1.2	U		1.2	U	
Acetone	67,500	NV	NV	11.4	UQ		10.9	UQ		30	H		11.9	UHQ		14.3	U		11.5	U		12.3	U	
Carbon disulfide	1,940	NV	NV	1.1	U		1.1	U		1.1	UH		1.2	UH		1.4	U		1.2	U		1.2	U	
Chloroform	5.72	NV	NV	1.8	J		1.1	U		1.1	UH		1.2	UH		1.4	U		1.2	U		1.2	U	
cis-1,2-Dichloroethene	782	NV	NV	1.1	U		1.1	U		1.1	UH		1.2	UH		1.4	U		1.2	U		1.2	U	
Methylene Chloride	199	NV	NV	2.9	J	J	1.1	J	J	1.5	JH		1.7	JH	J	1.4	U		1.3	J	J	1.2	U	
sec-Butylbenzene	NV [4]	NV	NV	1.1	U		1.1	U		1.1	UH		1.2	UH		1.4	U		1.2	U		1.2	U	
tert-Butylbenzene	NV [4]	NV	NV	1.1	U		1.1	U		1.1	UH		1.2	UH		1.4	U		1.2	U		1.2	U	
trans-1,2-Dichloroethene	273	NV	NV	1.1	U		1.1	U		1.1	UH		1.2	UH		1.4	U		1.2	U		1.2	U	
Trichloroethene	45.7	NV	NV	1.1	U		1.1	U		1.1	UH		1.2	UH		1.4	U		1.2	U		1.2	U	
SVOCs (SW846 8270C)	**mg/kg**	**mg/kg**	**mg/kg**	**µg/kg**			**µg/kg**			**µg/kg**			**µg/kg**			**µg/kg**			**µg/kg**			**µg/kg**		
Acenaphthene	3,440	NV	NV	20.5	U		20.4	U		32	J		22.2	U		23.5	U		20.5	U		23.2	U	
Benzo(a)anthracene	6.21	NV	NV	40	U		40	U		40	U		40	U		50	U		170	J		50	U	
Benzo(b)fluoranthene	6.21	NV	NV	39.9	U		39.7	U		43.6	U		43.1	U		45.6	U		250	JK		45	U	
Dimethyl phthalate	611,000	NV	NV	40	U		40	U		44	U		43	U		46	U		40	U		45	U	
Fluoranthene	2,290	NV	NV	80	U		79	U		87	U		86	U		91	U		300	J		90	U	
Chrysene	621	NV	NV	40	U		40	U		44	U		43	U		46	U		170	J		45	U	
Benzo(g,h,i)perylene	NV [4]	NV	NV	40	U		40	U		44	U		43	U		46	U		89	J		45	U	
Benzo(a)pyrene	0.621	NV	NV	40	U		40	U		40	U		40	U		50	U		130	J		50	U	
Indeno(1,2,3-cd)pyrene	6.21	NV	NV	40	U		40	U		44	U		43	U		46	U		77	J		45	U	
Pyrene	1,720	NV	NV	39.9	U		39.7	U		51	J		43.1	U		45.6	U		250	J		45	U	
Phenanthrene	1,830	NV	NV	40	U		40	U		44	U		43	U		46	U		64	J		45	U	
bis(2-Ethylhexyl)phthalate	347	NV	NV	110	J	J	120	J	J	110	J	J	130	J	J	170	J	J	100	J	J	100	J	J
TAL Metals (SW846 6010B/7471A)[7]	**mg/kg**	**mg/kg**	**mg/kg**	**mg/kg [7]**			**mg/kg [7]**			**mg/kg [7]**			**mg/kg [7]**			**mg/kg [7]**			**mg/kg [7]**			**mg/kg [7]**		
Aluminum	78,100	13,722	13,722.27	4,200			11,000			5,500			12,000			3,400		J	11,000		J	2,700		J
Arsenic	3.9	3.7	3.66	**5.3**			**27**			2.5	U		2.9	J		2.9	U		2.6	U		2.6	U	
Barium	15,600	169.3	169.25	35			120			39			51			39			58			58		
Beryllium	156	1.6	1.53	0.0374	U		0.36	J		0.0378	U		0.56	J		0.0434	U		0.47	J		0.0383	U	
Cadmium	77.9	0.3	0.28	0.15	U		0.152	U		0.151	U		0.158	U		0.173	U		0.3	J		0.153	U	
Calcium	NV [4]	317,332	317,331.59	130,000			200,000			180,000			140,000			190,000		J	130,000		J	170,000		J
Chromium	219	25	24.95	5.7			13			5.7			13			4.4	J		15			2.8	J	
Cobalt	23 [5]	7.7	7.70	2.8	Q		4.7	Q		2	Q		4.7	Q		1.1	JQ		3.7	Q		1.2	JQ	
Copper	3,130	13	12.96	2.9	JQ		7.7	Q		6.8	Q		6.2	JQ		2.5	JQ		6.7	Q		2	JQ	
Iron	54,800	23,049	23,049.48	5,000			12,000			4,800			11,000			3,000			9,800			2,300		
Lead	400	10.9	10.87	2.1			5.1			4.9			5.2			1.2	U		6.1			1	U	
Magnesium	NV [4]	16,991	16,990.65	6,000			5,200			6,400		J	17,000			2,500		J	8,900		J	4,900		J
Manganese	10,700	393	393.47	87	Q		190	Q		110	Q		130	Q		32	Q	J	200	Q	J	48	Q	J
Molybdenum	391	NV	NV	1.6	J		1.1	J		0.66	J		0.44	J		0.45	J		0.74	J		0.33	J	
Nickel	1,560	17.4	17.34	3.8	J		9.8			4.5	JQ		11			2.6	JQ		10	Q		2.7	JQ	
Potassium	NV [4]	5,077	5,077.12	970			2,500			1,600			3,200			1,000			2,600			760		
Silver	391	1.1	1.1	0.5	U		0.51	U		0.5	U		0.53	U		0.58	U		0.52	U		0.51	U	
Sodium	NV [4]	5,196	5,195.97	250	JQ		280	JQ		250	J		980	Q		1,300			390	J		1,600		
Vanadium	391	42.6	42.53	16	Q		44	Q		12	Q		18	Q		5.9	Q		21	Q		9.2	Q	
Zinc	23,500	54.6	54.53	11	Q		27	Q		20	Q		28	Q		9.7	JQ		32	Q		6.4	JQ	
Mercury (µg/kg) [7]	7.71	10.8	10.76	10.2	U		9.15	U		9.95	U		10.8	U		10.9	U		10	U		10.2	U	
PCBs (SW846 8082)	**mg/kg**	**mg/kg**	**mg/kg**	**µg/kg**			**µg/kg**			**µg/kg**			**µg/kg**			**µg/kg**			**µg/kg**			**µg/kg**		
All PCBs	NV	NV	NV	ND			ND			ND			ND			ND			ND			ND		
Anions (EPA 300/SW846 9056)	**mg/kg**	**mg/kg**	**mg/kg**	**mg/kg**			**mg/kg**			**mg/kg**			**mg/kg**			**mg/kg**			**mg/kg**			**mg/kg**		
Nitrate as N	125,000	NV	NV	2.3	J	J	1.25	U		1.31	U		1.31	U		8.1		J	1.28	U		5.5	J	J
Chloride	NV [4]	NV	NV	110			30	J		60			360			1,400			110			3,100		
Sulfate	NV [4]	NV	NV	13,000			6,600			19,000			11,000			24,000			16,000			23,000		
TPH (SW846 8015 M)	**mg/kg**	**mg/kg**	**mg/kg**	**mg/kg**			**mg/kg**			**mg/kg**			**mg/kg**			**mg/kg**			**mg/kg**			**mg/kg**		
Gasoline Range Organics (C6 -C10)	800 [6]	NV	NV	0.644	UQ	UJ	0.6	JQ	J	0.666	UH		0.69	JQ	J	0.775	UQ	UJ	0.71	UQ	UJ	0.68	U	
Diesel Range Organics (C10-C22)	800 [6]	NV	NV	2.44	U		2.32	U		2.6	UM		2.4	U		2.77	UM		2.4	UM		2.57	UM	
Oil Range Organics (>C22-C36)	800 [6]	NV	NV	3.8	J	J	3.6	J	J	4.8	JM	J	3.7	J	J	4.9	JM	J	2.8	JM		2.57	UM	
General Chemistry (SM19 2540B M)	**%**	**%**	**%**	**%**			**%**			**%**			**%**			**%**			**%**			**%**		
Percent Moisture	NV	NV	NV	24			21			25			24			33			24			28		

Notes:

NMED = New Mexico Environment Department
VOC = Volatile Organic Compounds
SVOC = Semi-Volatile Organic Compounds
TPH = Total Petroleum Hydrocarbons
TAL = Target Analyte List
PCB = Polychlorinated Biphenyls
EPA = Environmental Protection Agency

µg/kg = Micrograms per kilogram
mg/kg = Milligrams per kilogram
ND = Not Detected
NV = No Value
% = percent
LQ = Laboratory Qualifier
CQ = Validating Chemist Qualifier

Qualifiers
J = Estimated result. Result is between the method detection limit and the reporting limit.
Q = One or more quality control criteria failed
M = Manually integrated compound
U = Undetected. Value set at the limit of detection.
H = Sample prepped or analyzed beyond the specified holding time
K = Benzo(b&k)fluoranthene are unresolved due to matrix, result is reported as Benzo(b)fluoranthene.

[1] NMED, December 2009. Technical Background Document for Development of Soil Screening Levels, Revision 5.0.
[2] Table 1, Conditional Approval Letter, *Basewide Background Study Report, Holloman Air Force Base, New Mexico* (NMED, December 2011)
[3] Table 5-18, *Basewide Background Study Report, Holloman Air Force Base, New Mexico* (NationView|Bhate JV III, July 2011)
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[5] USEPA Regions 3, 6, and 9 RSLs (November 2011)
[6] NMED TPH Screening Guidelines for Unknown Oil, Residential Direct Exposure, Table 2b (October 2006)
[7] Mercury analytical results are reported in µg/kg, while all other TAL metals are reported in mg/kg.
Bold value indicates analytes above NMED SSLs (Rev 5.0, December 2009) or TPH results above NMED TPH Screening Guidelines (October 2006)
Indicates that the combined TPH-GRO/DRO/ORO results exceed the NMED TPH Screening Guidelines (Unknown Oil, Residential Direct Exposure)
Indicates analytical results above the NMED Approved Basewide Background Levels, but below the NMED Residential SSL and/or USEPA RSL

Client Sample Nomenclature
SWMU183 = Soild Waste Management Unit 183 (Basewide Sewer System)
DP = Direct Push
A = Denotes a duplicate sample
Final digit(s) equal the sample interval depth in feet below ground surface

Table 7-1
Sub-Basins 1, 2, 3, 5, 6, 7, and 10 Soil Analytical Results, Phase I (April 2010)
SWMU 183, RFI Report
Holloman Air Force Base, New Mexico

Client Sample Identification:	Soil Screening Levels	Basewide Background Levels		SWMU183-DP24-11			SWMU183-DP25-5			SWMU183-DP25-5-A			SWMU183-DP36-9			SWMU183-DP37-12			SWMU183-DP38-10			SWMU183-DP38-10-A			SWMU183-DP39-7		
Lab Sample Identification:	NMED Residential[1]	NMED Approved Background Level[2]	Combined Soil Background Level[3]	280-2838-22			280-2709-4			280-2709-5			280-2776-1			280-2776-3			280-2776-9			280-2776-10			280-2776-7		
Date Sampled:				4/26/2010			4/21/2010			4/21/2010			4/23/2010			4/23/2010			4/23/2010			4/23/2010			4/22/2010		
Sub-Basin:				10			10			10			5			5			5			5			5		
Analyte (Method)				Result	LQ	CQ	Result	LQ	CQ	Result	LQ	CQ	Result	LQ	CQ	Result	LQ	CQ	Result	LQ	CQ	Result	LQ	CQ	Result	LQ	CQ
VOCs (SW846 8260B)	mg/kg	mg/kg	mg/kg	µg/kg			µg/kg			µg/kg			µg/kg			µg/kg			µg/kg			µg/kg			µg/kg		
1,2,3-Trichloropropane	0.915	NV	NV	1.4	U		0.95	U		0.97	U		1.3	U		1.3	U		1.2	U		1.3	U		1.4	U	
1,1,2,2-Tetrachloroethane	7.98	NV	NV	1.4	U		0.95	U		0.97	U		1.3	U		1.3	U		1.2	U		1.3	U		1.4	U	
1,2,4-Trimethylbenzene	62 [5]	NV	NV	1.4	U		0.95	U		0.97	U		1.3	U		1.3	U		1.2	U		1.3	U		1.4	U	
1,4-Dichlorobenzene	32.2	NV	NV	1.4	U		0.95	U		0.97	U		1.3	U		1.3	U		1.2	U		2.4	J		1.4	U	
Acetone	67,500	NV	NV	17	J		9.47	UQ		9.66	UQ		12.8	U		12.6	U		22	J	J	25			14.2	U	
Carbon disulfide	1,940	NV	NV	2.5	J		0.95	U		0.97	U		1.3	U		1.3	U		3.1	J	J	1.6	J	J	1.4	U	
Chloroform	5.72	NV	NV	1.4	U		0.95	U		0.97	U		1.3	U		1.3	U		1.2	U		1.3	U		1.4	U	
cis-1,2-Dichloroethene	782	NV	NV	1.4	U		0.95	U		0.97	U		1.3	U		1.3	U		2.7	J	J	39		J	1.4	U	
Methylene Chloride	199	NV	NV	1.4	U		1.5	J	J	0.97	U		1.3	U		1.3	U		1.2	U		1.3	U		1.4	U	
sec-Butylbenzene	NV [4]	NV	NV	1.4	U		0.95	U		0.97	U		1.3	U		1.3	U		1.2	U		1.3	U		1.4	U	
tert-Butylbenzene	NV [4]	NV	NV	1.4	U		0.95	U		0.97	U		1.3	U		1.3	U		1.2	U		1.3	U		1.4	U	
trans-1,2-Dichloroethene	273	NV	NV	1.4	U		0.95	U		0.97	U		1.3	U		1.3	U		4.6	J	J	74		J	1.4	U	
Trichloroethene	45.7	NV	NV	1.4	U		0.95	U		0.97	U		1.3	U		1.3	U		1.2	U		3.3	J		1.4	U	
SVOCs (SW846 8270C)	mg/kg	mg/kg	mg/kg	µg/kg			µg/kg			µg/kg			µg/kg			µg/kg			µg/kg			µg/kg			µg/kg		
Acenaphthene	3,440	NV	NV	26	UQ		19.1	U		19.4	U		22.1	U		23.5	U		22.3	U		23	U		23.9	U	
Benzo(a)anthracene	6.21	NV	NV	50	U		40	U		40	U		40	U		50	U		40	U		40	U		50	U	
Benzo(b)fluoranthene	6.21	NV	NV	50.6	U		37.1	U		37.6	U		42.9	U		45.7	U		43.2	U		44.6	U		46.5	U	
Dimethyl phthalate	611,000	NV	NV	51	UQ		37	U		38	U		43	U		46	U		53	J		45	U		46	U	
Fluoranthene	2,290	NV	NV	100	U		74	U		75	U		86	U		91	U		86	U		89	U		93	U	
Chrysene	621	NV	NV	51	U		37	U		38	U		43	U		46	U		43	U		45	U		46	U	
Benzo(g,h,i)perylene	NV [4]	NV	NV	51	U		37	U		38	U		43	U		46	U		43	U		45	U		46	U	
Benzo(a)pyrene	0.621	NV	NV	50	U		40	U		40	U		40	U		50	U		40	U		40	U		50	U	
Indeno(1,2,3-cd)pyrene	6.21	NV	NV	51	U		37	U		38	U		43	U		46	U		43	U		45	U		46	U	
Pyrene	1,720	NV	NV	50.6	U		37.1	U		37.6	U		42.9	U		45.7	U		43.2	U		44.6	U		46.5	U	
Phenanthrene	1,830	NV	NV	51	U		37	U		38	U		43	U		46	U		43	U		45	U		46	U	
bis(2-Ethylhexyl)phthalate	347	NV	NV	120	J	J	99	J	J	100	J	J	86	U		91	U		86	U		89	U		93	U	
TAL Metals (SW846 6010B/7471A)[7]	mg/kg	mg/kg	mg/kg	mg/kg [7]			mg/kg [7]			mg/kg [7]			mg/kg [7]			mg/kg [7]			mg/kg [7]			mg/kg [7]			mg/kg [7]		
Aluminum	78,100	13,722	13,722.27	3,200		J	11,000			8,900			7,400			3,700			4,100	J	J	7,500		J	2,600		
Arsenic	3.9	3.7	3.66	2.7	U		3.3			2.7			2.7	U		2.5	U		2.6	U		2.5	U		2.6	U	
Barium	15,600	169.3	169.25	33			94			93			86			170			56		J	180		J	23		
Beryllium	156	1.6	1.53	0.0405	U		0.32	J		0.23	J		0.15	J		0.0379	U		0.0386	U		0.17	J		0.0393	U	
Cadmium	77.9	0.3	0.28	0.162	U		0.134	U		0.131	U		0.16	U		0.152	U		0.154	U		7.4			0.157	U	
Calcium	NV [4]	317,332	317,331.59	210,000		J	81,000			96,000			150,000			200,000			160,000	J	J	88,000		J	170,000		
Chromium	219	25	24.95	3.5	J		10			8.5			8.9			4.3	J		4.4	J	J	130		J	3	J	
Cobalt	23 [5]	7.7	7.70	1.2	JQ		3.5	Q		3.1	Q		2.9	Q		1.3	Q		1.7	Q		2.7	Q		0.92	JQ	
Copper	3,130	13	12.96	2.6	JQ		8.7	Q		7.5	Q		4.4	JQ		1.5	JQ		3.4	JQ	J	110	Q	J	2.5	JQ	
Iron	54,800	23,049	23,049.48	2,800			9,100			7,700			6,800			3,000			3,800	J	J	6,800		J	2,800		
Lead	400	10.9	10.87	1.1	J		4.9			4.2			3.1			1	U		1.4		J	92		J	1	U	
Magnesium	NV [4]	16,991	16,990.65	3,700		J	6,100			4,900			12,000			2,300			3,100		J	5,200		J	1,400		
Manganese	10,700	393	393.47	42	Q	J	210	Q		170	Q		120	Q		61	Q		98	Q		99	Q		34	Q	
Molybdenum	391	NV	NV	0.58	J		1.5	J		1.3	J		0.33	J		0.16	J		0.17	J	J	4.1		J	0.14	J	
Nickel	1,560	17.4	17.34	2.7	JQ		7.4			6.5			6.4			2.7	J		3.7	J	J	7.9		J	1.9	J	
Potassium	NV [4]	5,077	5,077.12	920			3,600			3,100			2,000			920			1,200			2,000			750		
Silver	391	1.1	1.1	0.54	U		0.45	U		0.44	U		0.53	U		0.51	U		0.51	U		94			0.52	U	
Sodium	NV [4]	5,196	5,195.97	530	J		810	Q		780	Q		430	JQ		270	JQ		530	JQ		740	Q		240	JQ	
Vanadium	391	42.6	42.53	9.4	Q		18	Q		16	Q		13	Q		7.6	Q		10	Q	J	19	Q	J	7.5	Q	
Zinc	23,500	54.6	54.53	8.5	JQ		26	Q		22	Q		18	Q		7.4	JQ		12	Q	J	300	Q	J	7	JQ	
Mercury (µg/kg)[7]	7.71	10.8	10.76	12.9	U		9.45	U		8.57	U		11.2	U		10.7	U		11	J	J	2,100		J	10.5	U	
PCBs (SW846 8082)	mg/kg	mg/kg	mg/kg	µg/kg			µg/kg			µg/kg			µg/kg			µg/kg			µg/kg			µg/kg			µg/kg		
All PCBs	NV	NV	NV	ND			ND			ND			ND			ND			ND			ND			ND		
Anions (EPA 300/SW846 9056)	mg/kg	mg/kg	mg/kg	mg/kg			mg/kg			mg/kg			mg/kg			mg/kg			mg/kg			mg/kg			mg/kg		
Nitrate as N	125,000	NV	NV	1.57	U		1.13	U		1.11	U		1.33	U		1.34	U		1.3	U		1.33	U		4	J	J
Chloride	NV [4]	NV	NV	740			650			700			48			62			180			190			180		
Sulfate	NV [4]	NV	NV	26,000			16,000			17,000			16,000			14,000			18,000			19,000			18,000		
TPH (SW846 8015 M)	mg/kg	mg/kg	mg/kg	mg/kg			mg/kg			mg/kg			mg/kg			mg/kg			mg/kg			mg/kg			mg/kg		
Gasoline Range Organics (C6 -C10)	800 [6]	NV	NV	0.811	U		0.62	JQ	J	0.6	JQ	J	0.696	U		0.696	U		0.707	U		0.94	J	J	0.816	U	
Diesel Range Organics (C10-C22)	800 [6]	NV	NV	3.09	UM		2.28	U		2.15	U		2.59	U		2.61	U		2.51	UM		2.53	UM		2.59	U	
Oil Range Organics (>C22-C36)	800 [6]	NV	NV	3.09	UM		3.5	J	J	3.4	J	J	4	J	J	4	J	J	9.6	JM	J	5	JM	J	3.9	J	J
General Chemistry (SM19 2540B M)	%	%	%	%			%			%			%			%			%			%			%		
Percent Moisture	NV	NV	NV	37			13			14			26			28			25			28			29		

Notes:

NMED = New Mexico Environment Department
VOC = Volatile Organic Compounds
SVOC = Semi-Volatile Organic Compounds
TPH = Total Petroleum Hydrocarbons
TAL = Target Analyte List
PCB = Polychlorinated Biphenyls
EPA = Environmental Protection Agency

µg/kg = Micrograms per kilogram
mg/kg = Milligrams per kilogram
ND = Not Detected
NV = No Value
% = percent
LQ = Laboratory Qualifier
CQ = Validating Chemist Qualifier

Qualifiers
J = Estimated result. Result is between the method detection limit and the reporting limit.
Q = One or more quality control criteria failed
M = Manually integrated compound
U = Undetected. Value set at the limit of detection.
H = Sample prepped or analyzed beyond the specified holding time
K = Benzo(b&k)fluoranthene are unresolved due to matrix, result is reported as Benzo(b)fluoranthene.

[1] NMED, December 2009. Technical Background Document for Development of Soil Screening Levels, Revision 5.0.
[2] Table 1, Conditional Approval Letter, *Basewide Background Study Report, Holloman Air Force Base, New Mexico* (NMED, December 2011)
[3] Table 5-18, *Basewide Background Study Report, Holloman Air Force Base, New Mexico* (NationView|Bhate JV III, July 2011)
[4] No Value established for NMED Residential SSL (December 2009) and USEPA Region 3, 6, and 9 Regional Screening Levels (RSLs) (November 2011)
[5] USEPA Regions 3, 6, and 9 RSLs (November 2011)
[6] NMED TPH Screening Guidelines for Unknown Oil, Residential Direct Exposure, Table 2b (October 2006)
[7] Mercury analytical results are reported in µg/kg, while all other TAL metals are reported in mg/kg.
Bold value indicates analytes above NMED SSLs (Rev 5.0, December 2009) or TPH results above NMED TPH Screening Guidelines (October 2006)
Indicates that the combined TPH-GRO/DRO/ORO results exceed the NMED TPH Screening Guidelines (Unknown Oil, Residential Direct Exposure)
Indicates analytical results above the NMED Approved Basewide Background Levels, but below the NMED Residential SSL and/or USEPA RSL

Client Sample Nomenclature
SWMU183 = Soild Waste Management Unit 183 (Basewide Sewer System)
DP = Direct Push
A = Denotes a duplicate sample
Final digit(s) equal the sample interval depth in feet below ground surface

Table 7-1
Sub-Basins 1, 2, 3, 5, 6, 7, and 10 Soil Analytical Results, Phase I (April 2010)
SWMU 183, RFI Report
Holloman Air Force Base, New Mexico

Client Sample Identification:	Soil Screening Levels	Basewide Background Levels		SWMU183-DP40-9			SWMU183-DP41-10			SWMU183-DP42-12			SWMU183-DP43-12			SWMU183-DP44-10			SWMU183-DP45-11			SWMU183-DP46-7		
Lab Sample Identification:	NMED Residential[1]	NMED Approved Background Level[2]	Combined Soil Background Level[3]	280-2776-6			280-2776-2			280-2838-23			280-2838-1			280-2838-2			280-2776-5			280-2709-14		
Date Sampled:				4/22/2010			4/23/2010			4/26/2010			4/24/2010			4/24/2010			4/22/2010			4/22/2010		
Sub-Basin:				5			5			5			3			2			2			2		
Analyte (Method)				**Result**	**LQ**	**CQ**	**Result**	**LQ**	**CQ**	**Result**	**LQ**	**CQ**	**Result**	**LQ**	**CQ**	**Result**	**LQ**	**CQ**	**Result**	**LQ**	**CQ**	**Result**	**LQ**	**CQ**
VOCs (SW846 8260B)	**mg/kg**	**mg/kg**	**mg/kg**	**µg/kg**			**µg/kg**			**µg/kg**			**µg/kg**			**µg/kg**			**µg/kg**			**µg/kg**		
1,2,3-Trichloropropane	0.915	NV	NV	1.2	UH		1.4	U		1.3	U		1.2	UH		1.2	UH		1.1	UH		1.3	U	
1,1,2,2-Tetrachloroethane	7.98	NV	NV	1.2	UH		1.4	U		1.3	U		1.2	UH		1.2	UH		1.1	UH		1.3	U	
1,2,4-Trimethylbenzene	62 [5]	NV	NV	1.2	UH		1.4	U		1.3	U		1.2	UH		1.2	UH		1.1	UH		1.3	U	
1,4-Dichlorobenzene	32.2	NV	NV	1.2	UH		1.4	U		1.3	U		1.2	UH		1.2	UH		1.1	UH		1.3	U	
Acetone	67,500	NV	NV	11.9	UH		17	J		13	U		13	JH		12.1	UH		11.3	UH		12.6	UQ	
Carbon disulfide	1,940	NV	NV	1.2	UH		1.6	J		1.3	U		1.3	JH		1.2	UH		1.1	UH		1.3	U	
Chloroform	5.72	NV	NV	1.2	UH		1.4	U		1.3	U		1.2	UH		1.2	UH		1.1	UH		1.3	U	
cis-1,2-Dichloroethene	782	NV	NV	1.2	UH		1.4	U		1.3	U		1.2	UH		1.2	UH		1.1	UH		1.3	U	
Methylene Chloride	199	NV	NV	1.2	UH		1.4	U		1.3	U		1.2	UH		1.2	UH		1.1	UH		2.3	J	J
sec-Butylbenzene	NV [4]	NV	NV	1.2	UH		1.4	U		1.3	U		1.2	UH		1.2	UH		1.1	UH		1.3	U	
tert-Butylbenzene	NV [4]	NV	NV	1.2	UH		1.4	U		1.3	U		1.2	UH		1.2	UH		1.1	UH		1.3	U	
trans-1,2-Dichloroethene	273	NV	NV	1.2	UH		1.4	U		1.3	U		1.2	UH		1.2	UH		1.1	UH		1.3	U	
Trichloroethene	45.7	NV	NV	1.2	UH		1.4	U		1.3	U		1.2	UH		1.2	UH		1.1	UH		1.3	U	
SVOCs (SW846 8270C)	**mg/kg**	**mg/kg**	**mg/kg**	**µg/kg**			**µg/kg**			**µg/kg**			**µg/kg**			**µg/kg**			**µg/kg**			**µg/kg**		
Acenaphthene	3,440	NV	NV	24.3	U		23.2	U		22.4	U		21.6	U		21.5	U		20.2	U		22.4	U	
Benzo(a)anthracene	6.21	NV	NV	50	U		50	U		40	U		40	U		40	U		40	U		40	U	
Benzo(b)fluoranthene	6.21	NV	NV	47.2	U		45.1	U		43.4	U		41.9	U		41.8	U		39.2	U		43.4	U	
Dimethyl phthalate	611,000	NV	NV	47	U		45	U		43	U		55	J		42	U		39	U		43	U	
Fluoranthene	2,290	NV	NV	94	U		90	U		87	U		84	U		84	U		78	U		87	U	
Chrysene	621	NV	NV	47	U		45	U		43	U		42	U		42	U		39	U		43	U	
Benzo(g,h,i)perylene	NV [4]	NV	NV	47	U		45	U		43	U		42	U		42	U		39	U		43	U	
Benzo(a)pyrene	0.621	NV	NV	50	U		50	U		40	U		40	U		40	U		40	U		40	U	
Indeno(1,2,3-cd)pyrene	6.21	NV	NV	47	U		45	U		43	U		42	U		42	U		39	U		43	U	
Pyrene	1,720	NV	NV	47.2	U		45.1	U		43.4	U		41.9	U		41.8	U		39.2	U		43.4	U	
Phenanthrene	1,830	NV	NV	47	U		45	U		43	U		42	U		42	U		39	U		43	U	
bis(2-Ethylhexyl)phthalate	347	NV	NV	94	U		90	U		99	J	J	84	U		84	U		78	U		99	J	J
TAL Metals (SW846 6010B/7471A)[7]	**mg/kg**	**mg/kg**	**mg/kg**	**mg/kg [7]**			**mg/kg [7]**			**mg/kg [7]**			**mg/kg [7]**			**mg/kg [7]**			**mg/kg [7]**			**mg/kg [7]**		
Aluminum	78,100	13,722	13,722.27	3,600			4,600			4,200		J	2,100	J		7,000			6,600			3,100		
Arsenic	3.9	3.7	3.66	2.8	J		2.5	U		2.7	U		2.3	U		2.5	U		2.3	J		2.7	U	
Barium	15,600	169.3	169.25	65			42			38			22			65			62			33		
Beryllium	156	1.6	1.53	0.0418	U		0.0382	U		0.055	J		0.0345	U		0.22	J		0.18	J		0.04	U	
Cadmium	77.9	0.3	0.28	0.167	U		0.153	U		0.164	U		0.138	U		0.151	U		0.141	U		0.16	U	
Calcium	NV [4]	317,332	317,331.59	190,000			150,000			120,000		J	98,000	J		84,000			120,000			170,000		
Chromium	219	25	24.95	4.2	J		5.3			4.2	J		2.5	J		7.3			9			3.3	J	
Cobalt	23 [5]	7.7	7.70	1.6	Q		1.7	Q		1.8	Q		1	JQ		2.4	Q		2.3	Q		1.2	JQ	
Copper	3,130	13	12.96	2.2	JQ		2.5	JQ		2.1	JQ		1.6	JQ		5.9	JQ		3.4	JQ		2.7	JQ	
Iron	54,800	23,049	23,049.48	3,700			4,400			4,300			2,000	J		6,200			5,800			2,900		
Lead	400	10.9	10.87	1.1	U		1.7			1.8			0.92	U		11			3.2			1.5		
Magnesium	NV [4]	16,991	16,990.65	2,000			2,700			2,100		J	1,300		J	3,500		J	5,500			3,100		
Manganese	10,700	393	393.47	63	Q		68	Q		34	Q	J	28	Q		110	Q		88	Q		48	Q	
Molybdenum	391	NV	NV	0.14	J		0.43	J		0.22	J		0.21	J		0.2	J		0.12	U		0.22	J	
Nickel	1,560	17.4	17.34	2.9	J		3.9	J		3.5	JQ		1.7	JQ		5.6	Q		5.2			2.7	J	
Potassium	NV [4]	5,077	5,077.12	960			1,300			1,100			560			2,200			1,700			940		
Silver	391	1.1	1.1	0.56	U		0.51	U		0.55	U		0.46	U		0.5	U		0.47	U		0.53	U	
Sodium	NV [4]	5,196	5,195.97	760	Q		230	JQ		450	J		130	J		190	J		270	JQ		760	Q	
Vanadium	391	42.6	42.53	13	Q		11	Q		10	Q		5.5	Q		13	Q		24	Q		9.3	Q	
Zinc	23,500	54.6	54.53	8.7	JQ		11	Q		10	JQ		5.6	JQ		20	Q		15	Q		9	JQ	
Mercury (µg/kg) [7]	7.71	10.8	10.76	11.5	U		10.6	U		10.6	U		10.6	U		10.5	U		9.18	U		10	U	
PCBs (SW846 8082)	**mg/kg**	**mg/kg**	**mg/kg**	**µg/kg**			**µg/kg**			**µg/kg**			**µg/kg**			**µg/kg**			**µg/kg**			**µg/kg**		
All PCBs	NV	NV	NV	ND			ND			ND			ND			ND			ND			ND		
Anions (EPA 300/SW846 9056)	**mg/kg**	**mg/kg**	**mg/kg**	**mg/kg**			**mg/kg**			**mg/kg**			**mg/kg**			**mg/kg**			**mg/kg**			**mg/kg**		
Nitrate as N	125,000	NV	NV	1.41	U		1.31	U		1.4	J	J	1.29	U		1.25	U		1.24	U		1.3	U	
Chloride	NV [4]	NV	NV	650			76			500			28	J		20	J		71			760		
Sulfate	NV [4]	NV	NV	20,000			18,000			20,000			18,000			15,000			15,000			20,000		
TPH (SW846 8015 M)	**mg/kg**	**mg/kg**	**mg/kg**	**mg/kg**			**mg/kg**			**mg/kg**			**mg/kg**			**mg/kg**			**mg/kg**			**mg/kg**		
Gasoline Range Organics (C6 -C10)	800 [6]	NV	NV	0.706	U		0.694	U		0.723	U		0.62	UH		0.591	UH		0.674	UH		0.682	UQ	UJ
Diesel Range Organics (C10-C22)	800 [6]	NV	NV	2.75	U		2.51	U		2.65	UM		2.52	UM		2.35	UM		2.41	U		2.49	U	
Oil Range Organics (>C22-C36)	800 [6]	NV	NV	4.2	J	J	3.9	J	J	2.65	UM		5	JM	J	5.1	JM	J	3.7	J	J	3.8	J	J
General Chemistry (SM19 2540B M)	**%**	**%**	**%**	**%**			**%**			**%**			**%**			**%**			**%**			**%**		
Percent Moisture	NV	NV	NV	31			27			29			23			22			21			26		

Notes:
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SVOC = Semi-Volatile Organic Compounds
TPH = Total Petroleum Hydrocarbons
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Qualifiers
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Bold value indicates analytes above NMED SSLs (Rev 5.0, December 2009) or TPH results above NMED TPH Screening Guidelines (October 2006)
Indicates that the combined TPH-GRO/DRO/ORO results exceed the NMED TPH Screening Guidelines (Unknown Oil, Residential Direct Exposure)
Indicates analytical results above the NMED Approved Basewide Background Levels, but below the NMED Residential SSL and/or USEPA RSL

Client Sample Nomenclature
SWMU183 = Soild Waste Management Unit 183 (Basewide Sewer System)
DP = Direct Push
A = Denotes a duplicate sample
Final digit(s) equal the sample interval depth in feet below ground surface

Table 7-1
Sub-Basins 1, 2, 3, 5, 6, 7, and 10 Soil Analytical Results, Phase I (April 2010)
SWMU 183, RFI Report
Holloman Air Force Base, New Mexico

Client Sample Identification:	Soil Screening Levels	Basewide Background Levels		SWMU183-DP47-11			SWMU183-DP48-5			SWMU183-DP48-5-A			SWMU183-DP49-6			SWMU183-DP50-7			SWMU183-DP51-8			SWMU183-DP52-6		
Lab Sample Identification:	NMED Residential[1]	NMED Approved Background Level[2]	Combined Soil Background Level[3]	280-2838-3			280-2709-12			280-2709-13			280-2709-9			280-2709-8			280-2709-11			280-2709-7		
Date Sampled:				4/24/2010			4/22/2010			4/22/2010			4/22/2010			4/22/2010			4/22/2010			4/21/2010		
Sub-Basin:				1			1			1			1			1			1			1		
Analyte (Method)				Result	LQ	CQ	Result	LQ	CQ	Result	LQ	CQ	Result	LQ	CQ	Result	LQ	CQ	Result	LQ	CQ	Result	LQ	CQ
VOCs (SW846 8260B)	mg/kg	mg/kg	mg/kg	μg/kg			μg/kg			μg/kg			μg/kg			μg/kg			μg/kg			μg/kg		
1,2,3-Trichloropropane	0.915	NV	NV	1.4	UH		570	U	UJ	600	Q	J	1.3	U		1.3	U		1.4	U		1.2	U	
1,1,2,2-Tetrachloroethane	7.98	NV	NV	1.4	UH		280	U	UJ	600	Q	J	1.3	U		1.3	U		1.4	U		1.2	U	
1,2,4-Trimethylbenzene	62 [5]	NV	NV	1.4	UH		280	U	UJ	83	JQ	J	1.3	U		1.3	U		1.4	U		1.2	U	
1,4-Dichlorobenzene	32.2	NV	NV	1.4	UH		280	U	UJ	57	UQ	UJ	1.3	U		1.3	U		1.4	U		1.2	U	
Acetone	67,500	NV	NV	14	UH		600	U	UJ	100	U	UJ	12.9	UQ		12.8	UQ		21	JQ		11.5	UQ	
Carbon disulfide	1,940	NV	NV	1.4	UH		280	U	UJ	57	U	UJ	1.3	U		1.3	U		1.8	J		1.2	U	
Chloroform	5.72	NV	NV	1.4	UH		285	U	UJ	57.3	U	UJ	1.3	U		1.3	U		1.4	U		1.2	U	
cis-1,2-Dichloroethene	782	NV	NV	1.4	UH		280	U	UJ	57	U	UJ	1.3	U		1.3	U		1.4	U		1.2	U	
Methylene Chloride	199	NV	NV	1.4	UH		570	U	UJ	110	U	UJ	1.6	J	J	2.4	J	J	2.4	J	J	1.2	U	
sec-Butylbenzene	NV [4]	NV	NV	1.4	UH		5,000		J	100	JQ	J	1.3	U		1.3	U		1.4	U		1.2	U	
tert-Butylbenzene	NV [4]	NV	NV	1.4	UH		390	J	J	57	UQ	UJ	1.3	U		1.3	U		1.4	U		1.2	U	
trans-1,2-Dichloroethene	273	NV	NV	1.4	UH		285	U	UJ	57.3	U	UJ	1.3	U		1.3	U		1.4	U		1.2	U	
Trichloroethene	45.7	NV	NV	1.4	UH		280	U	UJ	57	U	UJ	1.3	U		1.3	U		1.9	J		1.2	U	
SVOCs (SW846 8270C)	mg/kg	mg/kg	mg/kg	μg/kg			μg/kg			μg/kg			μg/kg			μg/kg			μg/kg			μg/kg		
Acenaphthene	3,440	NV	NV	24.8	U		22.4	U		21.8	U		22.5	U		22.3	U		22.9	U		21.6	U	
Benzo(a)anthracene	6.21	NV	NV	50	U		40	U		40	U		40	U		40	U		40	U		40	U	
Benzo(b)fluoranthene	6.21	NV	NV	48.1	U		43.5	U		42.3	U		43.6	U		43.4	U		44.4	U		42	U	
Dimethyl phthalate	611,000	NV	NV	48	U		54	J		42	U		44	U		43	U		44	U		42	U	
Fluoranthene	2,290	NV	NV	96	U		87	U		85	U		87	U		87	U		89	U		84	U	
Chrysene	621	NV	NV	48	U		43	U		42	U		44	U		43	U		44	U		42	U	
Benzo(g,h,i)perylene	NV [4]	NV	NV	48	U		43	U		42	U		44	U		43	U		44	U		42	U	
Benzo(a)pyrene	0.621	NV	NV	50	U		40	U		40	U		40	U		40	U		40	U		40	U	
Indeno(1,2,3-cd)pyrene	6.21	NV	NV	48	U		43	U		42	U		44	U		43	U		44	U		42	U	
Pyrene	1,720	NV	NV	48.1	U		43.5	U		42.3	U		43.6	U		43.4	U		44.4	U		42	U	
Phenanthrene	1,830	NV	NV	48	U		43	U		42	U		44	U		43	U		44	U		42	U	
bis(2-Ethylhexyl)phthalate	347	NV	NV	96	U		140	J	J	150	J	J	100	J	J	100	J	J	110	J	J	97	J	J
TAL Metals (SW846 6010B/7471A)[7]	mg/kg	mg/kg	mg/kg	mg/kg [7]			mg/kg [7]			mg/kg [7]			mg/kg [7]			mg/kg [7]			mg/kg [7]			mg/kg [7]		
Aluminum	78,100	13,722	13,722.27	3,500			3,300			4,100			6,000			2,400			12,000			12,000		
Arsenic	3.9	3.7	3.66	2.8	U		2.4	U		2.3	U		2.4	J		2.6	U		**4**			**4**		
Barium	15,600	169.3	169.25	25			57			53			63			27			90			54		
Beryllium	156	1.6	1.53	0.0421	U		0.0364	U		0.0349	U		0.0345	U		0.0389	U		0.34	J		0.39	J	
Cadmium	77.9	0.3	0.28	0.168	U		0.146	U		0.14	U		0.138	U		0.156	U		0.161	U		0.141	U	
Calcium	NV [4]	317,332	317,331.59	160,000			160,000			160,000			160,000			160,000			140,000			92,000		
Chromium	219	25	24.95	3.6	J		3.8	J		4.9			5.9			2.5	J		10			12		
Cobalt	23 [5]	7.7	7.70	1	JQ		1.7	Q		1.7	Q		2.2	Q		0.79	JQ		3.4	Q		3.9	Q	
Copper	3,130	13	12.96	2.5	JQ		3.3	JQ		3.6	JQ		4	JQ		2.3	JQ		6.3	JQ		8.8	Q	
Iron	54,800	23,049	23,049.48	2,700			3,300			3,900			5,200			2,200			8,600			11,000		
Lead	400	10.9	10.87	1.1	U		1.4			1.9			2.3			1	U		4.4			5.8		
Magnesium	NV [4]	16,991	16,990.65	2,500		J	2,800			4,300			4,900			3,200			28,000			6,800		
Manganese	10,700	393	393.47	25	Q		53	Q		76	Q		99	Q		24	Q		160	Q		170	Q	
Molybdenum	391	NV	NV	0.21	J		0.52	J		0.5	J		0.74	J		0.13	U		2.9	J		0.51	J	
Nickel	1,560	17.4	17.34	2.6	JQ		3.3	J		3.5	J		4.1	J		1.9	J		7.6			8.5		
Potassium	NV [4]	5,077	5,077.12	850			1,000			1,200			2,200			710			2,800			4,000		
Silver	391	1.1	1.1	0.56	U		0.49	U		0.47	U		0.46	U		0.52	U		0.54	U		0.47	U	
Sodium	NV [4]	5,196	5,195.97	640	J		710	Q		860	Q		1,200	Q		1,600	Q		4,100	Q		950	Q	
Vanadium	391	42.6	42.53	9.2	Q		14	Q		15	Q		13	Q		7.1	Q		21	Q		24	Q	
Zinc	23,500	54.6	54.53	7.6	JQ		8.1	JQ		10	Q		15	Q		5.9	JQ		26	Q		31	Q	
Mercury (μg/kg) [7]	7.71	10.8	10.76	12.1	U		9.71	U		11.2	U		9.67	U		9.96	U		10.2	U		10.4	U	
PCBs (SW846 8082)	mg/kg	mg/kg	mg/kg	μg/kg			μg/kg			μg/kg			μg/kg			μg/kg			μg/kg			μg/kg		
All PCBs	NV	NV	NV	ND			ND			ND			ND			ND			ND			ND		
Anions (EPA 300/SW846 9056)	mg/kg	mg/kg	mg/kg	mg/kg			mg/kg			mg/kg			mg/kg			mg/kg			mg/kg			mg/kg		
Nitrate as N	125,000	NV	NV	1.46	U		1.24	U		1.29	U		1.6	J	J	2.9	J	J	1.34	U		1.25	U	
Chloride	NV [4]	NV	NV	680			810			1,000			1,600			2,900			3,600			870		
Sulfate	NV [4]	NV	NV	22,000			10,000		J	18,000		J	16,000			21,000			3,200			2,400		
TPH (SW846 8015 M)	mg/kg	mg/kg	mg/kg	mg/kg			mg/kg			mg/kg			mg/kg			mg/kg			mg/kg			mg/kg		
Gasoline Range Organics (C6 -C10)	800 [6]	NV	NV	0.739	UH		5.8	MQ	J	30	MQ	J	0.622	UQ	UJ	0.732	UQ	UJ	0.7	UQ	UJ	0.615	UQ	UJ
Diesel Range Organics (C10-C22)	800 [6]	NV	NV	2.75	UM		310	M	J	760	MQ	J	2.49	UM		2.67	U		2.76	UM		2.43	U	
Oil Range Organics (>C22-C36)	800 [6]	NV	NV	4.9	JM	J	11	JM	J	13	JMQ	J	4.6	JM	J	4.1	J	J	6.6	JM	J	3.7	J	J
General Chemistry (SM19 2540B M)	%	%	%	%			%			%			%			%			%			%		
Percent Moisture	NV	NV	NV	32			24			26			27			28			23					

Notes:

NMED = New Mexico Environment Department
VOC = Volatile Organic Compounds
SVOC = Semi-Volatile Organic Compounds
TPH = Total Petroleum Hydrocarbons
TAL = Target Analyte List
PCB = Polychlorinated Biphenyls
EPA = Environmental Protection Agency

μg/kg = Micrograms per kilogram
mg/kg = Milligrams per kilogram
ND = Not Detected
NV = No Value
% = percent
LQ = Laboratory Qualifier
CQ = Validating Chemist Qualifier

Qualifiers
J = Estimated result. Result is between the method detection limit and the reporting limit.
Q = One or more quality control criteria failed
M = Manually integrated compound
U = Undetected. Value set at the limit of detection.
H = Sample prepped or analyzed beyond the specified holding time
K = Benzo(b&k)fluoranthene are unresolved due to matrix, result is reported as Benzo(b)fluoranthene.

[1] NMED, December 2009. Technical Background Document for Development of Soil Screening Levels, Revision 5.0.
[2] Table 1, Conditional Approval Letter, *Basewide Background Study Report, Holloman Air Force Base, New Mexico* (NMED, December 2011)
[3] Table 5-18, *Basewide Background Study Report, Holloman Air Force Base, New Mexico* (NationView|Bhate JV III, July 2011)
[4] No Value established for NMED Residential SSL (December 2009) and USEPA Region 3, 6, and 9 Regional Screening Levels (RSLs) (November 2011)
[5] USEPA Regions 3, 6, and 9 RSLs (November 2011)
[6] NMED TPH Screening Guidelines for Unknown Oil, Residential Direct Exposure, Table 2b (October 2006)
[7] Mercury analytical results are reported in μg/kg, while all other TAL metals are reported in mg/kg.
Bold value indicates analytes above NMED SSLs (Rev 5.0, December 2009) or TPH results above NMED TPH Screening Guidelines (October 2006)
Indicates that the combined TPH-GRO/DRO/ORO results exceed the NMED TPH Screening Guidelines (Unknown Oil, Residential Direct Exposure)
Indicates analytical results above the NMED Approved Basewide Background Levels, but below the NMED Residential SSL and/or USEPA RSL

Client Sample Nomenclature
SWMU183 = Soild Waste Management Unit 183 (Basewide Sewer System)
DP = Direct Push
A = Denotes a duplicate sample
Final digit(s) equal the sample interval depth in feet below ground surface

Table 7-2
Sub-Basin 4 Soil Analytical Results, Phase I (April 2010)
SWMU 183 RFI Report
Holloman Air Force Base, New Mexico
NationView Project No. 8080014

Client Sample Identification:	Soil Screening Levels	Basewide Background Levels		SWMU183-DP26-10			SWMU183-DP27-7			SWMU183-DP28-7			SWMU183-DP29-7			SWMU183-DP30-8		
Lab Sample Identification:	NMED Residential[1]	NMED Approved Background Level[2]	Combined Soil Background Level[3]	280-2838-18			280-2838-9			280-2838-10			280-2838-11			280-2838-12		
Date Sampled:				4/24/2010			4/23/2010			4/23/2010			4/23/2010			4/24/2010		
Sub-Basin:				4			4			4			4			4		
Analyte (Method)				**Result**	**LQ**	**CQ**	**Result**	**LQ**	**CQ**	**Result**	**LQ**	**CQ**	**Result**	**LQ**	**CQ**	**Result**	**LQ**	**CQ**
VOCs (SW846 8260B)	**mg/kg**	**mg/kg**	**mg/kg**	**µg/kg**			**µg/kg**			**µg/kg**			**µg/kg**			**µg/kg**		
Acetone	67,500	NV	NV	12.5	UH		11.1	UH		13.4	UH		16	JH		11.7	UH	
Carbon disulfide	1,940	NV	NV	1.3	UH		1.1	UH		1.3	UH		1.3	UH		1.2	UH	
SVOCs (SW846 8270C)	**mg/kg**	**mg/kg**	**mg/kg**	**µg/kg**			**µg/kg**			**µg/kg**			**µg/kg**			**µg/kg**		
Dimethyl phthalate	611,000	NV	NV	41	U		41	U		41	U		46	U		41	U	
bis(2-Ethylhexyl)phthalate	347	NV	NV	92	J	J	82	U		81	U		92	U		83	U	
TAL Metals (SW846 6010B/7471A)	**mg/kg**	**mg/kg**	**mg/kg**	**mg/kg**			**mg/kg**			**mg/kg**			**mg/kg**			**mg/kg**		
Aluminum	78,100	13,722	13,722.27	11,000		J	4,600			3,300			4,600			6,400		
Arsenic	3.9	3.7	3.66	2.6	J		**4**			2.6	U		2.5	U		**4.3**		
Barium	15,600	169.3	169.25	81			45			30			40			36		
Beryllium	156	1.6	1.53	0.54			0.19	J		0.0397	U		0.12	J		0.2	J	
Cadmium	77.9	0.3	0.28	0.131	U		0.145	U		0.159	U		0.147	U		0.157	U	
Calcium	NV[4]	317,332	317,331.59	70,000		J	160,000			160,000			120,000			160,000		
Chromium	219	25	24.95	12			6			3.5	J		5.8			7.5		
Cobalt	23[5]	7.7	7.70	3.8	Q		2.4	Q		1.1	JQ		1.5	Q		2.6	Q	
Copper	3,130	13	12.96	7.9	Q		3.4	JQ		1.7	JQ		2.7	JQ		4.1	JQ	
Iron	54,800	23,049	23,049.48	11,000			5,900			2,900			4,500			6,000		
Lead	400	10.9	10.87	6.1			3.3			1.1	J		2.5			2.8		
Magnesium	NV[4]	16,991	16,990.65	6,600		J	2,800		J	1,400		J	2,000		J	5,900		J
Manganese	10,700	393	393.47	130	Q	J	110	Q		40	Q		50	Q		87	Q	
Molybdenum	391	NV	NV	0.32	J		0.48	J		0.13	U		0.13	J		0.38	J	
Nickel	1,560	17.4	17.34	9.8	Q		5.8	Q		2.7	JQ		3.7	JQ		6.4	Q	
Potassium	NV[4]	5,077	5,077.12	2,600			1,100			810			1,100			1,500		
Sodium	NV[4]	5,196	5,195.97	180	J		430	J		200	J		310	J		290	J	
Vanadium	391	42.6	42.53	26	Q		15	Q		6.6	Q		12	Q		18	Q	
Zinc	23,500	54.6	54.53	29	Q		15	Q		7.9	JQ		11	Q		15	Q	
PCBs (SW846 8082)	**mg/kg**	**mg/kg**	**mg/kg**	**µg/kg**			**µg/kg**			**µg/kg**			**µg/kg**			**µg/kg**		
All PCBs	NV	NV	NV	ND			ND			ND			ND			ND		
Anions (EPA 300/SW846 9056)	**mg/kg**	**mg/kg**	**mg/kg**	**mg/kg**			**mg/kg**			**mg/kg**			**mg/kg**			**mg/kg**		
Nitrate as N	125,000	NV	NV	1.26	U		1.2	U		1.33	U		1.36	U		1.32	U	
Chloride	NV[4]	NV	NV	83			28	J		63			200			76		
Sulfate	NV[4]	NV	NV	15,000			15,000			21,000			17,000			16,000		
TPH (SW846 8015 M)	**mg/kg**	**mg/kg**	**mg/kg**	**mg/kg**			**mg/kg**			**mg/kg**			**mg/kg**			**mg/kg**		
Gasoline Range Organics (C6 -C10)	800[6]	NV	NV	0.596	UH		0.623	UH		0.704	UHQ	UJ	0.724	UH		0.658	UH	
Diesel Range Organics (C10-C22)	800[6]	NV	NV	2.3	UM		2.45	UM		2.45	UM		2.68	UM		2.65	UM	
Oil Range Organics (>C22-C36)	800[6]	NV	NV	3.6	JM	J	4.1	JM	J	3.9	JM	J	5	JM	J	4.2	JM	J
Herbicides (SW846 8151A)	**mg/kg**	**mg/kg**	**mg/kg**	**µg/kg**			**µg/kg**			**µg/kg**			**µg/kg**			**µg/kg**		
All Herbicides	NV	NV	NV	ND			ND			ND			ND			ND		
Pesticides (SW846 8081A)	**mg/kg**	**mg/kg**	**mg/kg**	**µg/kg**			**µg/kg**			**µg/kg**			**µg/kg**			**µg/kg**		
All Pesticides	NV	NV	NV	ND			ND			ND			ND			ND		
General Chemistry (SM19 2540B M)	**%**	**%**	**%**	**%**			**%**			**%**			**%**			**%**		
Percent Moisture	NV	NV	NV	21			20			25			28			26		

Client Sample Identification:	Soil Screening Levels	Basewide Background Levels		SWMU183-DP31-12			SWMU183-DP32-6			SWMU183-DP33-8			SWMU183-DP34-13			SWMU183-DP34-13-A			SWMU183-DP35-14		
Lab Sample Identification:	NMED Residential[1]	NMED Approved Background Level[2]	Combined Soil Background Level[3]	280-2838-13			280-2838-17			280-2838-8			280-2838-15			280-2838-14			280-2838-16		
Date Sampled:				4/24/2010			4/24/2010			4/23/2010			4/24/2010			4/24/2010			4/24/2010		
Sub-Basin:				4			4			4			4			4			4		
Analyte (Method)				**Result**	**LQ**	**CQ**	**Result**	**LQ**	**CQ**	**Result**	**LQ**	**CQ**	**Result**	**LQ**	**CQ**	**Result**	**LQ**	**CQ**	**Result**	**LQ**	**CQ**
VOCs (SW846 8260B)	**mg/kg**	**mg/kg**	**mg/kg**	**µg/kg**			**µg/kg**			**µg/kg**			**µg/kg**			**µg/kg**			**µg/kg**		
Acetone	67,500	NV	NV	14.3	UH		13	UH		13.1	UH		11.3	UHJ		12	UH		12.3	UH	
Carbon disulfide	1,940	NV	NV	1.4	UH		1.3	UH		12	H		1.1	UH		1.2	UH		1.2	UH	
SVOCs (SW846 8270C)	**mg/kg**	**mg/kg**	**mg/kg**	**µg/kg**			**µg/kg**			**µg/kg**			**µg/kg**			**µg/kg**			**µg/kg**		
Dimethyl phthalate	611,000	NV	NV	51	J		43	U		45	U		41	U		39	U		45	U	
bis(2-Ethylhexyl)phthalate	347	NV	NV	88	U		100	J	J	90	U		94	J	J	92	J	J	110	J	J
TAL Metals (SW846 6010B/7471A)	**mg/kg**	**mg/kg**	**mg/kg**	**mg/kg**			**mg/kg**			**mg/kg**			**mg/kg**			**mg/kg**			**mg/kg**		
Aluminum	78,100	13,722	13,722.27	3,000		J	2,900		J	3,800			14,000	J	J	12,000		J	17,000		J
Arsenic	3.9	3.7	3.66	2.6	U		2.6	U		2.6	U		3.8			**4.4**			**5.7**		
Barium	15,600	169.3	169.25	27			30			27			120			100			89		
Beryllium	156	1.6	1.53	0.0384	U		0.0387	U		0.039	J		0.81			0.63			0.92		
Cadmium	77.9	0.3	0.28	0.153	U		0.155	U		0.155	U		0.14	J		0.17	J		0.23	J	
Calcium	NV[4]	317,332	317,331.59	150,000		J	150,000		J	120,000			110,000	J	J	140,000		J	150,000		J
Chromium	219	25	24.95	3.6	J		3.1	J		4.4	J		19	J		16			19		
Cobalt	23[5]	7.7	7.70	1.2	JQ		0.99	JQ		1.4	Q		7	Q		5.1	Q		7	Q	
Copper	3,130	13	12.96	1.9	JQ		1.6	JQ		2.3	JQ		10	Q		9.8	Q		11	Q	
Iron	54,800	23,049	23,049.48	2,900			2,600			3,900			16,000	J		14,000			16,000		
Lead	400	10.9	10.87	1.2			1	J		1.8			8.8			7.8			9.9		
Magnesium	NV[4]	16,991	16,990.65	1,800		J	1,600		J	1,600		J	22,000	J	J	19,000		J	14,000		J
Manganese	10,700	393	393.47	38	Q	J	33	Q	J	49	Q		260	QJ	J	190	Q	J	240	Q	J
Molybdenum	391	NV	NV	0.24	J		0.22	J		0.49	J		1.5	J		1.5	J		0.67	J	
Nickel	1,560	17.4	17.34	2.7	JQ		2.2	JQ		3.4	JQ		17	Q		14	Q		16	Q	
Potassium	NV[4]	5,077	5,077.12	830			780			1,000			3,000	J		2,500			3,600		
Sodium	NV[4]	5,196	5,195.97	260	J		420	J		190	J		540	J		500	J		610	J	
Vanadium	391	42.6	42.53	7.2	Q		6.4	Q		12	Q		33	Q		32	Q		39	Q	
Zinc	23,500	54.6	54.53	7.6	JQ		6.9	JQ		10	Q		42	Q		38	Q		46	Q	
PCBs (SW846 8082)	**mg/kg**	**mg/kg**	**mg/kg**	**µg/kg**			**µg/kg**			**µg/kg**			**µg/kg**			**µg/kg**			**µg/kg**		
All PCBs	NV	NV	NV	ND			ND			ND			ND			ND			ND		
Anions (EPA 300/SW846 9056)	**mg/kg**	**mg/kg**	**mg/kg**	**mg/kg**			**mg/kg**			**mg/kg**			**mg/kg**			**mg/kg**			**mg/kg**		
Nitrate as N	125,000	NV	NV	2.4	J	J	1.33	U		1.42	U		5.5	J	J	7.9		J	1.4	J	J
Chloride	NV[4]	NV	NV	78			78			69			77			100			250		
Sulfate	NV[4]	NV	NV	20,000			22,000			22,000			18,000			20,000			21,000		
TPH (SW846 8015 M)	**mg/kg**	**mg/kg**	**mg/kg**	**mg/kg**			**mg/kg**			**mg/kg**			**mg/kg**			**mg/kg**			**mg/kg**		
Gasoline Range Organics (C6 -C10)	800[6]	NV	NV	0.69	JH	J	0.743	UH		0.745	UH		0.702	UH		0.664	UH		0.699	UH	
Diesel Range Organics (C10-C22)	800[6]	NV	NV	2.53	UM		2.61	UM		2.61	UM		2.47	UM		2.47	UM		2.64	UM	
Oil Range Organics (>C22-C36)	800[6]	NV	NV	4.6	JM	J	4.1	JM	J	4.2	JM	J	4	JM	J	4	JM	J	4.3	JM	J
Herbicides (SW846 8151A)	**mg/kg**	**mg/kg**	**mg/kg**	**µg/kg**			**µg/kg**			**µg/kg**			**µg/kg**			**µg/kg**			**µg/kg**		
All Herbicides	NV	NV	NV	ND			ND			ND			ND			ND			ND		
Pesticides (SW846 8081A)	**mg/kg**	**mg/kg**	**mg/kg**	**µg/kg**			**µg/kg**			**µg/kg**			**µg/kg**			**µg/kg**			**µg/kg**		
All Pesticides	NV	NV	NV	ND			ND			ND			ND			ND			ND		
General Chemistry (SM19 2540B M)	**%**	**%**	**%**	**%**			**%**			**%**			**%**			**%**			**%**		
Percent Moisture	NV	NV	NV	28			26			30			23			22			27		

Notes:
NMED = New Mexico Environment Department
VOC = Volatile Organic Compounds
SVOC = Semi-Volatile Organic Compounds
TPH = Total Petroleum Hydrocarbons
TAL = Target Analyte List
PCB = Polychlorinated Biphenyls
EPA = Environmental Protection Agency
µg/kg = Micrograms per kilogram
mg/kg = Milligrams per kilogram
ND = Not Detected
NV = No Value
% = percent
LQ = Laboratory Qualifiers
CQ = Validating Chemist Qualifiers
Qualifiers
J = Estimated result. Result is between the method detection limit and the reporting limit.
Q = One or more quality control criteria failed
M = Manually integrated compound
U = Undetected. Value set at the limit of detection.
H = Sample prepped or analyzed beyond the specified holding time

[1] NMED, December 2009. Technical Background Document for Development of Soil Screening Levels, Revision 5.0.
[2] Table 1, Conditional Approval Letter, *Basewide Background Study Report, Holloman Air Force Base, New Mexico* (NMED, December 2011)
[3] Table 5-18, *Basewide Background Study Report, Holloman Air Force Base, New Mexico* (NationView|Bhate JV III, July 2011)
[4] No Value established for NMED Residential SSL (December 2009) and USEPA Region 3, 6, and 9 Regional Screening Levels (RSLs) (November 2011)
[5] USEPA Regions 3, 6, and 9 RSLs (November 2011)
[6] NMED TPH Screening Guidelines for Unknown Oil, Residential Direct Exposure, Table 2b (October 2006)
Bold value indicates analytes above NMED SSLs (Rev 5.0, December 2009) or TPH results above NMED TPH Screening Guidelines (October 2006)
Indicates analytical results above the NMED Approved Basewide Background Levels, but below the NMED Residential SSL and/or USEPA RSL
Client Sample Nomenclature
SWMU183 = Soild Waste Management Unit 183 (Basewide Sewer System)
DP = Direct Push
A = Denotes a duplicate sample
Final digit(s) equal the sample interval depth in feet below ground surface

Table 7-3
Sub-Basin 8 Soil Analytical Results, Phase I (April 2010)
SWMU 183 RFI Report
Holloman Air Force Base, New Mexico
NationView Project No. 8080014

Client Sample Identification:	Soil Screening Levels	Basewide Background Levels		SWMU183-DP05-7.5			SWMU183-DP05-7.5A			SWMU183-DP06-11.5			SWMU183-DP07-12			SWMU183-DP08-11			SWMU183-DP09-6.5			SWMU183-DP10-9		
Lab Sample Identification:	NMED Residential[1]	NMED Approved Background Level[2]	Combined Soil Background Level[3]	280-2612-1			280-2612-4			280-2612-3			280-2612-6			280-2612-7			280-2652-5			280-2652-6		
Date Sampled:				4/20/2010			4/20/2010			4/20/2010			4/20/2010			4/20/2010			4/20/2010			4/20/2010		
Sub-Basin:				8			8			8			8			8			8			8		
Analyte (Method)				Result	LQ	CQ	Result	LQ	CQ	Result	LQ	CQ	Result	LQ	CQ	Result	LQ	CQ	Result	LQ	CQ	Result	LQ	CQ
VOCs (SW846 8260B)	**mg/kg**	**mg/kg**	**mg/kg**	**µg/kg**			**µg/kg**			**µg/kg**			**µg/kg**			**µg/kg**			**µg/kg**			**µg/kg**		
2-Butanone (MEK)	39,600	NV	NV	12.9	U		12.1	U		12.2	UH		12.1	U		22			13.1	UH		11.6	UH	
Acetone	67,500	NV	NV	12.9	U		14	J		12.2	UH		12.1	U		100			13.1	UH		11.6	UH	
Carbon disulfide	1,940	NV	NV	1.3	UJ		1.2	U		1.2	UH		1.2	U		1.5	J		1.3	UH		1.2	UH	
Methylene Chloride	199	NV	NV	1.3	U		1.2	U		1.2	UH		1.2	U		1	U		1.3	UH		1.4	JH	J
SVOCs (SW846 8270C)	**mg/kg**	**mg/kg**	**mg/kg**	**µg/kg**			**µg/kg**			**µg/kg**			**µg/kg**			**µg/kg**			**µg/kg**			**µg/kg**		
bis(2-Ethylhexyl)phthalate	347	NV	NV	90	J		110	J		70	J		89	J		90	J		88	J		140	J	
TAL Metals (SW846 6010B/7471A)	**mg/kg**	**mg/kg**	**mg/kg**	**mg/kg**			**mg/kg**			**mg/kg**			**mg/kg**			**mg/kg**			**mg/kg**			**mg/kg**		
Aluminum	78,100	13,722	13,722.27	16,000	J	J	8,800		J	4,500		J	10,000		J	15,000		J	6,400		J	12,000		J
Barium	15,600	169.3	169.25	74			69			46			87			86			48			70		
Beryllium	156	1.6	1.53	0.79		J	0.35	J	J	0.16	J		0.31	J		0.6			0.037	U		0.44	J	
Cadmium	77.9	0.3	0.28	0.33	J		0.23	J		0.17	J		0.15	U		0.143	U		0.148	U		0.18	J	
Calcium	NV [4]	317,332	317,331.59	120,000	J	J	130,000		J	100,000		J	190,000		J	190,000		J	200,000	J	J	160,000	J	J
Chromium	219	25	24.95	19	J		12			6.7			11			17			6.7			14		
Cobalt	23 [5]	7.7	7.70	5.2	Q		4	Q		2.3	Q		3.5	Q		4.4	Q		2.1	Q		4	Q	
Copper	3,130	13	12.96	11	Q	J	5.8	JQ	J	3.9	JQ	J	4.8	JQ	J	7.1	Q	J	3.2	JQ	J	6.7	Q	J
Iron	54,800	23,049	23,049.48	12,000	J		8,100			5,000			8,500			14,000			5,300			10,000		
Lead	400	10.9	10.87	7.5			4.6			3.6			4.7			5.6			2.5			5.9		
Magnesium	NV [4]	16,991	16,990.65	23,000	J		18,000			7,300			4,500			5,400			3,000			11,000		
Manganese	10,700	393	393.47	180	QJ	J	160	Q	J	140	Q	J	120	Q	J	170	Q	J	98	Q	J	200	Q	J
Molybdenum	391	NV	NV	0.93	J	J	0.25	J	J	0.37	J		0.19	J		0.21	J		0.46	J		0.61	J	
Nickel	1,560	17.4	17.34	15	Q		9.6	Q		5.6	Q		7.8	Q		12	Q		4.5	JQ		10	Q	
Potassium	NV [4]	5,077	5,077.12	3,700	J	J	2,100		J	1,300			2,700			3,700			1,700			2,700		
Selenium	391	1.4	1.4	2.2	J		1.6	U		1.3	U		1.6	U		1.5	U		1.6	U		1.6	U	
Sodium	NV [4]	5,196	5,195.97	390	J		300	J		770			660			340	J		310	J		3,300		
Vanadium	391	42.6	42.53	28	QJ		17	Q		11	Q		18	Q		28	Q		13	Q		23	Q	
Zinc	23,500	54.6	54.53	43	Q	J	24	Q	J	17	Q		22	Q		35	Q		15	Q		29	Q	
PCBs (SW846 8082)	**mg/kg**	**mg/kg**	**mg/kg**	**µg/kg**			**µg/kg**			**µg/kg**			**µg/kg**			**µg/kg**			**µg/kg**			**µg/kg**		
All PCBs	NV	NV	NV	ND			ND			ND			ND			ND			ND			ND		
Perchlorate (SW846 6860)	**mg/kg**	**mg/kg**	**mg/kg**	**µg/kg**			**µg/kg**			**µg/kg**			**µg/kg**			**µg/kg**			**µg/kg**			**µg/kg**		
Perchlorate	54.8	NV	NV	0.33	U		0.31	U		2.7			0.33	U		0.3	U		0.3	U		3.3		
Anions (EPA 300/SW846 9056)	**mg/kg**	**mg/kg**	**mg/kg**	**mg/kg**			**mg/kg**			**mg/kg**			**mg/kg**			**mg/kg**			**mg/kg**			**mg/kg**		
Nitrate as N	125,000	NV	NV	6.8		J	9.7		J	17		J	8.2		J	1.2	J	J	11		J	23		J
Chloride	NV [4]	NV	NV	26	J		27	J		460			50			12	J		11	J		2,300		
Sulfate	NV [4]	NV	NV	190		J	1,600		J	1,500			19,000			11,000			17,000			22,000		
TPH (SW846 8015 M)	**mg/kg**	**mg/kg**	**mg/kg**	**mg/kg**			**mg/kg**			**mg/kg**			**mg/kg**			**mg/kg**			**mg/kg**			**mg/kg**		
Gasoline Range Organics (C6 -C10)	800 [6]	NV	NV	0.684	UH		0.672	UH		0.668	UH		0.683	UH		0.581	U		0.744	UH		0.574	UHM	
Diesel Range Organics (C10-C22)	800 [6]	NV	NV	2.65	U		2.47	U		2.11	U		2.59	U		6	M		2.41	U		2.46	U	
Oil Range Organics (>C22-C36)	800 [6]	NV	NV	2.65	U		2.47	U		2.11	U		2.59	U		24	M		2.41	U		2.46	U	
Radiochemistry	**pCi/g**	**pCi/g**	**pCi/g**	**pCi/g**			**pCi/g**			**pCi/g**			**pCi/g**			**pCi/g**			**pCi/g**			**pCi/g**		
Radium 226 (EPA 903.0 MOD)	1,570 [7]	1.35	1.35	7.7E-01	J		9.5E-01	J		3.5E-01	J	J	3.7E-01	J	J	5.2E-01	J		3.3E-01	J		6.8E-01		J
Radium 228 (EPA 904 MOD)	3,470 [7]	0.95	0.95	9.2E-01	J		5.7E-01	U		4.0E-02	U		1.31E+00			1.11E+00			-3.0E-03	U		1.4E-01		U
Tritium (EPA 906.0 MOD)	323,000,000 [7]	NV	NV	1.4E-01	J		1.9E-01	J		3.0E-01	J		1.6E-01	J		2.5E-01	J		3.7E-01	U		9.0E-02		U
Carbon 14 (EERF C-01-1)	2,570,000 [7]	0.84	0.84	1.4E-01	U		1.0E-01	U		6.0E-02	U		-3.0E-02	U		1.4E-01	U		1.8E-01	U		1.2E-01		U
General Chemistry (SM19 2540B M)	**%**	**%**	**%**	**%**			**%**			**%**			**%**			**%**			**%**			**%**		
Percent Moisture (TA-STL)	NV	NV	NV	25.9			24.7			13.1			25.9			20.8			16.5			18.3		
Percent Moisture (TA-DEN)	NV	NV	NV	26			24			6.0			23			18			19			19		

Notes:

NMED = New Mexico Environment Department
UTL = Upper Tolerance Limit
VOC = Volatile Organic Compounds
SVOC = Semi-Volatile Organic Compounds
TPH = Total Petroleum Hydrocarbons
EPA = Environmental Protection Agency
EERF = Eastern Environmental Radiation Facilities
TAL = Target Analyte List
PCB = Polychlorinated Biphenyls
µg/kg = Micrograms per kilogram
mg/kg = Milligrams per kilogram
pCi/g = PicoCuries per gram
LQ = Laboratory Qualifiers
CQ = Validating Chemist Qualifiers

ND = Not Detected
NV = No Value
% = percent
TA-STL = Test America - St Louis
TA-DEN = Test America - Denver

[1] NMED, December 2009. Technical Background Document for Development of Soil Screening Levels, Revision 5.0.
[2] Table 1, Conditional Approval Letter, *Basewide Background Study Report, Holloman Air Force Base, New Mexico* (NMED, December 2011)
[3] Table 5-18, *Basewide Background Study Report, Holloman Air Force Base, New Mexico* (NationView|Bhate JV III, July 2011)
[4] No Value established for NMED Residential SSL (December 2009) and USEPA Region 3, 6, and 9 Regional Screening Levels (RSLs) (November 2011)
[5] USEPA Regions 3, 6, and 9 RSLs (November 2011)
[6] NMED TPH Screening Guidelines for Unknown Oil, Residential Direct Exposure, Table 2b (October 2006)
[7] USEPA Soil Screening Guidance for Radionuclides: Technical Background Document; Table A.1 (Inhalation of Fugitive Dusts) (USEPA, October 2000)

Bold value indicates analytes above NMED SSLs (Rev 5.0, December 2009) or TPH results above NMED TPH Screening Guidelines (October 2006)
Indicates that the combined TPH-GRO/DRO/ORO results exceed the NMED TPH Screening Guidelines (Unknown Oil, Residential Direct Exposure)
Indicates analytical results above the NMED Approved Basewide Background Levels, but below applicable NMED Residential SSL and/or USEPA RSL

Qualifiers
J = Estimated result. Result is between the method detection limit and the reporting limit.
Q = One or more quality control criteria failed
M = Manually integrated compound
U = Undetected. Value set at the limit of detection
H = Sample prepped or analyzed beyond the specified holding time

Client Sample Nomenclature
SWMU183 = Soild Waste Management Unit 183 (Basewide Sewer System)
DP = Direct Push
A = Denotes a duplicate sample
Final digit(s) equal the sample interval depth below ground surface

Table 7-4
Sub-Basin 9 Soil Analytical Results, Phase I (April 2010)
SWMU 183, RFI Report
Holloman Air Force Base, New Mexico
NationView Project No. 8080014

Client Sample Identification:	Soil Screening Levels	Basewide Background Levels		SWMU183-DP01-5			SWMU183-DP01-5-A			SWMU183-DP02-9.5			SWMU183-DP03-13			SWMU183-DP04-11		
Lab Sample Identification:	NMED Residential[1]	NMED Approved Background Level[2]	Combined Soil Background Level[3]	280-2652-7			280-2652-14			280-2652-1			280-2652-2			280-2652-3		
Date Sampled:				4/20/2010			4/20/2010			4/20/2010			4/21/2010			4/21/2010		
Sub-Basin:				9			9			9			9			9		
Analyte (Method)				Result	LQ	CQ	Result	LQ	CQ	Result	LQ	CQ	Result	LQ	CQ	Result	LQ	CQ
VOCs (SW846 8260B)	**mg/kg**	**mg/kg**	**mg/kg**	**µg/kg**			**µg/kg**			**µg/kg**			**µg/kg**			**µg/kg**		
Methylene Chloride	199	NV	NV	4.2	JH	J	1.2	UH		1.1	UH		1.1	UH		1.5	UH	
SVOCs (SW846 8270C)	**mg/kg**	**mg/kg**	**mg/kg**	**µg/kg**			**µg/kg**			**µg/kg**			**µg/kg**			**µg/kg**		
bis(2-Ethylhexyl)phthalate	347	NV	NV	190	J	J	83	J	J	92	J		96	J		75	U	
TAL Metals (SW846 6010B/7471A)	**mg/kg**	**mg/kg**	**mg/kg**	**mg/kg**			**mg/kg**			**mg/kg**			**mg/kg**			**mg/kg**		
Aluminum	78,100	13,722	13,722.27	13,000	J	J	14,000		J	13,000		J	8,400		J	1,400		J
Arsenic	3.9	3.7	3.66	2.7	J		3.1			2.6			2.3	U		2.2	U	
Barium	15,600	169.3	169.25	100			96			46			110			13		
Beryllium	156	1.6	1.53	0.39	J		0.36	J		0.59			0.2	J		0.0332	U	
Cadmium	77.9	0.3	0.28	0.141	U		0.143	U		0.13	J		0.137	U		0.133	U	
Calcium	NV [4]	317,332	317,331.59	120,000	J	J	150,000	J	J	160,000	J	J	180,000	J	J	200,000	J	J
Chromium	219	25	24.95	12			12			15			8			1.2	J	
Cobalt	23 [5]	7.7	7.70	3.6	Q		4	Q		4.1	Q		2.2	Q		0.43	JQ	
Copper	3,130	13	12.96	9.8	Q	J	7.9	Q	J	6.6	Q	J	4.6	JQ	J	1.1	JQ	J
Iron	54,800	23,049	23,049.48	10,000	J		10,000			12,000			6,300			1,200		
Lead	400	10.9	10.87	8.1			5.6			6			3			0.88	U	
Magnesium	NV [4]	16,991	16,990.65	5,500	J		3,300			4,900			4,600			590		
Manganese	10,700	393	393.47	220	QJ	J	190	Q	J	160	Q	J	130	Q	J	17	Q	J
Molybdenum	391	NV	NV	0.56	J		0.83	J		0.31	J		0.19	J		0.11	U	
Nickel	1,560	17.4	17.34	8.8	Q		8.8	Q		10	Q		5.7	Q		0.75	JQ	
Potassium	NV [4]	5,077	5,077.12	3,400			3,300			3,100			2,100			360		
Sodium	NV [4]	5,196	5,195.97	380	J		290	J		350	J		1,600			100	J	
Vanadium	391	42.6	42.53	21	Q		21	Q		25	Q		16	Q		3.2	Q	
Zinc	23,500	54.6	54.53	33	Q		31	Q		32	Q		15	Q		3.4	JQ	
PCBs (SW846 8082)	**mg/kg**	**mg/kg**	**mg/kg**	**µg/kg**			**µg/kg**			**µg/kg**			**µg/kg**			**µg/kg**		
All PCBs	NV	NV	NV	ND			ND			ND			ND			ND		
Anions (EPA 300/SW846 9056)	**mg/kg**	**mg/kg**	**mg/kg**	**mg/kg**			**mg/kg**			**mg/kg**			**mg/kg**			**mg/kg**		
Nitrate as N	125,000	NV	NV	19		J	67		J	4.4	J	J	7.1		J	1.17	U	
Chloride	NV [4]	NV	NV	36			39			40			300			5.87	U	
Sulfate	NV [4]	NV	NV	17,000			15,000			17,000			18,000			16,000		
TPH (SW846 8015 M)	**mg/kg**	**mg/kg**	**mg/kg**	**mg/kg**			**mg/kg**			**mg/kg**			**mg/kg**			**mg/kg**		
Gasoline Range Organics (C6 -C10)	800 [6]	NV	NV	0.612	UHM		0.669	UH		0.61	UHM		0.644	UM		0.83	UM	
Diesel Range Organics (C10-C22)	800 [6]	NV	NV	2.31	U		2.4	U		2.3	U		2.38	U		2.35	U	
Oil Range Organics (>C22-C36)	800 [6]	NV	NV	2.31	U		2.4	U		2.3	U		2.38	U		2.35	U	
Radiochemistry	**pCi/g**	**pCi/g**	**pCi/g**	**pCi/g**			**pCi/g**			**pCi/g**			**pCi/g**			**pCi/g**		
Radium 226 (EPA 903.0 MOD)	1,570 [7]	1.35	1.35	1.5E-01	U		2.9E-01	J		5.6E-01	J		3.2E-01	J		1.80E-01	U	
Radium 228 (EPA 904 MOD)	3,470 [7]	0.95	0.95	-2.2E-01	U		1.2E-01	U		8.0E-01	J		8.4E-01	J		3.10E-01	U	
Tritium (EPA 906.0 MOD)	323,000,000 [7]	NV	NV	2.0E-02	U		2.2E-01	U		1.1E-01	U		6.0E-02	U		1.30E-01	U	
Carbon 14 (EERF C-01-1)	2,570,000 [7]	0.84	0.84	2.0E-01	U		1.7E-01	U		3.1E-01	U		3.5E-01	U		1.80E-01	U	
General Chemistry (SM19 2540B M)	**%**	**%**	**%**	**%**			**%**			**%**			**%**			**%**		
Percent Moisture (TA-STL)	NV	NV	NV	16.8			18.7			12.5			16.1			16.4		
Percent Moisture (TA-DEN)	NV	NV	NV	16			18			15			17			17		

Notes:
NMED = New Mexico Environment Department
UTL = Upper Tolerance Limit
VOC = Volatile Organic Compounds
SVOC = Semi-Volatile Organic Compounds
TPH = Total Petroleum Hydrocarbons
EPA = Environmental Protection Agency
EERF = Eastern Environmental Radiation Facilities
TAL = Target Analyte List
PCB = Polychlorinated Biphenyls
µg/kg = Micrograms per kilogram
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pCi/g = PicoCuries per gram
ND = Not Detected
NV = No Value
% = percent
TA-STL = Test America - Saint Louis
TA-DEN = Test America - Denver
LQ = Laboratory Qualifiers
CQ = Validating Chemist Qualifiers

Qualifiers
J = Estimated result. Result is between the method detection limit and the reporting limit.
Q = One or more quality control criteria failed
M = Manually integrated compound
U = Undetected. Value set at the limit of detection.
H = Sample prepped or analyzed beyond the specified holding time

[1] NMED, December 2009. Technical Background Document for Development of Soil Screening Levels, Revision 5.0.
[2] Table 1, Conditional Approval Letter, *Basewide Background Study Report, Holloman Air Force Base, New Mexico* (NMED, December 2011)
[3] Table 5-18, *Basewide Background Study Report, Holloman Air Force Base, New Mexico* (NationView|Bhate JV III, July 2011)
[4] No Value established for NMED Residential SSL (December 2009) and USEPA Region 3, 6, and 9 Regional Screening Levels (RSLs) (November 2011)
[5] USEPA Regions 3, 6, and 9 RSLs (November 2011)
[6] NMED TPH Screening Guidelines for Unknown Oil, Residential Direct Exposure, Table 2b (October 2006)
[7] USEPA Soil Screening Guidance for Radionuclides: Technical Background Document; Table A.1 (Inhalation of Fugitive Dusts) (USEPA, October 2000)
Bold value indicates analytes above NMED SSLs (Rev 5.0, December 2009) or TPH results above NMED TPH Screening Guidelines (October 2006)
Indicates that the combined TPH-GRO/DRO/ORO results exceed the NMED TPH Screening Guidelines (Unknown Oil, Residential Direct Exposure)
Indicates analytical results above the NMED Approved Basewide Background Levels, but below the NMED Residential SSL and/or USEPA RSL

Client Sample Nomenclature
SWMU183 = Soild Waste Management Unit 183 (Basewide Sewer System)
DP = Direct Push
A = Denotes a duplicate sample
Final digit(s) equal the sample interval depth in feet below ground surface

Table 7-5
Sub-Basins 1 and 10 Soil Analytical Results, Phase II (July 2010)
SWMU 183 RFI Report
Holloman Air Force Base, New Mexico
NationView Project No. 8080014

Client Sample Identification:	Soil Screening Levels	Basewide Background Levels		SWMU183-DP53-4			SWMU183-DP54-9			SWMU183-DP59-3			SWMU183-DP60-6			SWMU183-DP61-4		
Lab Sample Identification:	NMED Residential[1]	NMED Approved Background Level[2]	Combined Soil Background Level[3]	F75130-3			F75130-4			F75126-2			F75126-3			F75130-2		
Date Sampled:				7/15/2010			7/15/2010			7/14/2010			7/14/2010			7/15/2010		
Sub-Basin:				10			10			1			1			1		
Analyte (Method)				Result [4]	LQ	CQ	Result [4]	LQ	CQ	Result [4]	LQ	CQ	Result [4]	LQ	CQ	Result [4]	LQ	CQ
VOCs (SW846 8260B)	mg/kg	µg/kg	µg/kg	µg/kg			µg/kg			µg/kg			µg/kg			µg/kg		
Acetone	67,500	NV	NV	26	U		26	U		25	U		40.8	J	J	24	U	
Carbon disulfide	1,940	NV	NV	2.9	U		2.9	U		2.8	U		3.6	J	J	2.7	U	
Methylene chloride	199	NV	NV	6.1	U		6.1	U		5.9	U		8.9	JB	J	6.3	JB	J
SVOCs (SW846 8270C)	mg/kg	µg/kg	µg/kg	µg/kg			µg/kg			µg/kg			µg/kg			µg/kg		
All SVOCs	NV	NV	NV	ND			ND			ND			ND			ND		
PCBs (SW846 8082)	mg/kg	mg/kg	mg/kg	µg/kg			µg/kg			µg/kg			µg/kg			µg/kg		
All PCBs	NV	NV	NV	ND			ND			ND			ND			ND		
TAL Metals (SW846 6010B/7471A)	mg/kg	mg/kg	mg/kg	mg/kg			mg/kg			mg/kg			mg/kg			mg/kg		
Aluminum	78,100	13,722	13,722.27	10,900			5,470			2,610			8,450			8,560		
Antimony	31.3	1.6	1.6	1.1	U		1.2	U		0.98	U		1.0	U		0.54	U	
Arsenic	3.9	3.7	3.66	**4.0**	J		2.6	J		2.9	J		**3.9**	J		2.5	J	
Barium	15,600	169.3	169.25	224			68.9	J		43.8	J		74.5	J		51.5	J	
Beryllium	156	1.6	1.53	0.57	U		0.62	U		0.49	U		0.51	U		0.43	J	
Cadmium	77.9	0.3	0.28	0.57	U		0.62	U		0.49	U		0.51	U		0.27	U	
Calcium	NV [6]	317,332	317,331.59	185,000			225,000			185,000			179,000			113,000		
Chromium	219	25	24.95	11.3			6.7			2.5	J		7.7			8.2		
Cobalt	23 [5]	7.7	7.70	3.9	J		1.9	J		1.2	J		2.8	J		3.8	J	
Copper	3,130	13	12.96	8.6	J		3.3	J		2.8	J		6.1	J		8.0		
Iron	54,800	23,049	23,049.48	9,150			5,420			2,260			6,470			8,130		
Lead	400	10.9	10.87	6.2	J		2.6	J		1.0	J		3.7	J		6.0		
Magnesium	NV [6]	16,991	16,990.65	8,430			3,510			2,610			28,000			5,950		
Manganese	10,700	393	393.47	142			77.9			24.8			112			183		
Nickel	1,560	17.4	17.34	9.2	J		4.4	J		2.3	J		6.4	J		8.0	J	
Potassium	NV [6]	5,077	5,077.12	3,230	J		1,420	J		966	J		2,060	J		3,530		
Silver	391	1.1	1.1	0.57	U		0.62	U		0.49	U		2.5	J		0.27	U	
Sodium	NV [6]	5,196	5,195.97	430	U		460	U		370	U		2,750	J		669	J	
Vanadium	391	42.6	42.53	24.0	J		11.4	J		12.4	J		25.9			12.7	J	
Zinc	23,500	54.6	54.53	138			11.5	J		5.6	J		22.4			25.5		
TPH (SW846 8015 M)	mg/kg	mg/kg	mg/kg	mg/kg			mg/kg			mg/kg			mg/kg			mg/kg		
Gasoline Range Organics (C6-C10)	800 [7]	NV	NV	4.0	U		3.9	U		3.8	U		3.9	U		3.8	U	
Diesel Range Organics (C10-C22)	800 [7]	NV	NV	6.8	U		6.8	U		6.5	U		6.6	U		6.3	U	
Oil Range Organics (>C22-C36)	800 [7]	NV	NV	6.8	U		6.8	U		6.5	U		6.6	U		6.3	U	
Anions (EPA 300/SW846 9056)	mg/kg	mg/kg	mg/kg	mg/kg			mg/kg			mg/kg			mg/kg			mg/kg		
Chloride	NV [6]	NV	NV	58.6			29.5			1,820			4,840			826		
Nitrogen, Nitrate	125,000	NV	NV	1.5		J	0.68	U		0.66	U		3.5		J	0.90	J	J
Sulfate	NV [6]	NV	NV	14,700			19,300			18,800			15,700			7,400		
General Chemistry (SM19 2540B M)	%	%	%	%			%			%			%			%		
Solids, Percent	NV	NV	NV	73.1			73.4			75.7			75.1			78.1		

Notes:
NMED = New Mexico Environment Department
VOC = Volatile Organic Compounds
SVOC = Semi-Volatile Organic Compounds
TPH = Total Petroleum Hydrocarbons
TAL = Target Analyte List
PCB = Polychlorinated Biphenyls
EPA = Environmental Protection Agency
µg/kg = Micrograms per kilogram
mg/kg = Milligrams per kilogram
% = percent
NV = No Value
ND = All compounds not detected
LQ = Laboratory Qualifier
CQ = Validating Chemist Qualifier

[1] NMED, December 2009. Technical Background Document for Development of Soil Screening Levels (SSL), Revision 5.0.
[2] Table 1, Conditional Approval Letter, *Basewide Background Study Report, Holloman Air Force Base, New Mexico* (NMED, December 2011)
[3] Table 5-18, *Basewide Background Study Report, Holloman Air Force Base, New Mexico* (NationView|Bhate JV III, July 2011)
[4] If results are not detected (U) then the value is set at the Method Detection Limit (MDL)
[5] USEPA Region 3, 6, and 9 Regional Screening Levels (RSLs) (November 2011)
[6] No Value established for NMED Residential SSL (December 2009) and USEPA RSL (November 2011)
[7] NMED TPH Screening Guidelines for Unknown Oil, Residential Direct Exposure, Table 2b (October 2006)
Bold value indicates analytes above NMED SSLs (Rev 5.0, December 2009) or TPH results above NMED TPH Screening Guidelines (October 2006)
Indicates analytical results above the NMED Approved Basewide Background Levels, but below the NMED Residential SSL and USEPA RSL
Client Sample Nomenclature
SWMU183 = Soild Waste Management Unit 183 (Basewide Sewer System)
DP = Direct Push
Final digit(s) equal the sample interval depth in feet below ground surface
Qualifiers
U = Not Detected

Table 7-5
Sub-Basins 1 and 10 Soil Analytical Results, Phase II (July 2010)
SWMU 183 RFI Report
Holloman Air Force Base, New Mexico
NationView Project No. 8080014

J = Indicates an estimated value
B = Suspected Laboratory Contaminant

Table 7-6
Sub-Basin 4 Soil Analytical Results, Phase II (July 2010)
SWMU 183 RFI Report
Holloman Air Force Base, New Mexico
NationView Project No. 8080014

Client Sample Identification:	Soil Screening Levels	Basewide Background Levels		SWMU183-DP55-10			SWMU183-DP55-10-A			SWMU183-DP56-4			SWMU183-DP57-6			SWMU183-DP58-10	
Lab Sample Identification:	NMED Residential[1]	NMED Approved Background Level[2]	Combined Soil Background Level[3]	F75091-1			F75091-2			F75130-1			F75091-3			F75126-1	
Date Sampled:				7/14/2010			7/14/2010			7/15/2010			7/14/2010			7/14/2010	
Sub-Basin:				4			4			4			4			4	
Analyte (Method)				Result[4]	LQ	CQ	Result[4]	LQ	CQ	Result[4]	LQ	CQ	Result[4]	LQ	CQ	Result[4]	LQ
VOCs (SW846 8260B)	**mg/kg**	**µg/kg**	**µg/kg**	**µg/kg**			**µg/kg**			**µg/kg**			**µg/kg**			**µg/kg**	
Methylene chloride	199	NV	NV	7.0	J		5.4	U		12.7	B	J	9.4	J		16.8	B
SVOCs (SW846 8270C)	**mg/kg**	**µg/kg**	**µg/kg**	**µg/kg**			**µg/kg**			**µg/kg**			**µg/kg**			**µg/kg**	
All SVOCs	NV	NV	NV	ND			ND			ND			ND			ND	
Herbicides (SW846 8151A)	**mg/kg**	**mg/kg**	**mg/kg**	**µg/kg**			**µg/kg**			**µg/kg**			**µg/kg**			**µg/kg**	
All Herbicides	NV	NV	NV	ND			ND			ND			ND			ND	
Pesticides (SW846 8081A)	**mg/kg**	**mg/kg**	**mg/kg**	**µg/kg**			**µg/kg**			**µg/kg**			**µg/kg**			**µg/kg**	
All Pesticides	NV	NV	NV	ND			ND			ND			ND			ND	
PCBs (SW846 8082)	**mg/kg**	**mg/kg**	**mg/kg**	**ug/kg**			**ug/kg**			**ug/kg**			**ug/kg**			**ug/kg**	
All PCBs	NV	NV	NV	ND			ND			ND			ND			ND	
TAL Metals (SW846 6010B/7471A)	**mg/kg**	**mg/kg**	**mg/kg**	**mg/kg**			**mg/kg**			**mg/kg**			**mg/kg**			**mg/kg**	
Aluminum	78,100	13,722	13,722.27	2,220		J	2,930		J	3,100			2,920		J	3,370	
Antimony	31.3	1.6	1.6	0.14	J		0.13	J		1.0	U		0.41	J		0.63	U
Arsenic	3.9	3.7	3.66	0.94			1.1			1.5	J		1.3			1.5	J
Barium	15,600	169.3	169.25	33.9		J	27.1		J	29.3	J		21.2			28.0	J
Beryllium	156	1.6	1.53	0.12	J		0.15	J		0.52	U		0.13	J		0.31	U
Cadmium	77.9	0.3	0.28	0.060	J		0.081	J		0.52	U		0.28			0.31	U
Calcium	NV[6]	317,332	317,331.59	23,300		J	58,500		J	179,000			145,000			170,000	
Chromium	219	25	24.95	3.0			3.7			3.1	J		3.6	J		3.6	
Cobalt	23[5]	7.7	7.70	1.2	J		1.3	J		1.3	J		1.3	J		1.4	J
Copper	3,130	13	12.96	1.2	J		1.6	J		2.4	J		2.3	J		2.8	J
Iron	54,800	23,049	23,049.48	2,610		J	2,940		J	2,760			2,470		J	3,180	
Lead	400	10.9	10.87	1.9			2.1			1.8	J		1.5			1.8	J
Magnesium	NV[6]	16,991	16,990.65	1,150		J	1,420		J	1,920	J		1,360		J	1,680	
Manganese	10,700	393	393.47	45.4		J	48.1		J	40.8			49.1		J	64.5	
Nickel	1,560	17.4	17.34	2.1			2.4			2.9	J		2.8			2.8	J
Potassium	NV[6]	5,077	5,077.12	507			696			812	J		812			880	J
Sodium	NV[6]	5,196	5,195.97	51.9	J	J	89.0	J	J	390	U		180	J		230	U
Vanadium	391	42.6	42.53	6.5		J	6.6		J	8.1	J		9.5		J	6.8	J
Zinc	23,500	54.6	54.53	6.4			7.8			6.7	J		6.3	J		7.9	
TPH (SW846 8015 M)	**mg/kg**	**mg/kg**	**mg/kg**	**mg/kg**			**mg/kg**			**mg/kg**			**mg/kg**			**mg/kg**	
Gasoline Range Organics (C6-C10)	800[7]	NV	NV	2.7	U		3.1	U		3.9	U		3.9	U		4.3	U
Diesel Range Organics (C10-C22)	800[7]	NV	NV	5.3	U		5.9	U		6.6	U		6.7	U		6.8	U
Oil Range Organics (>C22-C36)	800[7]	NV	NV	5.3	U		5.9	U		6.6	U		6.7	U		6.8	U
Anions (EPA 300/SW846 9056)	**mg/kg**	**mg/kg**	**mg/kg**	**mg/kg**			**mg/kg**			**mg/kg**			**mg/kg**			**mg/kg**	
Chloride	NV[6]	NV	NV	24.2			27.1			35.8			87.1			121	
Nitrogen, Nitrate	125,000	NV	NV	0.56	U		0.81	J		1.3		J	3.9			0.97	J
Sulfate	NV[6]	NV	NV	4,740		J	9,500		J	13,600			19,700			14,400	
General Chemistry (SM19 2540B M)	**%**	**%**	**%**	**%**			**%**			**%**			**%**			**%**	
Solids, Percent	NV	NV	NV	89.7			85.9			74.4			76.0			72.7	

Notes:
NMED = New Mexico Environment Department
TAL = Target Analyte List
PCB = Polychlorinated Biphenyls
VOC = Volatile Organic Compounds
SVOC = Semi-Volatile Organic Compounds
TPH = Total Petroleum Hydrocarbons
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µg/kg = Micrograms per kilogram
mg/kg = Milligrams per kilogram
% = percent
NV = No Value
ND = All compounds not detected

Qualifiers
U = Not detected
J = Indicates an estimated value
B = Suspected Laboratory Contaminant

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[4] If results are not detected (U) then the value is set at the Method Detection Limit (MDL)
[5] USEPA Region 3, 6, and 9 Regional Screening Levels (RSLs) (November 2011)
[6] No Value established for NMED Residential SSL (December 2009) and USEPA RSL (November 2011)
[7] NMED TPH Screening Guidelines for Unknown Oil, Residential Direct Exposure, Table 2b (October 2006)
Bold value indicates analytes above NMED SSLs (Rev 5.0, December 2009) or TPH results above NMED TPH Screening Guidelines (October 2006)
Indicates analytical results above the NMED Approved Basewide Background Levels, but below the NMED Residential SSL and/or USEPA RSL

Client Sample Nomenclature
SWMU183 = Soild Waste Management Unit 183 (Basewide Sewer System)
DP = Direct Push
A = Denotes a duplicate sample

Table 7-6
Sub-Basin 4 Soil Analytical Results, Phase II (July 2010)
SWMU 183 RFI Report
Holloman Air Force Base, New Mexico
NationView Project No. 8080014

LQ = Laboratory Qualifier
CQ = Validating Chemist Qualifier

Final digit(s) equal the sample interval depth in feet below ground surface

Table 7-6
Sub-Basin 4 Soil Analytical Results, Phase II (July 2010)
SWMU 183 RFI Report
Holloman Air Force Base, New Mexico
NationView Project No. 8080014

CQ
J
J

Table 7-7
Groundwater Analytical Results, Sub-Basins 1 and 10 (August 2010)
SWMU 183 RFI Report
Holloman Air Force Base, New Mexico
NationView Project No. 8080014

Client Sample Identification:	Groundwater Screening Levels		Basewide Background Levels		SWMU183-MW01			SWMU183-MW02			SWMU183-MW07			SWMU183-MW08			SWMU183-MW08			SWMU183-MW08			SWMU183-MW09		
Lab Sample Identification:	NMWQCC[1]	USEPA MCL [2]	NMED Approved Background Levels (Dissolved Constituents)[3]	Dissolved Metals in Groundwater UTL [4]	F75797-1			F75797-3			F75797-4			F75843-1			F77188-1			F78755-1			F75843-2		
Date Sampled:					8/11/2010			8/12/2010			8/12/2010			8/13/2010			10/11/2010			12/14/2010			8/13/2010		
Sub-Basin:					10			10			1			1			1			1			1		
Analyte (Method)					Result [5]	Q	Q1	Result [5]	Q	Q1	Result [5]	Q	Q1	Result [5]	Q	Q1	Result [5]	Q	Q1	Result [5]	Q	Q1	Result [5]	Q	Q1
VOCs (SW846 8260B)	µg/L	µg/L	µg/L	µg/L	µg/L			µg/L			µg/L			µg/L			µg/L			µg/L			µg/L		
Chloroform	100	NV	NV	NV	5.6			0.25	U		0.25	U		0.25	U		NA			NA			0.25	U	
cis-1,2-Dichloroethylene	NV	70	NV	NV	0.32	U		0.32	U		0.32	U		0.90	J		NA			NA			0.32	U	
Methyl chloride	NV	NV	NV	NV	0.50	U		0.52	J		0.50	U		0.50	U		NA			NA			0.50	U	
Trichloroethylene	100	5	NV	NV	0.24	U		**5.0**			0.24	U		**5.2**			NA			NA			0.24	U	
SVOCs (SW846 8270C)	µg/L	µg/L	µg/L	µg/L	µg/L			µg/L			µg/L			µg/L			µg/L			µg/L			µg/L		
Di-n-butyl phthalate	NV	NV	NV	NV	0.95	U		0.99	U		1.0	U		1.3	U		NA			NA			1.2	J	
TPH (SW846 8015 M)	mg/L	mg/L	mg/L	mg/L	mg/L			mg/L			mg/L			mg/L			mg/L			mg/L			mg/L		
Gasoline Range Organics (C6-C10)	50.0 [6]	NV	NV	NV	0.050	U		0.050	U		0.050	U		0.050	U		NA			NA			0.050	U	
Diesel Range Organics (C10-C22)	50.0 [6]	NV	NV	NV	0.095	U		0.10	U		0.10	U		NA			NA			0.095	U		0.105	J	
Oil Range Organics (>C22-C36)	50.0 [6]	NV	NV	NV	0.095	U		0.10	U		0.10	U		NA			NA			0.095	U		0.129	J	
PCBs (SW846 8082)	µg/L	µg/L	µg/L	µg/L	µg/L			µg/L			µg/L			µg/L			µg/L			µg/L			µg/L		
All PCBs	1	0.5	NV	NV	ND			ND			ND			ND			NA			NA			ND		
TAL Metals Analysis (EPA 200.7)	µg/L	µg/L	µg/L	µg/L	µg/L			µg/L			µg/L			µg/L			µg/L			µg/L			µg/L		
Aluminum	NV	50 [7]	54	54	25	U		25	U		25	U		39.0	J		NA			NA			25	U	
Antimony	NV	6	6	10	2.0	U		2.0	U		2.0	U		2.5	J		NA			NA			2.0	U	
Arsenic	100	10	10	28.53	7.0	J		**13.3**			5.1	J		2.0	U		NA			NA			2.0	U	
Barium	1,000	2,000	30.2	30.13	39.6	J		16.6	J		40.2	J		107	J		NA			NA			97.1	J	
Calcium	NV	NV	1,151,302	1,151,301.20	579,000			568,000			886,000			1,420,000			NA			NA			1,030,000		
Cobalt	50	NV	2.6	2.6	1.0	U		3.9	J		6.7	J		9.2	J		NA			NA			7.2	J	
Copper	1,000	1,300	22	57.46	6.3	J		5.8	J		8.8	J		21.0	J		NA			NA			12.4	J	
Iron	1,000	300 [7]	65.6	65.56	35	U		36.5	J		35	U		35	U		NA			NA			35	U	
Lead	50	15	9	9	1.0	U		1.2	J		1.7	J		4.0	U		NA			NA			2.1	J	
Magnesium	NV	NV	3,630,927	3,630,926.70	79,900			241,000			612,000			3,480,000			NA			NA			978,000		
Manganese	200	50 [7]	50	118.65	4.4	J		**860**			**238**			**1,790**			NA			NA			**1,780**		
Nickel	200	NV	15.9	15.89	2.0	U		3.8	J		15.2	J		16.6	J		NA			NA			34.4	J	
Potassium	NV	NV	120,480	120,479.98	9,010	J		20,200			25,400			148,000			NA			NA			73,700		
Sodium	NV	NV	19,972,499	19,972,499.00	110,000			284,000			1,720,000			9,310,000			NA			NA			2,420,000		
Vanadium	NV	NV	73.8	73.73	43.3	J		58.3			25.3	J		4.0	U		NA			NA			2.4	J	
General Chemistry	mg/L	mg/L	mg/L	mg/L	mg/L			mg/L			mg/L			mg/L			mg/L			mg/L			mg/L		
Solids, Total Dissolved (SM19 2540C)	1,000	500 [7]	NV	65,956.58 [9]	**3,140**			**4,440**			**11,200**			NA			**41,500**			NA			**13,200**		
Chloride (EPA 300/SW846 9056)	250	250 [7]	35,040 [8]	35,039.73 [9]	158			474			4,130			NA			14,600			NA			6,160		
Nitrogen, Nitrate (EPA 300/SW846 9056)	10	10	NV	NV	4.2			3.0			5.0	U		NA			5.0	U		NA			5.0	U	
Sulfate (EPA 300/SW846 9056)	600	250 [7]	17,419 [8]	17,418.99 [9]	1,280			1,630			1,980			NA			3,530			NA			2,250		

Notes:

NMWQCC = New Mexico Water Quality Control Commission
USEPA = United States Environmental Protection Agency
NMED = New Mexico Environment Department
MCL = Maximum Contaminant Level
UTL = Upper Tolerance Limit
VOC = Volatile Organic Compounds
SVOC = Semi-Volatile Organic Compounds
TPH = Total Petroleum Hydrocarbons
EPA = Environmental Protection Agency
TAL = Total Analyte List
PCB = Polychlorinated Biphenyls
µg/L = Micrograms per liter
mg/L = Milligrams per liter
NV = No Value
Q = Laboratory Qualifier
Q1 = Validaing Chemist Qualifier
Qualifiers
U = Not detected
J = Indicates an estimated value
Client Sample Nomenclature
SWMU183 = Solid Waste Management Unit 183 (Basewide Sewer System)
MW = Monitoring Well

[1] Standards for Groundwater, if 10,000 mg/L TDS Concentration or Less, New Mexico Administrative Code 20.6.2.3103
[2] USEPA National Primary Drinking Water Regulations MCLs (816-F-09-004, May 2009)
[3] Table 3, Conditional Approval Letter, *Basewide Background Study Report, Holloman Air Force Base, New Mexico* (NMED, December 2011)
[4] Table 5-18, *Basewide Background Study Report, Holloman Air Force Base, New Mexico* (NationView|Bhate JV III, July 2011)
[5] If results are not detected (U) then the value is set at the Method Detection Limit (MDL)
[6] NMED TPH Screening Guidelines for Unknown Oil, Concentration in groundwater, Table 2b (October 2006)
[7] USEPA Secondary Drinking Water Standard
[8] Table 2, Conditional Approval Letter, *Basewide Background Study Report, Holloman Air Force Base, New Mexico* (NMED, December 2011)
[9] Value established in the Basewide Background Study Report, HAFB, New Mexico (NationView/Bhate JV III, July 2011) and derived from the Total Groundwater UTL.
Bold value indicates analytes above the New Mexico Groundwater Quality Standards, the USEPA MCLs, or the NMED TPH Screening Guidelines
Indicates combined TPH-GRO/DRO/ORO analytical results above the NMED TPH Screening Guideline for Unknown Oil, Concentration in Groundwater, Table 2b
Indicates analytical results above the New Mexico Groundwater Quality Standard, or USEPA MCL, but below the NMED approved Basewide Background Level
Indicates analytical results above the NMED approved Basewide Background Level, but below applicable New Mexico Groundwater Quality Standard, or USEPA MCL

Table 7-8
Groundwater Analytical Results, Sub-Basin 4 (August 2010)
SWMU 183 RFI Report
Holloman Air Force Base, New Mexico
NationView Project No. 8080014

Client Sample Identification:	Groundwater Screening Levels		Basewide Background Levels		SWMU183-MW03			SWMU183-MW03-A			SWMU183-MW04			SWMU183-MW05			SWMU183-MW06		
Lab Sample Identification:	NMWQCC[1]	USEPA MCL[2]	NMED Approved Background Levels (Dissolved Constituents)[3]	Dissolved Metals in Groundwater UTL[4]	F75750-1			F75750-2			F75797-2			F75843-4			F75843-3		
Date Sampled:					8/11/2010			8/11/2010			8/11/2010			8/13/2010			8/13/2010		
Sub-Basin:					4			4			4			4			4		
Analyte (Method)					**Result [5]**	**Q**	**Q1**	**Result [5]**	**Q**	**Q1**	**Result [5]**	**Q**	**Q1**	**Result [5]**	**Q**	**Q1**	**Result [5]**	**Q**	**Q1**
VOCs (SW846 8260B)	**µg/L**	**µg/L**	**µg/L**	**µg/L**	**µg/L**			**µg/L**			**µg/L**			**µg/L**			**µg/L**		
Chloroform	100	NV	NV	NV	0.26	J		0.31	J		0.25	U		0.25	U		0.25	U	
SVOCs (SW846 8270C)	**µg/L**	**µg/L**	**µg/L**	**µg/L**	**µg/L**			**µg/L**			**µg/L**			**µg/L**			**µg/L**		
All SVOCs	NV	NV	NV	NV	ND			ND			ND			ND			ND		
TPH (SW846 8015 M)	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**			**mg/L**			**mg/L**			**mg/L**			**mg/L**		
Gasoline Range Organics (C6-C10)	50.0 [6]	NV	NV	NV	0.050	U		0.050	U		0.050	U		0.050	U		0.050	U	
Diesel Range Organics (C10-C22)	50.0 [6]	NV	NV	NV	0.10	U		0.098	U		0.098	U		0.095	U		0.095	U	
Oil Range Organics (>C22-C36)	50.0 [6]	NV	NV	NV	0.10	U		0.098	U		0.098	U		0.119	J		0.127	J	
Herbicides (SW846 8151A)	**µg/L**	**µg/L**	**µg/L**	**µg/L**	**µg/L**			**µg/L**			**µg/L**			**µg/L**			**µg/L**		
All Herbicides	NV	NV	NV	NV	ND			ND			ND			ND			ND		
PCBs (SW846 8082)	**µg/L**	**µg/L**	**µg/L**	**µg/L**	**µg/L**			**µg/L**			**µg/L**			**µg/L**			**µg/L**		
All PCBs	1	0.5	NV	NV	ND			ND			ND			ND			ND		
Pesticides (SW846 8081A)	**µg/L**	**µg/L**	**µg/L**	**µg/L**	**µg/L**			**µg/L**			**µg/L**			**µg/L**			**µg/L**		
All Pesticides	NV	NV	NV	NV	ND			ND			ND			ND			ND		
TAL Metals Analysis (EPA 200.7/245.1)	**µg/L**	**µg/L**	**µg/L**	**µg/L**	**µg/L**			**µg/L**			**µg/L**			**µg/L**			**µg/L**		
Antimony	NV	6	6	10	2.7	J		2.1	J		2.0	U		2.0	U		2.0	U	
Arsenic	100	10	10	28.53	2.0	U		2.0	U		6.6	J		2.0	U		2.0	U	
Barium	1,000	2,000	30.2	30.13	20.4	J		20.5	J		29.3	J		66.3	J		64.9	J	
Calcium	NV	NV	1,151,302	1,151,301.20	637,000			664,000			603,000			491,000			628,000		
Chromium	50	100	2.5	2.5	2.0	U		2.0	U		2.0	U		1.3	J		2.0	U	
Cobalt	50	NV	2.6	2.6	1.0	J		1.2	J		2.8	J		1.6	J		3.8	J	
Copper	1,000	1,300	22	57.46	5.3	J		5.7	J		6.9	J		7.4	J		8.5	J	
Lead	50	15	9	9	2.2	J		1.0	U		1.5	J		1.0	U		1.2	J	
Magnesium	NV	NV	3,630,927	3,630,926.70	223,000			227,000			120,000			308,000			316,000		
Manganese	200	50 [7]	50	118.65	**1,070**			**1,070**			**339**			**852**			**1,450**		
Mercury	2	2	0.2	0.2	0.071	U		0.071	U		0.071	U		0.11	J		0.071	U	
Nickel	200	NV	15.9	15.89	2.0	U		2.0	U		4.6	J		8.8	J		18.2	J	
Potassium	NV	NV	120,480	120,479.98	5,580	J		5,710	J		13,900			29,000			23,100		
Selenium	50	50	25.3	25.26	11.4	J	J	17.0	J	J	4.0	U		5.9	J		4.0	U	
Sodium	NV	NV	19,972,499	19,972,499.00	479,000			472,000			218,000			466,000			667,000		
Vanadium	NV	NV	73.8	73.73	10.0	J		9.5	J		94.6			1.9	J		1.5	J	
Zinc	10,000	5,000 [7]	23	56.28	10	U		10	U		10	U		5.0	J		10	U	
General Chemistry	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**			**mg/L**			**mg/L**			**mg/L**			**mg/L**		
Solids, Total Dissolved (SM19 2540C)	1,000	500 [7]	NV	65,956.58 [9]	**3,750**			**5,030**			**4,060**			**4,770**			**5,130**		
Chloride (EPA 300/SW846 9056)	250	250 [7]	35,040 [8]	35,039.73 [9]	754			937			312			379			1,280		
Nitrogen, Nitrate (EPA 300/SW846 9056)	10	10	NV	NV	**62.7**			**78.1**			3.2			**15.7**			9.3		
Sulfate (EPA 300/SW846 9056)	600	250 [7]	17,419 [8]	17,418.99 [9]	1,680			2,120			1,520			2,760			2,330		

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Client Sample Nomenclature
SWMU183 = Solid Waste Management Unit 183 (Basewide Sewer System)
MW = Monitoring Well
A = Sample suffix denoting a field duplicate sample

ATTACHMENT A
NMED CORRESPONDENCE

ATTACHMENT B

VARIANCE FORM FOR THREE SOIL BORING RELOCATIONS

APPENDIX A

HISTORICAL DATA FROM PREVIOUS INVESTIGATIONS

Appendix A-1

Portions of the *Final infiltration and Inflow Study Report, Volume I, Holloman Air Force Base, NM*

Radian International LLC, August 1998

Appendix A-2

Portions of the *Industrial Wastewater Pretreatment Study Revised Phase I Draft Report, Holloman Air Force Base, NM*

Ecology and Environment, Inc. January 1998

APPENDIX B
SOIL BORING LOGS

APPENDIX C

MONITORING WELL CONSTRUCTION DIAGRAMS

APPENDIX D

MONITORING WELL DEVELOPMENT FORMS

APPENDIX E

MONITORING WELL SAMPLE COLLECTION FORMS

APPENDIX F
ANALYTICAL DATA PACKAGES
(PROVIDED ON ENCLOSED CD)

APPENDIX G
DATA VALIDATION REPORTS