Kirtland Air Force Base
Albuquerque, New Mexico

RCRA Facility Investigation Report
Appendix III Wasteline Sites

DRAFT FINAL - October 23, 1995

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INSTALLATION RESTORATION PROGRAM
KIRTLAND AIR FORCE BASE
ALBUQUERQUE, NEW MEXICO

DRAFT FINAL
RCRA FACILITY INVESTIGATION (RFI) REPORT
APPENDIX III WASTELINE SITES

OCTOBER 23, 1995

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ALBUQUERQUE, NEW MEXICO

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This RCRA Facility Investigation Report addresses 122 sites listed as solid waste management units associated with wastelines in Appendix III of Module IV to the RCRA Part B Permit (No. NM9 570 024-423) for Kirtland AFB and summarizes the RFI conducted at these sites during 1994 and 1995.

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PREFACE

This RCRA Facility Investigation (RFI) Report summarizes the RFI conducted during 1994 and 1995 at 122 sites listed as solid waste management units as listed in Appendix III of Module IV to the RCRA Part B Permit for Kirtland AFB. This report was prepared to address the requirement of the USAF Statement of Work, dated March 7, 1994 and also the requirements for an RFI Report as specified in the RCRA Part B Permit for Kirtland AFB. This report was prepared by Halliburton NUS Corporation from July through October 1994. Mr. Bassim D. Shebaro of the Air Force Center for Environmental Excellence was the Restoration Team Chief and Mr. Rodney C. Arnold served as the Contracting Officer's Representative.

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Appendix J Quality Assurance/Quality Control for Production of Documents

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ACRONYMS

ABW	Air Base Wing
AC	aircraft
AEC	Atomic Energy Commission
AFB	Air Force Base
AFCEE	U.S. Air Force Center for Environmental Excellence
AFMC	Air Force Materiel Command
AFWL	Air Force Weapons Laboratory
AGE	aerospace ground equipment
AMC	Air Mobility Command
amsl	above mean sea level
AOCs	areas of concern
ASTM	American Society of Testing Materials
BCF	bioconcentration factor
bgs	below ground surface
Bldg	building
BX	Base Exchange (Army Air Force Exchange Service)
CCV	continuing calibration verification
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CERF	Civil Engineering Research Facility
CFR	Code of Federal Regulations
CMA	Corrective Measures Action
CMI	Corrective Measures Implementation
CMS	Corrective Measures Study
COR	Contracting Officer's Representative
CCTW	Combat Crew Training Wing
CTW	Crew Training Wing
DCQAP	Data Control Quality Assurance Plan
DOD	U.S. Department of Defense
DOE	U.S. Department of Energy
DOT	U.S. Department of Transportation
DQO	data quality objective
DRO	diesel range organics
EM	Environmental Management Division
EOD	Explosive Ordnance Disposal
EPA	U.S. Environmental Protection Agency
FID	flame ionization detector
FCDNA	Field Command Defense Nuclear Agency
FR	Federal Register
FTL	Field Team Leader

ACRONYMS (Continued)

GFAA	graphite furnace atomic absorption
GRO	gasoline range organics
HDPE	high-density polyethylene
HHRB	human health risk-based
Hq	Headquarters
HR1	Hydrogeologic Region I
HR2	Hydrogeologic Region II
HR3	Hydrogeologic Region III
ICBM	intercontinental ballistic missile
ICS	interference check sample
IDL	instrument detection limit
IRIS	Integrated Risk Information System
IRP	Installation Restoration Program
ITRI	Inhalation Toxicology Research Institute
KAFB	Kirtland Air Force Base
LCS	laboratory control sample
LIMS	Laboratory Information Management System
MAC	Military Airlift Command
ml	milliliter
MS/MSD	matrix spike/matrix spike duplicate
MWSA	Manzano Weapons Storage Area
N/A	not applicable
NAF	Nonappropriated Fund
NaI	sodium iodide
NCO	Noncommissioned Officer
NCP	National Contingency Plan
ND	nondetect (or not detected)
NFA	No Further Action
NFRAP	No Further Response Action Planned
NGVD29	1929 National Geodetic Vertical Datum
NIST	National Institute of Standards and Technology
NMANG	New Mexico Air National Guard
NMED	New Mexico Environment Department
OD	outside diameter
OWS	oil/water separator

ACRONYMS (Concluded)

%Rs	percent recoveries
%RSDs	percent relative standard deviations
PAH	polynuclear aromatic hydrocarbons
pCi/g	picocuries per gram
PDSs	post digestion spikes
PID	photoionization detector
POC	point of contact
POTW	publicly owned treatment works
PPMv	parts per million/volume
PQL	Practical Quantitation Limits
PR/VSI	Preliminary Review/Visual Site Inspection
PVC	polyvinyl chloride
QAPP	Quality Assurance Project Plan
QA/QC	quality assurance/quality control
RAD	radionuclide
RB	radiological burial
RCRA	Resource Conservation and Recovery Act
RFI	RCRA Facility Investigation
RI/FS	Remedial Investigation/Feasibility Study
RPD	relative percent difference
RRF	relative response factor
SAP	Sampling and Analysis Plan
SNL	Sandia National Laboratories
SOP	standard operating procedure
SVOC	semivolatile organic compound
SWMU	solid waste management unit
TCLP	Toxicity Characteristic Leaching Procedure
TPH	total petroleum hydrocarbons
TRPH	total recoverable petroleum hydrocarbons
USAF	U.S. Air Force
USGS	U.S. Geological Survey
UST	underground storage tank
UTL	upper tolerance limit
VAQ	Visiting Airmen Quarters
VOA	volatile organic analysis
VOC	volatile organic compound
WSA	Weapons Storage Area

Executive Summary

EXECUTIVE SUMMARY

This Resource Conservation and Recovery Act (RCRA) Facility Investigation (RFI) at Kirtland Air Force Base (AFB) was performed to fulfill the requirements of the Kirtland AFB RCRA Part B Permit. Kirtland AFB is located in central New Mexico, southeast of and adjacent to the City of Albuquerque and the Albuquerque International Airport. Kirtland AFB encompasses 52,287± acres and is host to the 377th Air Base Wing of the Air Force Materiel Command.

This RFI Report presents the Appendix III wasteline investigation results. This investigation was performed in support of the U.S. Air Force Installation Restoration Program (IRP). Developed by the U.S. Department of Defense (DOD), this program identifies and evaluates hazardous waste storage and disposal sites on DOD property and mitigates any potential adverse effects to human health and the environment caused by management of hazardous waste at these sites. This investigation was performed after a RCRA Facility Assessment and previous IRP environmental investigations were conducted that identified various solid waste management units (SWMUs) where contaminants may have been released to the environment. The principal objectives of this investigation were to (1) confirm the presence or absence of contaminants at the sites evaluated, (2) determine which sites would require additional investigation to further define the nature and extent of contamination, if present, and (3) evaluate any actual and/or potential risk to public health and the environment.

Site investigations were prioritized by the U.S. Environmental Protection Agency based on the assumed potential for release and damage to the environment. Those sites having a similar potential were grouped together as appendices in the Kirtland AFB RCRA Part B Permit. Originally, three appendices (Appendix I, II, and III) were established, and each was scheduled as a separate investigation stage. Appendix I sites were previously investigated during the Stage 2A investigation (USAF, 1993a), and Appendix II sites during the Stage 2B RFI. This RFI Report presents the investigation results for sites contained in Appendix III.

The Appendix III Wasteline RFI sites include: 53 oil/water separator, sediment trap, and holding tank inflow and outflow lines; 41 septic tanks, leach fields, and lines; ten drain lines; eight sanitary sewer systems; five storm sewer systems; three sewage ejector unit lines; and one catch basin line. A sump observed during the field investigation, but not listed among the Appendix III sites, was also investigated because of the likelihood of a release.

Fieldwork for the Appendix III wasteline RFI was conducted from December 20, 1994, to July 6, 1995. RFI activities included surface and subsurface soil sample collection (with a Geoprobe), and laboratory analysis. Soil samples were analyzed for numerous parameters including volatile organics, semivolatile organics, metals, and petroleum hydrocarbons.

Of the 122 sites investigated, 111 sites had no evidence of a contaminant release; No Further Action proposals are recommended for these sites. The remaining 11 sites had evidence of contaminant release or had anomalous detections of one or more constituents of concern and will require additional data collection. Neither Corrective Measure Studies nor Corrective Measure Actions are currently recommended for any of these 11 sites. Table ES-1 presents the sites requiring additional data collection.

Table ES-1. Sites Requiring Additional Data Collection

SWMU	Description	Text Section	Page No.
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10-7	Oil/water separator lines between Buildings 481 and 482 (ST-219)[b]	5.16	5-96
8-13	Oil/water separator lines, between Buildings 1001 and 1002 (ST-221)[b]	5.17	5-103
8-28	Oil/water separator lines, Building 20338 (ST-250)	5.38	5-204
10-7	Oil/water separator lines, Building 20422 (ST-260)[a,b]	5.47	5-243
10-7	Oil/water separator lines, Building 30146 (ST-265)[a,b]	5.52	5-271
10-2	West Storm Sewer (ST-285)	7.1	7-3
10-2	East Storm Sewer (ST-286)	7.2	7-12
10-2	Central Storm Sewer (ST-325)	7.3	7-19
10-2	Storm drain, Building 1009 (ST-331)	7.4	7-25
10-21	Septic tank, leach field, and lines, Building 707 (ST-295)	8.10	8-70
10-21	Septic tank, leach field, and lines, Building 37501 and Bunker 37404 (ST-311)	8.26	8-169
10-7	Sewage ejector unit lines, Building 1043 (ST-229)	10.3	10-10

[a] Soil samples for line characterization collected only during Stage 2B investigation.
[b] Further investigation scheduled to be performed during the Phase II RFI for Appendix II SWMUs.

1.0 Introduction

Halliburton NUS Corporation (Halliburton NUS) has prepared this Resource Conservation and Recovery Act (RCRA) Facility Investigation (RFI) Report for Kirtland Air Force Base (AFB) as part of the United States Air Force (USAF) Installation Restoration Program (IRP) under Contract Number F33615-90 D 4011, Delivery Order 0022. This RFI Report addresses 12 solid waste management units (SWMUs) in Appendix III of Module IV to the RCRA Part B Permit for Kirtland AFB and the lines serving 11 SWMUs identified in Appendix II of the RCRA Part B Permit. The 12 Appendix III SWMUs include 56 wasteline sites and 14 non-wasteline sites; the 11 Appendix II SWMUs include 66 sites which have inflow and outflow lines, for a total of 136 sites (122 wasteline sites). This report summarizes the RFI conducted at the 122 wasteline sites during 1994 and 1995. This RFI Report was prepared to meet the requirements of the USAF Statement of Work dated March 7, 1994. The 14 non-wasteline sites are presented in a separate RFI report.

The purpose of this RFI was to obtain data to determine if a release of hazardous waste or hazardous waste constituents occurred at the 122 wasteline sites. The data will be used to identify the nature of any releases or to justify No Further Action (NFA).

The Kirtland AFB RCRA Part B Permit originally required submittal of three separate RCRA RFI Work Plans. Separate work plans were developed for Appendix I and II sites as identified in the permit. A third set of two work plans addresses the SWMUs contained in Appendix III. After petitioning by Kirtland AFB, the U.S. Environmental Protection Agency (EPA) approved the development of a fourth set of sites (Appendix IV), associated with former radiological activities at the base, that were realigned from Appendix I and Appendix II.

An additional appendix, Appendix V, has been included in the Kirtland AFB RCRA Part B Permit as a result of the discovery of nine previously unknown sites where potential releases to the environment may have occurred. These sites include six SWMUs, one of which consists of three distinct areas of concern (AOCs). The EPA Region 6 did not require a separate RFI Work Plan for these new sites. Rather, the investigations were conducted in accordance with the plans approved by the EPA on April 7, 1994, for the investigation of the Appendix III SWMUs.

1.1 USAF Installation Restoration Program

In 1995, Kirtland AFB, Federal and State regulators, and local citizen groups completed relative risk evaluations (RREs) at all IRP sites; a modification to the RCRA Part B Permit based on RREs is pending at the EPA. Sites evaluated as *high*, *medium*, or *low* risk will be realigned into Appendix I, II, or III, respectively. Appendix IV will remain unchanged and is reserved for sites having potential radiological or mixed waste contamination.

The USAF IRP is intended to identify, confirm/quantify, and remedy problems caused by past management of hazardous waste at USAF facilities. It is the basis for assessment and response actions at USAF installations. The IRP guidance was initially published in January 1982 under the provisions of the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) and was developed as a four-phased program:

- Phase I—Installation Assessment.
- Phase II—Confirmation/Quantification.
- Phase III—Technology Base Development.
- Phase IV—Remedial Action Plan/Operations.

Following passage of the Superfund Amendments and Reauthorization Act in October 1986, the USAF altered the IRP by combining Phases II and IV into one investigative/remedial stage to parallel the EPA CERCLA Remedial Investigation/Feasibility Study (RI/FS) process. The Appendix III RFI was performed under the guidance of the *Handbook for the Installation Restoration Program Remedial Investigations and Feasibility Studies (RI/FS)),* September 1993 (AFCEE, 1993). Although CERCLA guidelines are generally the basis for activities conducted under the IRP, this project was performed under the authority of RCRA in accordance with the Kirtland AFB RCRA Part B Permit. The field, analytical, and reporting procedures were performed in accordance with the 1993 IRP Handbook and in compliance with EPA and New Mexico Environment Department (NMED) requirements for RFIs as contained in the approved Appendix III Work Plan.

1.2 Installation Description

1.2.1 Base Location

Kirtland AFB is located in central New Mexico, southeast of and adjacent to the City of Albuquerque and next to the Albuquerque International Airport (Figure 1-1). The base is in Bernalillo County at an approximate latitude of 36° 46′ 00″ N and longitude of 108° 21′ 15″ W. The approximate area of the base is 52,287± acres. A general site plan for the base is presented in Figure 1-2.

1.2.2 Base History

Prior to 1928, the area where Kirtland AFB is now situated was rangeland. Construction of Albuquerque's first municipal airport, Oxnard Field, occurred between 1928 and 1930. The airfield was expanded in the mid-1930s to provide U.S. Army and U.S. Navy pilots with a transient refueling and maintenance stop. In the late 1930s to early 1940s, Oxnard Field was used as a transient stop for aircrews ferrying bomber aircraft to England. In 1939, the City of Albuquerque began planning a new municipal airport and the U.S. Army leased 2,000 acres of land adjacent to Oxnard Field.

The Albuquerque Army Air Base (home of the 19th Bombardment Group) was constructed in 1941 for B-17 and B-18 bomber combat crew training. In late 1941, the Bombardier School/Air Force Advanced Flying School opened at Albuquerque Army Air Base; training was expanded to include B-24s and AT-11 aircraft. In February 1942, Albuquerque Army Air Field was renamed Kirtland Field. Later that year, the Army Air Forces acquired Oxnard Field (approximately 11,000 acres east of Kirtland Field). Construction began on Albuquerque Air Depot Training Station, a training depot for aircraft mechanics (which later became Sandia Base).

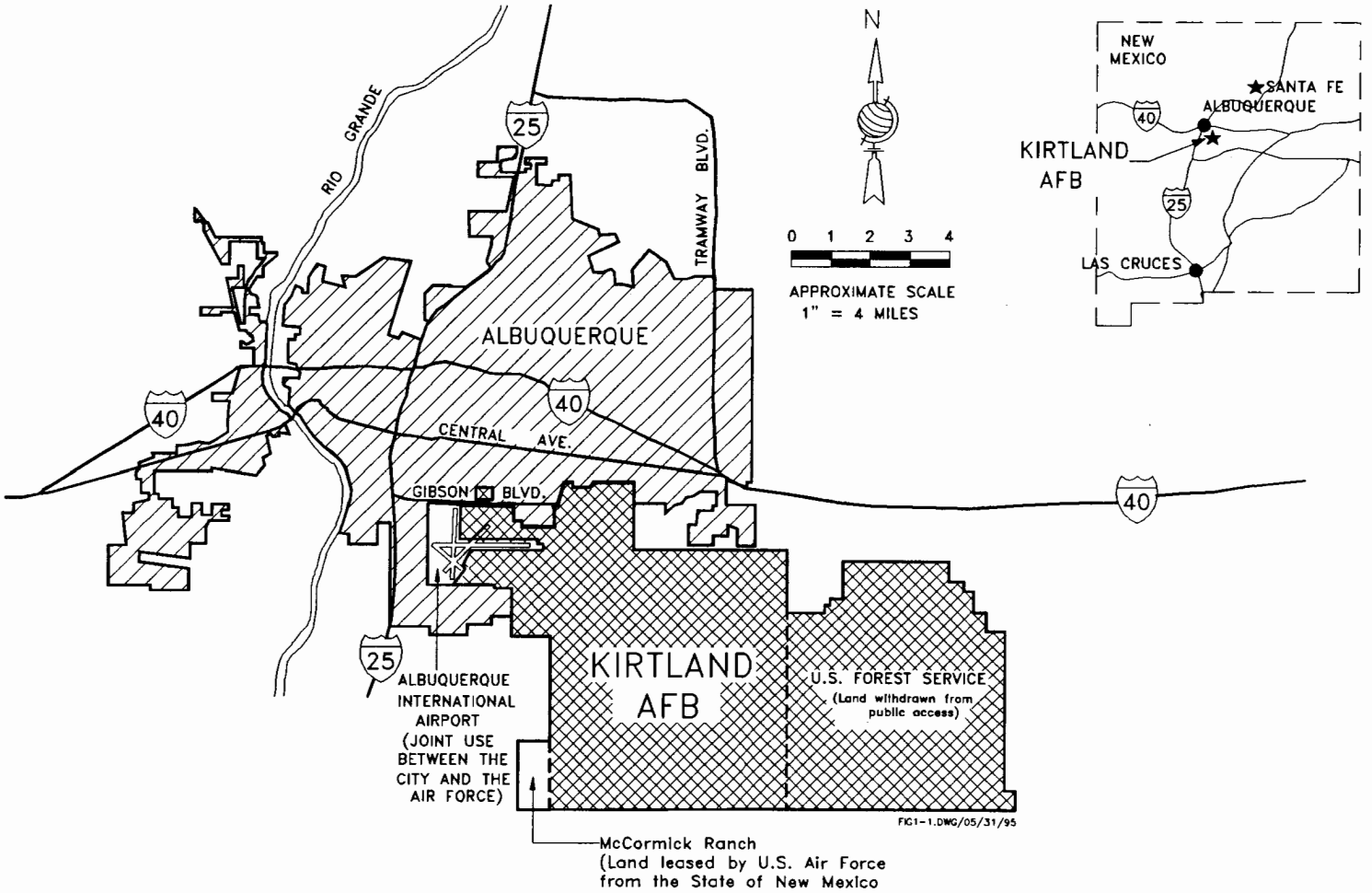

Figure 1-1. Location of Kirtland AFB, Albuquerque, New Mexico

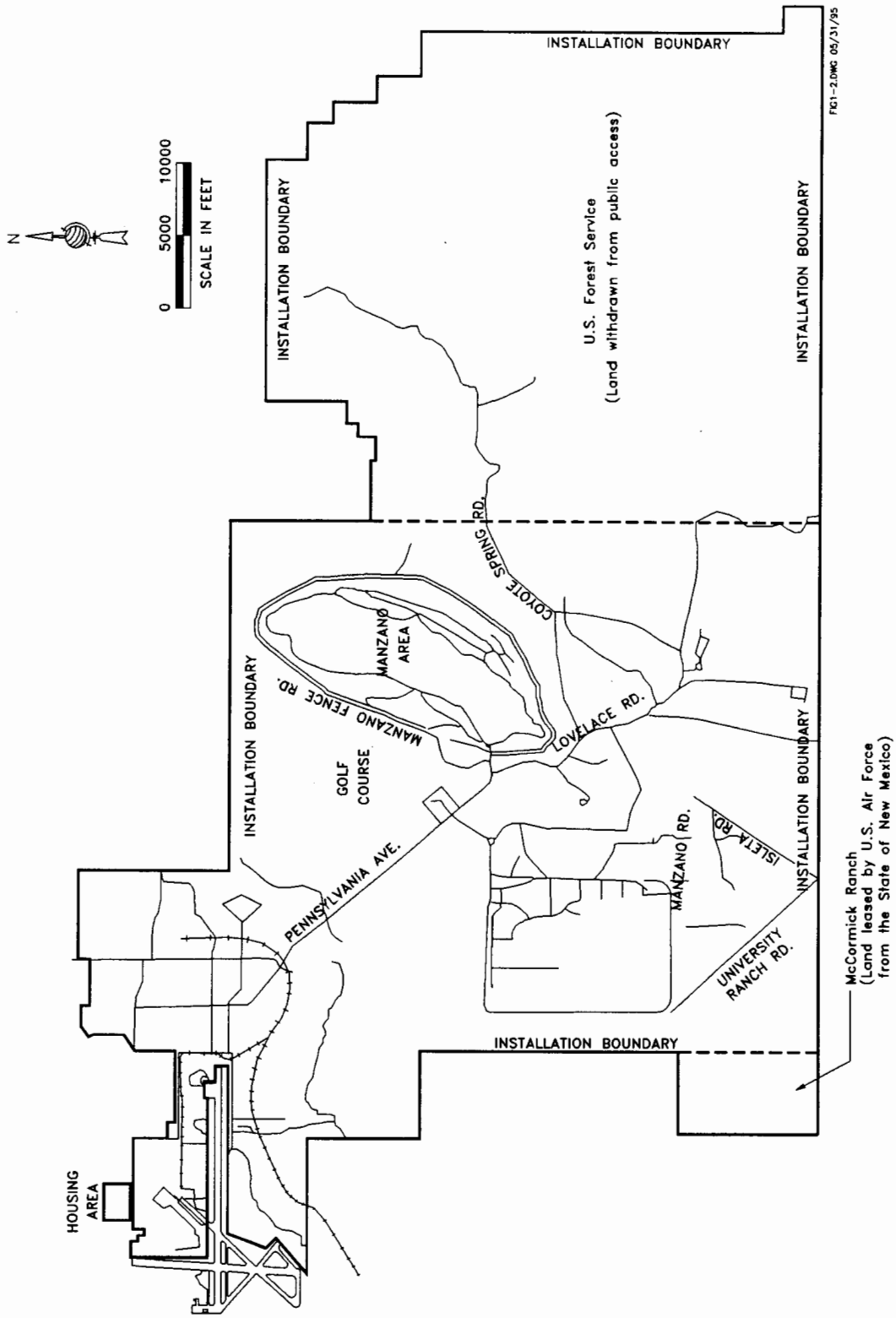

Figure 1-2. General Site Plan, Kirtland AFB, Albuquerque, New Mexico

From 1944 to 1945, Kirtland Field was used as an Army Air Force Medical Convalescent Center for returning veterans, and a dismantling and storage facility for war-weary and surplus planes. In 1946, the base became involved in activities supporting special weapons development. In 1947, Kirtland Field was redesignated Kirtland AFB. During 1947, the main mission of the base involved a continuation of World War II weapons development, ballistics, equipment handling, aircraft modification, and development tests for existing and proposed nuclear weapons (USAF, 1993).

In 1945, portions of Los Alamos Laboratory moved to Albuquerque Air Depot Training Station to manage development of special weapons assembly, and the station was redesignated as the Armed Forces Special Weapons Project (which later became the Air Force Special Weapons Center, then the Air Force Weapons Laboratory). The Sandia Branch of the Los Alamos Scientific Laboratory later became Sandia National Laboratories (SNL), the largest tenant at Kirtland AFB. SNL is involved in researching and developing energy source systems, as well as developing and testing special weapons.

Initial construction of a weapons storage area began in 1947. This storage area is within a small foothill range of the Manzano Mountains, known locally as Four Hills, near the southwestern boundary of what was then Sandia Base. The storage area, initially known as Site Able, later became Manzano Base and was later redesignated the Manzano Weapons Storage Area (MWSA).

In the 1960s, both Kirtland AFB and Sandia Base were primarily known as nuclear testing and development facilities. In 1963, the Air Force Weapons Laboratory (AFWL) was established at Kirtland AFB to undertake weapons research and to develop simulation techniques. The AFWL was one of the major tenants at Kirtland AFB. During this period, AFWL constructed facilities to simulate nuclear blast effects, including transient radiation, x-rays, and electromagnetic pulses (USAF, 1981). The AFWL became part of Air Force Phillips Laboratory in December 1990.

In 1966, the airfield, taxiways, and attendant properties were sold to the City of Albuquerque to become the Albuquerque International Airport, and Kirtland AFB initiated a lease arrangement with the City to conduct its military flying operations. In July 1971, Manzano and Sandia Bases merged with Kirtland AFB and became the eastern side of Kirtland AFB; the Air Force Special Weapons Center assumed management responsibilities. In the 1970s, Kirtland AFB evolved into essentially a research and development base, hosting other military organizations. The research and development activities were primarily in the areas of nuclear weapons and nuclear blast effects, electronics, lasers, and explosives. During the early 1970s, the Air Force Contract Management Division was in command of the base.

In 1976, the 4900th Air Base Wing (ABW) was created to oversee operational testing of emergency aircraft systems, and the 1550th Aircrew Training and Test Wing (later designated the Combat Crew Training Wing [CCTW]) brought regular flight operations to Kirtland AFB. Beginning in 1977, the Military Airlift Command (MAC) became responsible for host activities and the 1606 ABW was designated the host organization. The host supports the needs of all of the facility's associates (except SNL), including maintenance, transportation, and administration.

In 1982, Kirtland AFB became the hub of USAF space technology when the Air Force Space Technology Center was activated. In 1990, the Air Force Phillips Laboratory was established and became responsible for the missions of the Space Technology Center and Weapons Laboratory.

In October 1991, the 1550 CCTW merged with the 1606 ABW to form the 542d Crew Training Wing (CTW), the host organization at Kirtland AFB. The operational mission was to train all USAF helicopter and HC-130 crews and all pararescue personnel for worldwide operations.

In January 1993, the 542 CTW split from the host wing to once again become a separate flying/training wing under the Air Mobility Command (AMC) (formerly MAC), and the 377 ABW was activated as the new host base wing. Kirtland AFB was reassigned from AMC to Air Force Materiel Command (AFMC), headquartered at Wright-Patterson AFB, Ohio. The 542 CTW continued its role of training aircrews and pararescue specialists for worldwide duty with Air Force Special Operations Command and Air Rescue Service. On April 1, 1994, the 542 CTW became the 58th Special Operations Wing under the Air Education and Training Command. Kirtland AFB continues to be one of the nation's leading research, development, test, and evaluation facilities.

1.2.3 Current Base Activities

As the host organization at Kirtland AFB, the 377 ABW provides support to organizations and aids in war-time mobility requirements for various critical specialties. The wing has 2,522 employees, including 166 officers, 1,375 enlisted personnel, and 981 civilian employees who assist Kirtland's nearly 21,000 employees in more than 150 associate units. The two largest associates are the Phillips Laboratory and SNL (operated for the U.S. Department of Energy (DOE) under separate EPA identification numbers). Other major tenants include the Air Force Operational Test and Evaluation Center, the Defense Nuclear Agency's Field Command, the Air Force Safety Agency, the Air Force Inspection Agency, and the Air Force Security Police Agency. The 377 ABW furnishes the resources, equipment, and facilities necessary to support these complex and varied organizations.

Traditionally, Kirtland AFB has been divided into west and east sides based on the original demarcation line between the original Kirtland AFB and Sandia Army Base. For this report, all references to the western or eastern portions of the base encompass the entire area, including the United States Forest Service (USFS) withdrawn portion.

The Environmental Management Division (EM) of the 377 the Air Base Wing is responsible for waste management activities and environmental restoration efforts at Kirtland AFB. As of 1987, 806 buildings housed industrial shops, laboratories, and administrative activities. Over the years of facility operation, numerous functional changes have occurred for various buildings (e.g., from shop to laboratory to administration). Changes in laboratory research projects have resulted in changes in the waste stream composition and volume. Consequently, waste generation areas and the types of waste generated have changed over time (EPA, 1983; Atchue, 1988; and Gupta and La Russo, 1988). The facility EPA identification number was issued to the Installation Commander, who is considered the owner and operator of the U.S. Department of Defense (DOD) facility. The objectives of the Kirtland AFB environmental restoration program are as follows:

- Provide staff resources necessary to complete the environmental restoration program.
- Protect human health and the environment.
- Comply with applicable statutes and regulations.
- Meet EPA Region 6 and NMED schedules in any agreements and permits.

- Complete RFIs as soon as practicable for SWMUs.
- Identify all potential source areas.
- Establish areas of no suspected contamination.
- Initiate removal actions where necessary to control, eliminate, or reduce the risks to manageable levels.
- Characterize risks associated with releases of hazardous substances, pollutants, contaminants, or hazardous waste.
- Develop, screen, and select Corrective Measures Implementations (CMIs) that reduce risks in a manner consistent with statutory requirements.
- Commence CMIs as soon as practicable.

1.3 Report Format

This report has been prepared to present information about the 122 wasteline sites studied during the Appendix III RFI at Kirtland AFB. The 122 wasteline sites are divided into six categories. A summary of the sites by category is presented in Table 1-1. The individual sites are listed in Table 1-2. For sites that share the same SWMU number, the IRP site designation will also be used to avoid confusion. To correlate the inflow and outflow lines investigated during this RFI with known sites investigated during the Appendix II RFI, this table uses the Kirtland AFB number as the primary means of investigation. The general locations of the wasteline sites, including the Manzano Sanitary Sewer (SWMU 10-1H), are shown in Figure 1-3. The remaining sanitary sewers identified as SWMUs are in Figure 1-4. The report is organized into 10 sections plus appendices which are contained in separate volumes. Because of the large number of SWMUs associated with the wastelines, the Appendix III RFI Work Plan did not follow the format presented in the 1993 IRP Handbook. This Work Plan combined existing information and the proposed investigative plan for each specific site into the following subsections: Inflow and Outflow Lines to Oil/Water Separators (OWS), Sediment Traps, and Holding Tanks; Area Drain Lines; Storm Sewer Systems; Septic Tanks; Leach Fields; Sanitary Sewer Systems; and Miscellaneous Wasteline SWMUs.

The format for this RFI Report was developed in consultation with the USAF using site groupings consistent with the requirements of the Kirtland AFB RCRA Part B Permit and the Appendix III Work Plan.

- ***Section 1.0—Introduction***. This section outlines the current study and scope of this RFI, as well as general installation background information.

Table 1-1. Summary of Wasteline Sites by Category

Category	Number of Sites	RFI Report Section
Oil/Water Separator, Sediment Trap, and Holding Tank Inflow and Outflow Lines	53	5
Drain Lines	10	6
Storm Sewer Systems	5	7
Septic Tanks, Leach Fields, and Lines	41	8
Sanitary Sewer Systems	8	9
Miscellaneous Wastelines	5	10
TOTAL	122	

Table 1-2. Summary of Wastelines

Oil/Water Separators, Sediment Traps, and Holding Tank Inflow and Outflow Lines

SWMU No.	Kirtland AFB No.	Name
8-5	ST-201	Building 255, OWS Lines
10-7	ST-202	Building 333, Sediment Trap Lines
10-7	ST-203	Building 334, OWS Lines
10-7	ST-204	Building 333, OWS Lines
10-7	ST-205	Building 333, Sediment Trap Lines
10-7	ST-206	Building 336, OWS Lines
10-7	ST-207	Building 336, OWS Lines
10-7	ST-208	Building 336, OWS Lines
10-7	ST-210	Building 377, OWS Lines
10-7	ST-211	Building 381, OWS Lines
10-7	ST-212	Building 381, OWS Lines
10-7	ST-215	Building 471, OWS Lines
10-7	ST-216	Building 471, OWS Lines
10-7	ST-217	Building 481, OWS Lines
10-7	ST-218	Building 482, OWS Lines
10-7	ST-219	Buildings 481/482, OWS Lines
8-13	ST-221	Buildings 1001/1002, OWS Lines
10-7	ST-222	Building 1031, OWS Lines
10-7	ST-225	Building 1031, Holding Tank Lines
10-7	ST-226	Building 1037, Holding Tank Line
10-7	ST-227	Building 1037, Holding Tank Lines

Table 1-2. Summary of Wastelines (Continued)

Oil/Water Separators, Sediment Traps, and Holding Tank Inflow and Outflow Lines

SWMU No.	Kirtland AFB No.	Name
10-7	ST-230	Building 1046, OWS Lines
10-7	ST-231	Building 1046, Holding Tank Lines
10-7	ST-234	Building 1051, OWS Lines
10-7	ST-235	Building 1051, OWS Lines
10-7	ST-236	Building 1051, OWS Lines
10-7	ST-238	Building 1058, OWS Lines
10-7	ST-239	Building 1058, OWS Lines
10-7	ST-240	Building 1058, Holding Tank Lines
10-7	ST-241	Building 1061, OWS Lines
8-26	ST-242	Building 1063, OWS Lines
8-26	ST-243	Building 1063, OWS Lines
10-7	ST-244	Building 1064, OWS Lines
10-7	ST-245	Building 1064, Holding Tank Lines
10-7	ST-246	Building 1070, OWS Lines
10-7	ST-247	Building 2637, OWS Line
10-7	ST-248	Building 20205, OWS Lines
8-28	ST-250	Building 20338, OWS Lines
8-29	ST-251	Building 20344, OWS Lines
8-31	ST-252	Building 20348, OWS Lines
8-31	ST-253	Building 20348, OWS Lines
10-7	ST-254	Building 20365, OWS Lines

Table 1-2. Summary of Wastelines (Continued)

Oil/Water Separators, Sediment Traps, and Holding Tank Inflow and Outflow Lines

SWMU No.	Kirtland AFB No.	Name
10-7	ST-255	Building 20375, OWS Lines
10-7	ST-256	Building 20375, OWS Lines
10-7	ST-257	Building 20375, OWS Lines
10-7	ST-258	Building 20375, OWS Lines
10-7	ST-260	Building 20422, OWS Lines
8-47	ST-261	Building 20423, OWS Lines
8-55	ST-262	Building 20698, OWS Lines
10-7	ST-263	Building 23226, OWS Lines
10-7	ST-264	Building 30142, OWS Lines
10-7	ST-72	Building 30146, OWS Lines
10-7	ST-267	Building 57007, OWS Lines

Drain Lines

SWMU No.	Kirtland AFB No.	Name
WP-38	WP-38	Building 20687, Entomology Shop Drain and Outflow Line
8-6	WP-47	Building 1000, Silver Recovery Unit Drains and Line
10-7	ST-213	Building 381, Area Drain Lines
10-2BC	ST-220	Building 1001, Floor Drains and Lines
10-7	ST-224	Building 1031, Area Drain Lines
10-7	ST-228	Building 1040, Area Drain Line
10-2	ST-233	Building 1046, Area Drain Lines
10-7	ST-237	Building 1051, Area Drain Lines

Table 1-2. Summary of Wastelines (Continued)

Drain Lines (continued)

SWMU No.	Kirtland AFB No.	Name
10-7	ST-259	Building 20422, Area Drain Lines
10-2	ST-266	Building 57001, Area Drain Line

Storm Sewer Systems

SWMU No.	Kirtland AFB No.	Name
10-2H	ST-285	West Storm Sewer
10-2I	ST-286	East Storm Sewer
10-2AF	ST-325	Central Storm Sewer
10-2G	ST-331	Building 1009, Storm Drain
10-2D	ST-329	Building 336, Grease Trap and Internal Drains and Lines

Septic Tanks, Leach Fields, and Lines

SWMU No.	Kirtland AFB No.	Name
ST-273	ST-273	Building 618, Septic Tank, Leach Field, and Lines
10-21	ST-287	Building 523, Septic Tank, Leach Field, and Lines
10-21	ST-288	Building 614, Septic Tank, Leach Field, and Lines
10-21	ST-289	Buildings 617/620/675, Septic Tanks, Leach Fields, and Lines
10-21	ST-290	Building 619, Septic Tank, Leach Field, and Lines
10-21	ST-291	Building 618, Septic Tank, Leach Field, and Lines
10-21	ST-292	Building 622, Septic Tank, Leach Field, and Lines
10-21	ST-293	Building 37570, Septic Tank, Leach Field, and Lines

Table 1-2. Summary of Wastelines (Continued)

Septic Tanks, Leach Fields, and Lines (Continued)

SWMU No.	Kirtland AFB No.	Name
10-21	ST-294	Building 633, Septic Tank, Leach Field, and Lines
10-21	ST-295	Building 638, Septic Tank, Leach Field, and Lines
10-21	ST-296	Building 702, Septic Tank, Leach Field, and Lines
10-21	ST-297	Building 707, Septic Tank, Leach Field, and Lines
10-21	ST-298	Buildings 730/734, Septic Tank, Leach Field, and Lines
10-21	ST-299	Building 751, Septic Tank, Leach Field, and Lines
10-21	ST-300	Building 20199, Septic Tank, Leach Field, and Lines
10-21	ST-301	Building 20560, Septic Tank, Leach Field, and Lines
10-21	ST-302	Building 20599, Septic Tank, Leach Field, and Lines
10-21	ST-303	Building 20749, Septic Tank, Leach Field, and Lines
10-21	ST-304	Building 20797, Septic Tank, Leach Field, and Lines
10-21	ST-305	Building 28054, Septic Tank, Leach Field, and Lines
10-21	ST-306	Building 28054, Septic Tank, Leach Field, and Lines
10-21	ST-307	Building 30101, Septic Tank, Leach Field, and Lines
10-21	ST-308	Building 37511, Septic Tank, Leach Field, and Lines
10-21	ST-309	Building 37504, Septic Tank, Leach Field, and Lines
10-21	ST-310	Buildings 37507/37508/37513, Septic Tank, Leach Field, and Lines
10-21	ST-311	Building 37501 and Plant 1, Septic Tank, Leach Field, and Lines
10-21	ST-312	Building 37503 and Plant 2, Septic Tank, Leach Field, and Lines

Table 1-2. Summary of Wastelines (Continued)

Septic Tanks, Leach Fields, and Lines (Continued)

SWMU No.	Kirtland AFB No.	Name
10-21	ST-313	Buildings 37529/37530, Septic Tank, Leach Field, and Lines
10-21	ST-314	Buildings 48056/48057/48059, Septic Tank, Leach Field, and Lines
10-21	ST-315	Building 30102, Abandoned Septic Tank and Lines
10-21	ST-316	Buildings 57003/57012, Septic Tank, Leach Field, and Lines
10-21	ST-317	Building 57011, Septic Tank, Leach Field, and Lines
10-21	ST-318	Building 37200, Septic Tank, Leach Field, and Lines
10-21	ST-319	Building 37541, Septic Tank, Leach Field, and Lines
10-21	ST-320	Building 20149, Septic Tank, Leach Field, and Lines
10-21	ST-322	Buildings 37507/37508/37513, Septic Tank, Leach Field, and Lines
10-21	ST-323	Building 29042, Septic Tank, Leach Field, and Lines
10-21	ST-324	Building 29051, Septic Tank, Leach Field, and Lines
10-21	ST-330	Building 1032, Septic Tank, Leach Field, and Lines
10-21	ST-333	Building 66001, Septic Tank, Leach Field, and Lines
ST-340	ST-340	Buildings 57001/57002, Septic Tank, Leach Field, and Lines

Sanitary Sewer Systems

SWMU No.	Kirtland AFB No.	Name
10-1A	ST-278	Sanitary Sewer A
10-1B	ST-279	Sanitary Sewer B
10-1C	ST-280	Sanitary Sewer C

Table 1-2. Summary of Wastelines (Concluded)

Sanitary Sewer Systems (Continued)

SWMU No.	Kirtland AFB No.	Name
10-1D	ST-281	Sanitary Sewer D
10-1E	ST-282	Sanitary Sewer E
10-1F	ST-283	Sanitary Sewer F
10-1G	ST-284	Sanitary Sewer G
10-1H	ST-327	Manzano Sanitary Sewer

Miscellaneous Wastelines

SWMU No.	Kirtland AFB No.	Name
10-2D	ST-209	Building 336, Catch Basin Lines
10-7	ST-223	Building 1031, Sewage Ejector Unit Lines
10-2	ST-229	Building 1043, Sewage Ejector Unit Lines
10-2	ST-232	Building 1046, Sewage Ejector Unit Lines
—	AOC-20405	Building 20405, Undocumented Sump

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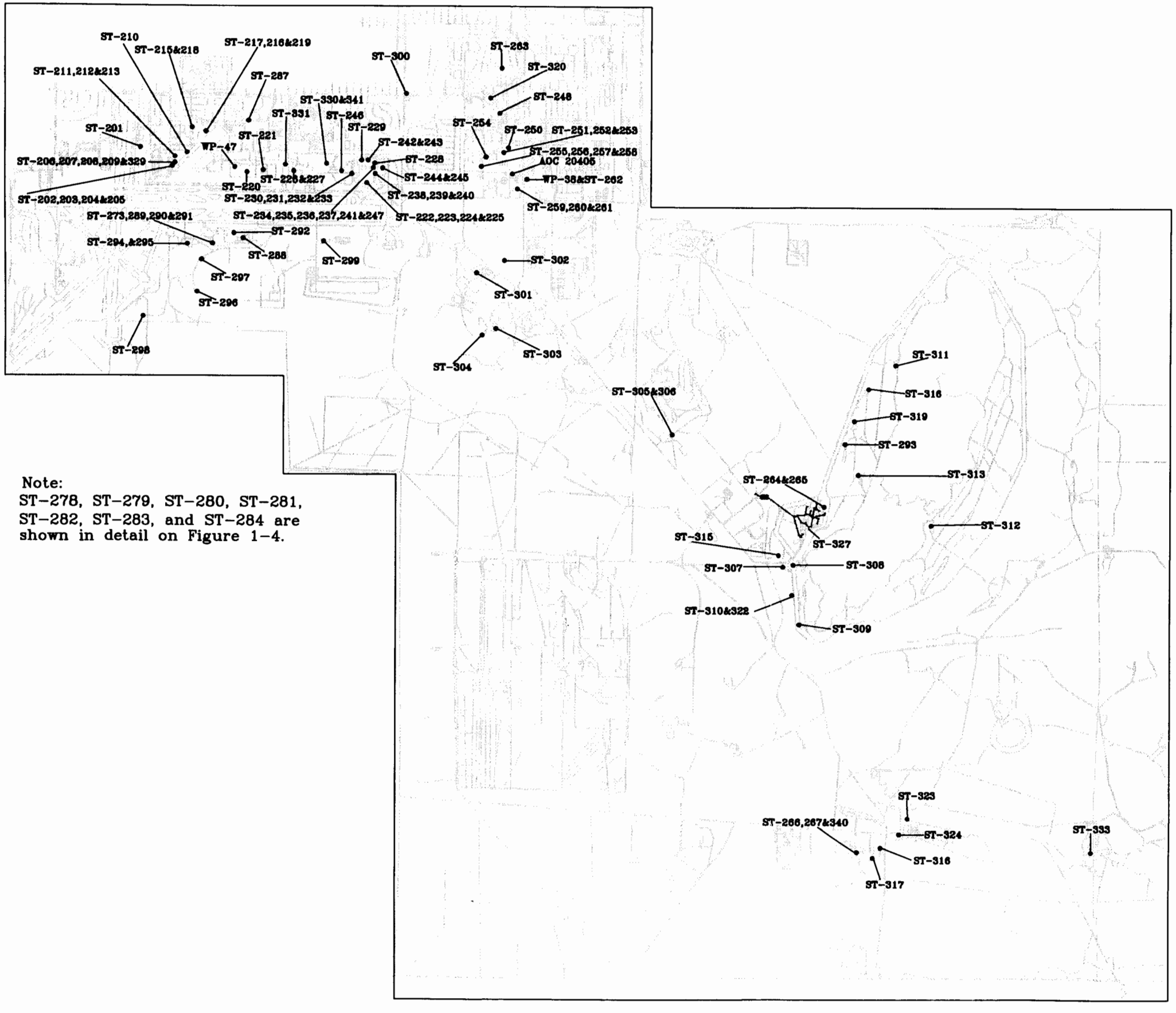


Note:
ST-278, ST-279, ST-280, ST-281, ST-282, ST-283, and ST-284 are shown in detail on Figure 1-4.

LEGEND

• Site Location

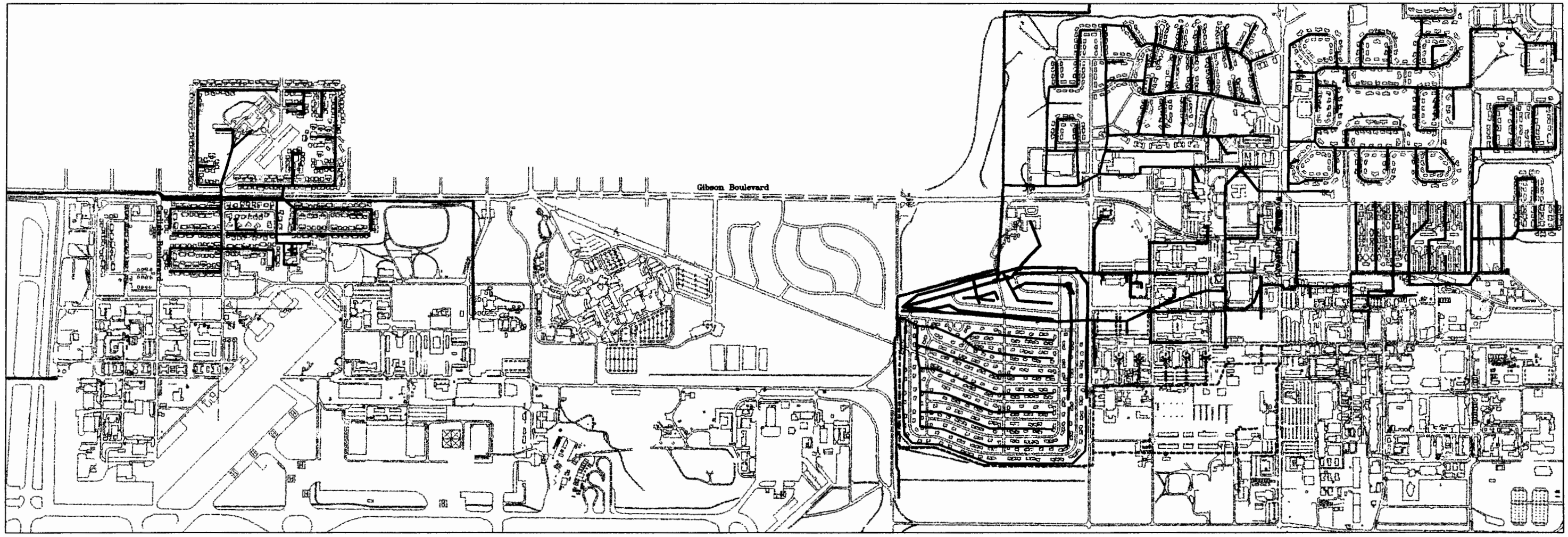
0 2250 4500 ft

FIG1-3.DWG 07/17/95

N

Figure 1-3

Location of Appendix III Wasteline Investigation Sites



LEGEND

- Sanitary Sewer A – See Figure 9–2
- Sanitary Sewer B
- Sanitary Sewer C
- Sanitary Sewer D
- Sanitary Sewer E – See Figure 9–4
- Sanitary Sewer F – See Figure 9–5
- Sanitary Sewer G – See Figure 9–6
- City Sewer Line

1200 600 0 1200

SCALE – FEET

FIG9-2.DWG 07/27/95

N

Figure 1-4

Sanitary Sewer Systems
Kirtland AFB

- ***Section 2.0—Environmental Setting***. This section focuses on environmental data and information common to the sites throughout the base. It includes information on climate, topography, geology, hydrogeology, soil, and surface water.

- ***Section 3.0—Investigation Procedures***. The field and laboratory procedures used during the investigation are described in this section.

- ***Section 4.0—Facility-Wide Results Summary***. This section presents an overview of the contaminants detected, their physical properties, and methodology for determining background metal concentrations.

- ***Sections 5.0 through 10.0—Site Descriptions***. These sections present information specific to each site. Each section contains a study area description, details on the investigation conducted at the site, and site-specific geologic and hydrogeologic characteristics. In addition, each section presents the analytical results for the samples collected and the nature and extent of any contamination as defined by those samples. Finally, each section contains a summary and conclusions subsection that, based on analytical results, either outlines any further data needs and makes recommendations for future action or proposes that a NFA decision document be prepared at each site.

- ***Appendices.*** Appendix information is as follows:

Appendix A	USAF Statement of Work
Appendix B	Biographies of Key Personnel
Appendix C	Soil Borehole Logs
Appendix D	Surveying Data
Appendix E	Chain-of-Custody Forms
Appendix F	Analytical Data
Appendix G	Correspondence with Federal, State, and Local Government Agencies
Appendix H	Data from Previous Investigations
Appendix I	Not used to avoid confusion with citation of previous Appendix I documents
Appendix J	Quality Assurance/Quality Control for Production of Documents
Appendix K	Analytical Data Quality Assurance/Quality Control

1.4 Previous Investigations

Formal environmental investigative design and remediation work has been performed at Kirtland AFB during the past 10 years. This work was performed to meet the corrective action schedule in Module IV of the RCRA Part B Permit issued in 1990. Table 1-3 and the following text describe these studies.

Table 1-3. Environmental Investigations Performed at Kirtland AFB

Study	Organization	Date
Phase I – Records Search	Engineering Science, Inc.	1981
Phase II – Stage 1	SAIC	1985
Phase II – Stage 2	USGS	1988-1993
RCRA PR/VSI	Kearney/Centaur for EPA	1988
RCRA Phase II – Stage 2A RFI at Appendix I SWMUs	USGS	1990–1993
RCRA Phase II – Stage 2B RFI at Appendix II SWMUs	USGS & Halliburton NUS	1993–1994
RCRA Phase II – RFI at Appendix III SWMUs	Halliburton NUS	1993–1994 Draft report to EPA in November 1995
RCRA Phase II – Stage 2D-1 RFI at Appendix IV SWMUs	Halliburton NUS	1993–1994
RCRA Phase II – RFI at Appendix IV SWMUs	Halliburton NUS	In progress Draft report to EPA in February 1996
RCRA Phase II – RFI at Appendix V SWMUs	Halliburton NUS	In progress Draft report to EPA in December 1995

- ***Phase I.*** IRP investigations at Kirtland AFB began with the Phase I—Records Search Report (USAF, 1981). This report consisted of a search of pertinent installation records, a literature search of published and unpublished reports, discussions with key installation personnel (both active and retired), an examination of topographic and geologic maps, an examination of aerial photographs and site visits, and an assessment of the hazard potential of each waste disposal site identified. Phase I identified 25 disposal sites on Kirtland AFB as potential contamination sources; these sites were prioritized for a Phase II evaluation.

- ***Phase II, Stage 1.*** This phase consisted of acquisition and analysis of preliminary site-specific environmental data to identify the environmental status of seven sites and propose remedial actions where applicable (USAF, 1985). The final report was issued in March 1985.

- ***Phase II, Stage 2.*** Ten sites were studied by the United States Geological Survey (USGS), New Mexico District, in Phase II, Stage 2, beginning in 1988. Based upon earlier studies and sampling

done by the NMED, these 10 sites were selected because potential contaminants were stored, discharged, or applied at the sites. The final report was issued in December 1993.

- ***RCRA PR/VSI.*** In April 1988, EPA Region 6 performed a Preliminary Review/Visual Site Inspection (PR/VSI) (Kearney/Centaur, 1988) under RCRA as part of the process for approving the RCRA Part B Permit Application for Kirtland AFB. Appendices I, II, and III of the RCRA Corrective Action Compliance Schedule identified numerous SWMUs requiring further investigation and characterization.

- ***RCRA Phase II, Stage 2A.*** After the PR/VSI, Kirtland AFB began site characterization studies following RCRA guidance, and began addressing the SWMUs generally as distributed in the EPA Appendix I, II, and III site list. Twenty-one of the SWMUs listed in Appendix I and Appendix II were investigated in Stage 2A. The 21 sites, which included nine of the first 10 sites already under investigation, were selected because they had the greatest potential for soil and groundwater contamination from past disposal and landfill activities. The results of the Phase II, Stage 2A investigation were presented in an RFI Report, issued in draft final form to EPA in December 1993.

- ***RCRA Phase II, Stage 2B.*** The Phase II, Stage 2B RFI addressed 73 sites, including a fire training area, a laser laboratory water disposal site, and numerous OWSs, area drains, holding tanks, underground storage tanks (USTs), and sewage ejector units. These sites are identified as SWMUs in Appendix II of the RCRA Corrective Action Compliance Schedule. A work plan prepared for the Stage 2B RFI sites was finalized in January 1992 and approved by the EPA in June 1993. At six of the Stage 2B RFI sites, field work was implemented by the USGS. The remaining 67 Phase II, Stage 2B RFI sites were investigated by Halliburton NUS. Kirtland AFB described the Scope of Work and the investigation was performed in accordance with the USAF 1991 IRP Handbook and 1994 Scope of Work. The Final Stage 2B RFI Report was submitted July 5, 1995, to the EPA after comments in response to a May 1995 Notice of Deficiency were addressed.

- ***RCRA Phase II, Appendix III.*** This current study is described in Section 1.5.

- ***RCRA Phase II, Stage 2D-1.*** The Phase II, Stage 2D-1 investigation addressed sites associated with former radiological activities at the base; it addressed two sites (RW-21 and SWMU 6-30). These sites are identified as SWMUs in Appendix IV of Module IV to the RCRA Part B Permit for Kirtland AFB. The Stage 2D-1 RFI used the applicable portions of the Stage 2B and Appendix III Work Plans. The Draft Final Stage 2D-1 RFI Report was submitted to the EPA in December 1994.

- ***RCRA Phase II, Appendix IV SWMUs.*** The Phase II, Appendix IV RFI addressed sites associated with former radiological activities at the base; it included five underground emergency holding tanks. These sites are identified as SWMUs in Appendix IV of Module IV to the RCRA Part B Permit for Kirtland AFB. The Appendix IV RFI Work Plan was approved by the EPA in a letter dated August 11, 1994. The draft of the RFI report for this stage is due to the EPA in February 1996.

- ***RCRA Phase II, Appendix V SWMUs.*** The Phase II, Appendix V RFI addresses eight newly identified sites where potential releases to the environment may have occurred. These nine sites, identified as the Appendix V sites, include six SWMUs, one of which consists of three distinct AOCs. The EPA Region 6 did not require a separate RFI Work Plan for these sites. Rather, the investigations were conducted in accordance with the plans approved by the EPA on April 7, 1994, for the investigation of the Appendix III SWMUs. The first draft of the Appendix V RFI Report is due to the EPA in December 1995.

1.5 Description of Current Study

The Appendix III RFI addresses the 122 wasteline sites listed in Table 1-2. These sites are identified as SWMUs in Appendices II and III of the RCRA Part B Permit. For the purposes of the investigation, the 122 wastelines were divided into six types: OWS, sediment trap and holding tank lines; area drain lines; storm sewer systems; septic tanks and leach fields; sanitary sewer systems; and miscellaneous wastelines. The OWS, sediment trap, and holding tank lines include 46 inflow and outflow lines, two sediment trap lines, and five holding tank lines. The OWS, sediment trap, and holding tanks are Appendix II sites; they are addressed in the Stage 2B Work Plan and the Stage 2B RFI Report. The Appendix III Work Plan and RFI Report address only the lines associated with the units. These liquids include oils, solvents, and lubricants.

OWSs are utilized throughout the Kirtland AFB to remove liquids with different specific gravities than water. The OWSs receive wastewater from wash racks, shop areas, aircraft and vehicle maintenance facilities, cleaning facilities, and runoff from waste and material storage areas. The subnatant (water) from these separators is discharged to the sanitary sewer or, in the case of SWMUs ST-222, ST-230, ST-244, and ST-267, to a holding tank, sewage ejector unit, or to a surface drainage conveyance. The accumulated oil waste may contain JP-4 fuel, motor oil, hydraulic fluid, cleaning solvents, detergents, and paint thinners. The sediment traps (ST-202 and ST-205) are designed to increase the efficiency of OWSs by trapping and containing solids from runoff before they enter downstream OWSs (ST-203 and ST-204). As the solids settle, liquid is discharged to the separators. The holding tanks receive oily wastewater (supernatant) from OWSs. The oily wastewater accumulates in the holding tanks or is removed with a vacuum system. The holding tanks and OWSs are periodically cleaned and the contents disposed of in accordance with applicable requirements.

Area drains are located throughout Kirtland AFB and service areas where both industrial and nonindustrial activities occur. Area drains are present at wash racks and aircraft maintenance facilities, and at parking lots and driveway areas. Contaminants potentially flowing into the drain SWMUs include petroleum contaminants (JP-4, diesel, and lubricating oils), metals, paints and solvents, and hydraulic fluid.

The SWMU-designated storm sewer systems include three storm sewers, one storm drain, and one internal area drain/grease trap that carry stormwater runoff from the western portion of Kirtland AFB near the flightline to the Tijeras Arroyo, which is an intermittent stream with a sandy bed and is a tributary of the Rio Grande.

Septic tanks are used throughout Kirtland AFB at locations not served by sanitary sewer systems and at areas where both industrial and nonindustrial activities occur. Potential waste from the septic tanks includes nonindustrial septic waste, washdown fluids, and waste associated with research activities, laboratories, and maintenance and repair of equipment.

The eight sanitary sewer systems have been designated as sanitary sewers A through H; the systems serve both industrial and residential areas on Kirtland AFB (Figure 1-4). The sanitary sewers carry sewage to the City of Albuquerque publicly owned treatment works (POTW). The systems receive flow from other SWMUs (OWSs at aircraft and vehicle maintenance facilities, cleaning facilities, etc.) and runoff from waste and material storage areas. Wastewater entering or having entered the sanitary sewers may contain JP-4, motor oil, hydraulic fluid, cleaning solvents, detergents, paint thinners, or pesticides.

The five miscellaneous wasteline sites include one previously undocumented catch basin, three sewage ejector units, and one sump. The sewage ejector sites and the catch basin serve other sites (namely, OWSs); potential waste associated with these sites includes oils, solvents, JP-4, hydraulic fluid, detergents, and paint thinners. The sump received sanitary waste from Building 20504.

1.5.1 Project Objectives

The overall goal of the environmental investigative work at Kirtland AFB is to adequately characterize any environmental contamination to determine:

- If further investigation activities are needed.
- If a No Further Action (NFA) designation is appropriate for any of the sites.

1.5.2 Investigative Process

This investigative process requires data collection and the development or refinement of a conceptual model for each site. A conceptual model consists of the following:

- Identification of any contaminants present and concentrations.
- Source characterization including location, source volume or quantity, and concentrations of hazardous constituents at the source.
- Identification of potential migration pathways.
- Identification of potential receptors.

The degree of refinement necessary for a conceptual model at a site will depend in part on the type and extent of contamination identified. During the RFI, data were collected to gain an understanding of the nature of potential contamination at the sites.

1.5.3 Scoping Documents

The following project scoping documents were used to implement the Appendix III RFI at Kirtland AFB:

- IRP Appendix III RFI Waste Line Investigation Work Plan (USAF, 1994b).
- IRP Appendix III RFI Non-Waste Line Investigation Work Plan (USAF, 1994c).
- IRP Appendix III RFI Data Collection Quality Assurance Project Plan and Field Sampling Plan (USAF, 1994d).
- IRP Appendix III RFI Health and Safety Plan (Halliburton NUS, 1994).
- IRP Conceptual Site Model Informal Technical Information Report for Kirtland AFB (USAF, 1994e).

These documents describe the scope of the RFI and address the requirements in Module IV of the Kirtland AFB RCRA Part B Permit.

1.5.4 Identity of Subcontractors and Their Roles

Specific subcontractors were required to assist with the implementation of the RFI activities. The following subcontractors were retained under subcontract to Halliburton NUS during the investigation:

- ***Surveyor***. Albuquerque Surveying Co., Inc., (Albuquerque, New Mexico) served as the licensed New Mexico land surveyor to determine the vertical and horizontal coordinates of soil borings and sediment sampling locations.
- ***Analytical Laboratory***. Halliburton NUS Laboratory (Pittsburgh, Pennsylvania) performed all laboratory analyses during the Appendix III RFI.
- ***Concrete Corers***. Associated Concrete Cutting, Inc., (Albuquerque, New Mexico) performed concrete coring where samples were collected in paved areas.

2

2.0 Environmental Setting

This section contains general information that is common to all of the sites under investigation. The environmental setting includes the base climatology, topography, surface water hydrology, geology, hydrogeology, biology, and land use.

2.1 Climate

The climate of Kirtland AFB and vicinity is typical of a high-desert plateau, with low precipitation, wide temperature extremes, and, typically, clear, sunny days. It is classified as Arid Continental. The mean annual precipitation ranges from 8.8 in. at Albuquerque International Airport, at the western boundary of the base, to nearly 20 in. at about an 8,000-ft elevation in the Manzano Mountains near the southeastern boundary of the base. The average monthly precipitation in the Albuquerque area ranges from less than 0.5 in. during the winter to more than 1.5 in. during the summer. Typically, almost half of the annual moisture is received in the summer months as brief, but locally heavy, precipitation during thunderstorms. Prolonged periods of continuous precipitation are rare. Average annual snowfall for Albuquerque is 14.7 in. (SNL, 1994). Snow rarely accumulates or remains longer than 24 hrs in the nonmountainous areas. In mountainous areas, snow cover is common from late fall to early spring.

The annual mean maximum temperature at Kirtland AFB is 69°F; the annual mean minimum temperature is 44°F. The highest mean maximum temperature is 91°F in July and the lowest mean minimum temperature is 24°F in January.

The prevailing wind direction from May through October is south to southeast and the mean wind speed is about 8 knots. From November through April, the prevailing wind direction is north to north-northwest and the mean wind speed is about 7 knots.

Potential evapotranspiration (evaporation occurring when no soil-water deficit exists) for the Albuquerque area is 30.9 in. per year. Actual evapotranspiration has been determined to be about 95 percent of precipitation in this climatic regime, and the remaining 5 percent is divided equally between runoff and recharge (USACE *et al.,* 1979).

2.2 Topography

Kirtland AFB is located within the Rio Grande Valley of the Mexican Highland Subdivision of the Basin and Range physiographic province. The Rio Grande Valley is a depressed linear rift feature extending from the headwaters of the Rio Grande in the central Rocky Mountains in southern Colorado, through New Mexico and Texas, to the western edge of the Gulf of Mexico. Kirtland AFB is located on a high, semiarid piedmont alluvial plain and mesa and adjacent foothills, about 5 mi east of the Rio Grande. The alluvial plain is cut by the east-west trending the Tijeras Arroyo, which drains into the Rio Grande. Most of the base is relatively flat, sloping gently west toward the Rio Grande. However, the eastern USFS withdrawn portion of Kirtland AFB extends into the Manzano Mountains. The western slope of the Manzano Mountains is precipitous, rough, and has numerous canyons and arroyos. Elevations range from 5,170 ft above mean sea level (amsl) where the Tijeras Arroyo crosses the western boundary of the base, to 7,988 ft amsl at the Manzano Lookout Tower in the Manzano Mountains. The mean elevation of Kirtland AFB is 5,348 ft (SNL, 1994).

2.3 Surface Water Hydrology

The Albuquerque area is drained by a single perennial river, the Rio Grande, which is about 5 mi west of the base. Drainage from land that parallels the river valley occurs by overland flow to arroyos and then to off-base flood canals and drains (manmade drainage canals or other similar features), or by infiltration into surface soil. Water reaching canals or drains is directed to the Rio Grande. Flooding is not a typical problem in the Kirtland area, although localized flooding may occur for brief periods where drainage flows exceed the capacity of arroyos and drains. This occurs almost exclusively during the summer thunderstorm season (July through September). Primary surface water drainage through Kirtland AFB occurs in the Tijeras Arroyo, Arroyo del Coyote, and an unnamed drainage channel south of Arroyo del Coyote.

The Tijeras Arroyo drains an area of about 150 sq mi bounded on the north by the Sandia Mountains and on the south by the Manzano Mountains. The Arroyo del Coyote drains an area of about 30 sq mi on the west face of the Manzano Mountains. Discharges to the arroyos are generally intermittent; water flowing in the arroyos typically evaporates or infiltrates over short distances. In flat-lying areas, overland sheet flow toward the arroyos can develop during intense rainfall. Because of the arid environment, the typically short duration of storms, and the permeable nature of surface soil, most of this flow tends to infiltrate before reaching the arroyos (Kearney, 1986; Kearney and Harding Lawson, 1987).

The USACE determined that the locations of the 100-year and 500-year flood plains at Kirtland AFB are confined to areas immediately adjacent to the Tijeras Arroyo and Arroyo del Coyote (USACE *et al.*, 1979). None of the Appendix III RFI sites are located in either flood plain.

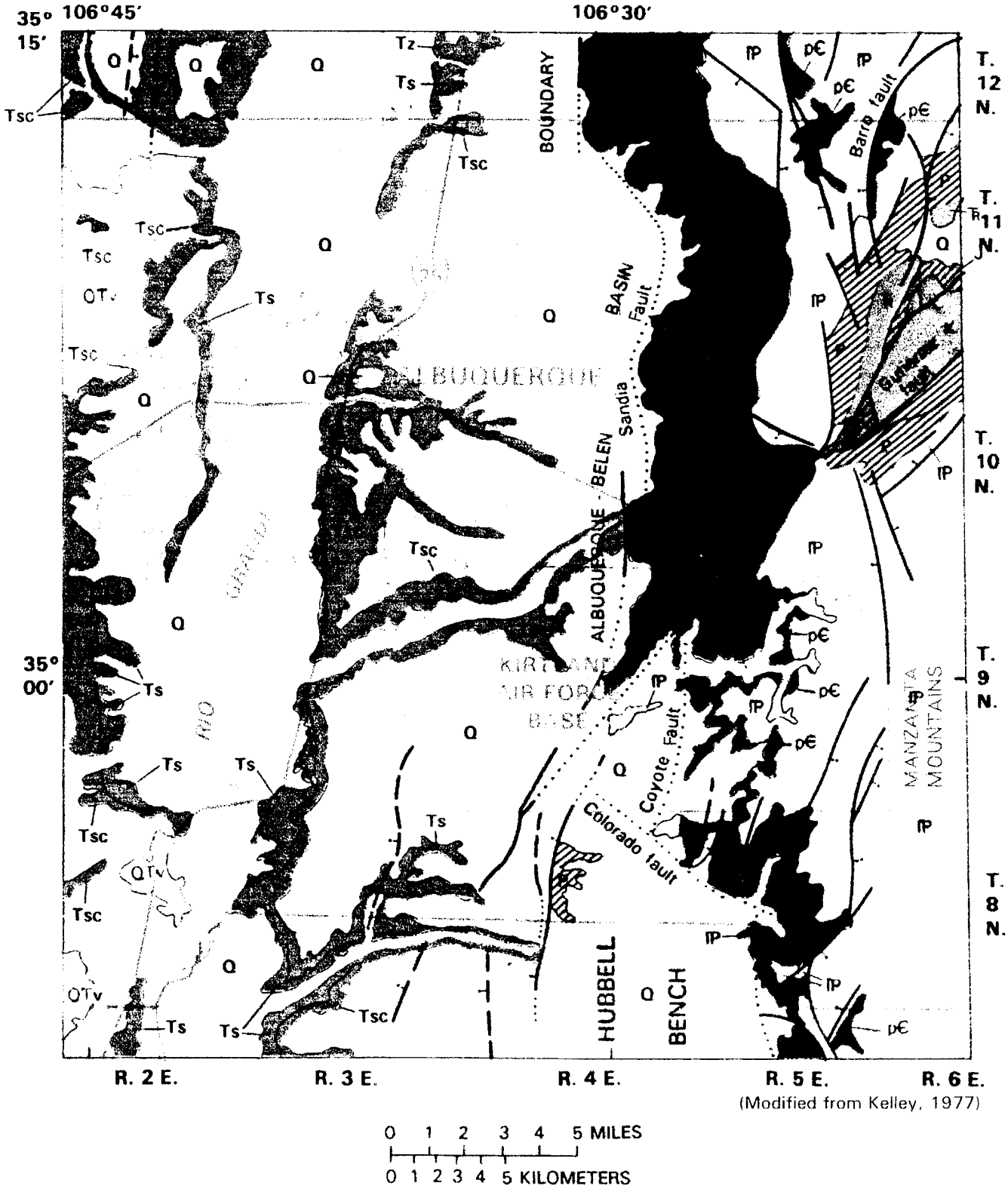
2.4 Geology and Soil

2.4.1 Geologic Setting

The geology of the Kirtland AFB area is complex and varied. The western portion of the base lies within the Albuquerque-Belen Basin. A bedrock geology map of Kirtland AFB and the surrounding area is shown in Figure 2-1. A generalized geologic section of the Albuquerque-Belen Basin and adjacent areas are shown in Figure 2-2. The eastern portion of the base is mountainous with elevations reaching more than 7,900 ft amsl within the Manzano Mountains. These mountains are composed primarily of Precambrian crystalline rock and Paleozoic marine carbonate rock.

The Albuquerque-Belen structural basin contains the through-flowing Rio Grande (the basin is approximately 90 mi x 30 mi). The basin is bounded by the Nacimiento uplift to the north; the Sandia, Manzanita, and Manzano-Los Piños uplifts to the east; the Socorro basin to the south; and the Lucero uplift and Puerco plateau to the west (Figure 2-3).

The Albuquerque-Belen Basin lies within a series of grabens and structural basins called the Rio Grande Rift that has a general north-south alignment and is bordered on the east and west by up-faulted blocks (Figure 2-4). The basin consists of a north, east-tilted half-graben and a south, west-tilted half-graben. The Tijeras fault, which crosses Kirtland AFB, may be the transition zone between the two half-grabens (Lozinski, 1988). Igneous, metamorphic, and sedimentary rock exposed in the Albuquerque area range in age from Precambrian to Holocene. Rock older than Tertiary is exposed in the Sandia and Manzano Mountains to the east and in the Rio Puerco Valley west of the Rio Grande.



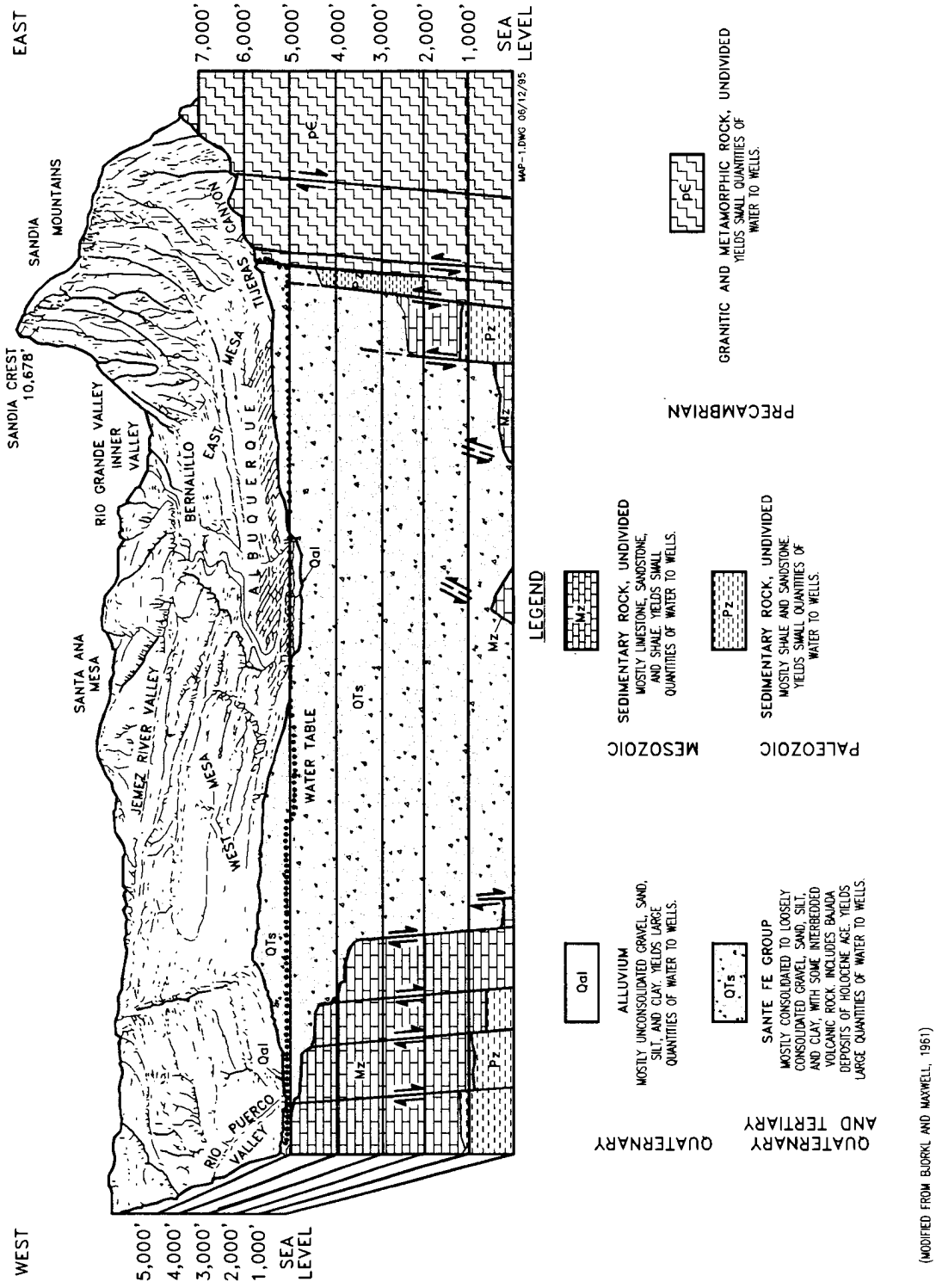
(Modified from Kelley, 1977)

Figure 2-1. Bedrock Geology of Kirtland AFB and Vicinity

LEGEND

Q	QUATERNARY AND HOLOCENE DEPOSITS--Includes alluvium, landslide deposits, eolian deposits, caliche, and gravel pediment
QTv	QUATERNARY AND TERTIARY VOLCANIC ROCK
	TERTIARY SANTA FE GROUP OF KELLEY, 1977--Ts, undivided: sandstone, mudstone, claystone, conglomerate, and fanglomerate. Tsc, Ceja Member of Kelley (1977), sandstone, and conglomerate. Tz, Zia Member of Kelley (1977), sandstone, mudstone, and conglomerate
K	CRETACEOUS, UNDIVIDED--Includes Mesaverde Formation, Mancos Shale, and Dakota Sandstone
	JURASSIC, UNDIVIDED--Includes Morrison Formation, Bluff Sandstone, Summerville and Todilto Formations, and Entrada Sandstone
TR	TRIASSIC, UNDIVIDED--Includes Chinle Formation and Santa Rosa Sandstone
P	PERMIAN ROCK, UNDIVIDED--Includes San Andres Formation, Glorieta Sandstone, and Yeso and Abo Formations
IP	PENNSYLVANIAN ROCK, UNDIVIDED--Includes Madera and Sandia Formations, thin Mississippian rock locally at base
	PRECAMBRIAN ROCK
—	CONTACT
	FAULT--Bar and ball on downthrown side. Dashed where approximately located; dotted where concealed

Figure 2-1. Bedrock Geology of Kirtland AFB and Vicinity (Continued)



(MODIFIED FROM BLORKL AND MAXWELL, 1961)

Figure 2-2. Generalized Geologic Cross-Section

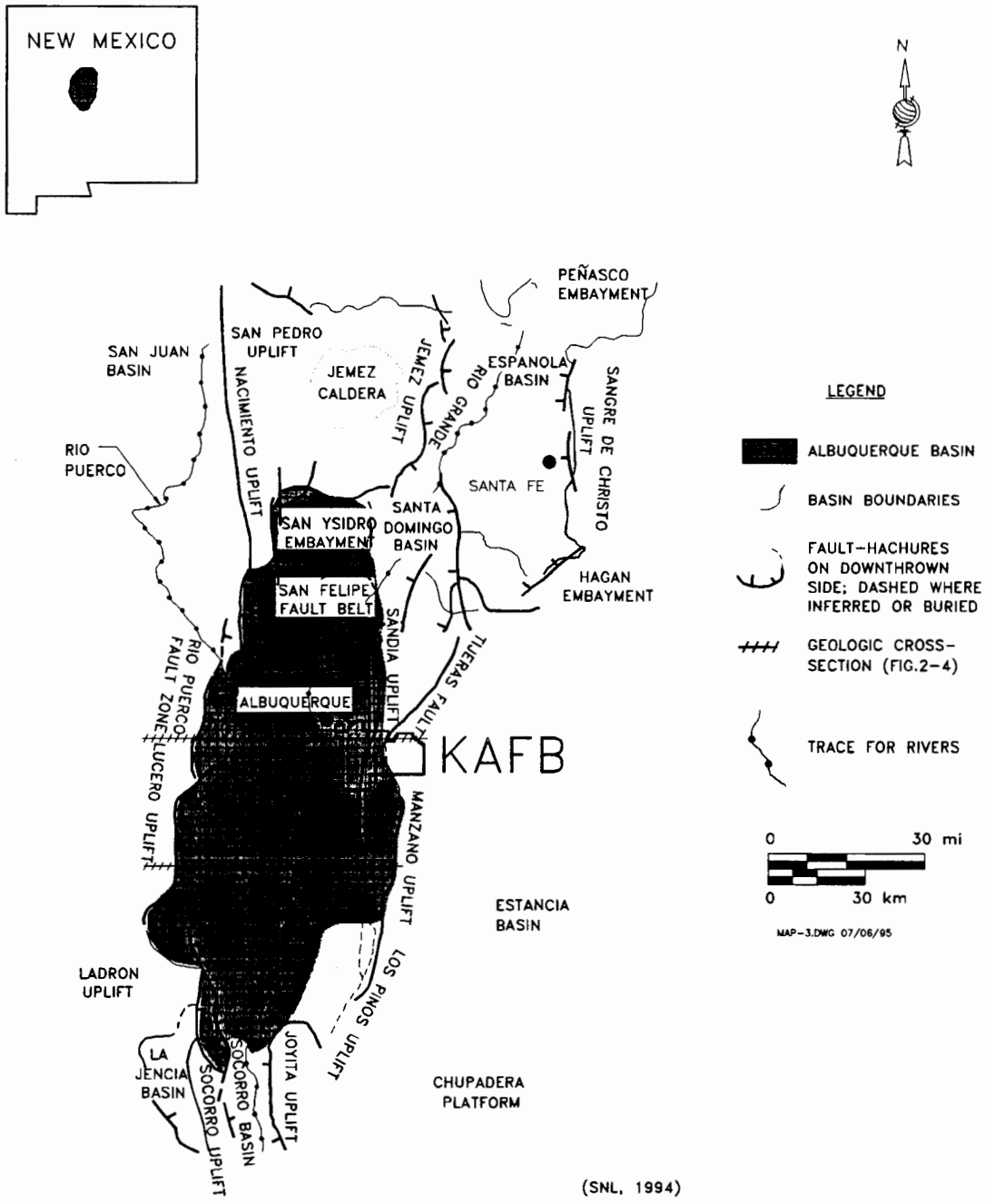
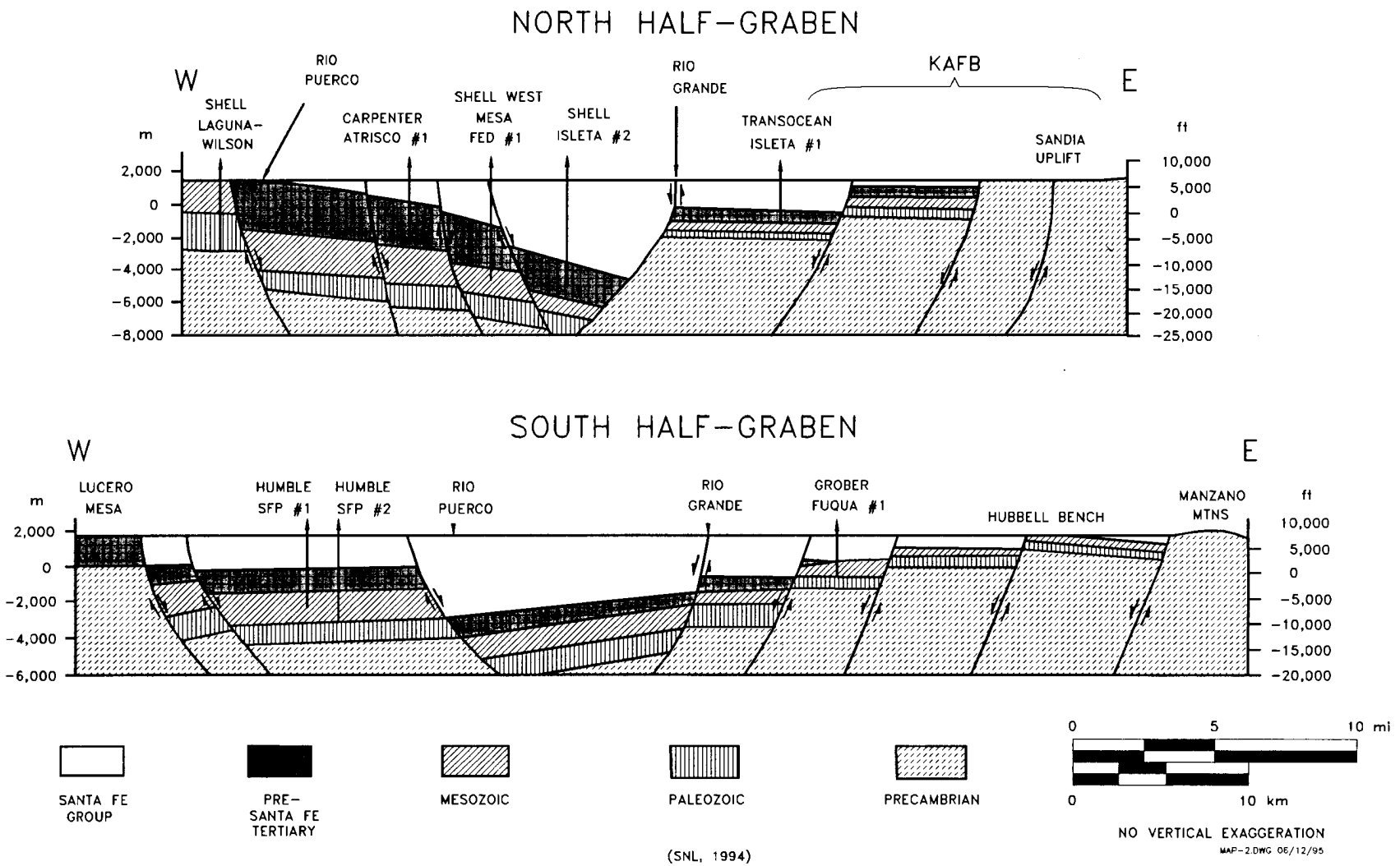


Figure 2-3. Regional Tectonic Setting of the Albuquerque Basin, North Central New Mexico



(SNL, 1994)

Figure 2-4. Diagrammatic Geologic Cross-Sections of the Central Albuquerque Basin, North and South of Tijeras Fault Zone as Located on Figure 2-3

The deposits within the Albuquerque-Belen Basin consist of interbedded gravel, sand, silt, and clay, the bulk of which are referred to as the Santa Fe Group. These sediments were deposited during the Late Tertiary and Quaternary as alluvial fan, playa, and fluvial deposits that filled the subsiding basin. The thickness of most basin-fill deposits is greater than 3,000 ft, although the thickness varies considerably because of faulting in the basin. In most areas, it is not possible to correlate lithologies between wells because of the lenticularity of the units and offsets that occurred during and after deposition (Anderholm, 1987).

The Santa Fe Group is comprised of beds of unconsolidated to loosely consolidated sediments and interbedded volcanic rock. The materials range in size from boulders to clay. Well-sorted stream channel deposits to poorly sorted slopewash deposits are found. The thickness of the Santa Fe Group beneath Kirtland AFB ranges from less than 100 ft to greater than 6,500 ft on the basis of gravity data (Kernodle and Scott, 1986). Eroded from the surrounding mountains, coalescing alluvial fans of materials were deposited on the Santa Fe Group. The alluvial fans extend west from the base of the Sandia and Manzano Mountains to the eastern edge of the Rio Grande floor. The fan sediments, which range from poorly sorted mud flow material to well-sorted stream gravel, consist of channel fill and interchannel deposits. The fan deposits thicken going eastward toward the mountains and range from 0 to 200 ft in thickness (Cardenas and Associates, 1985).

2.4.2 Soil

Information regarding surface soil is derived from the Stage 2B Work Plan (USGS, 1993a). Surface soil, described by Hacker (1977), generally includes the first 5 ft of unconsolidated material below ground surface. The following, a description of surface soil, is not applicable to the deeper part of the vadose zone (alluvium and Santa Fe Group) through which potential contaminants could migrate toward the water table. Most soil on the western part of Kirtland AFB is loamy sand. Loam denotes a mixture of clay (7 to 27 percent), silt (28 to 50 percent), and sand (less than 52 percent). The soil tends to be finer-grained on gentler slopes than on steeper slopes. On the hills near Tijeras Arroyo, soil tends to be more stony or gravelly than on the more level land. Soil in the mountains, where slopes are the steepest, tends to be stony, gravelly, and shallow, with some bedrock outcroppings.

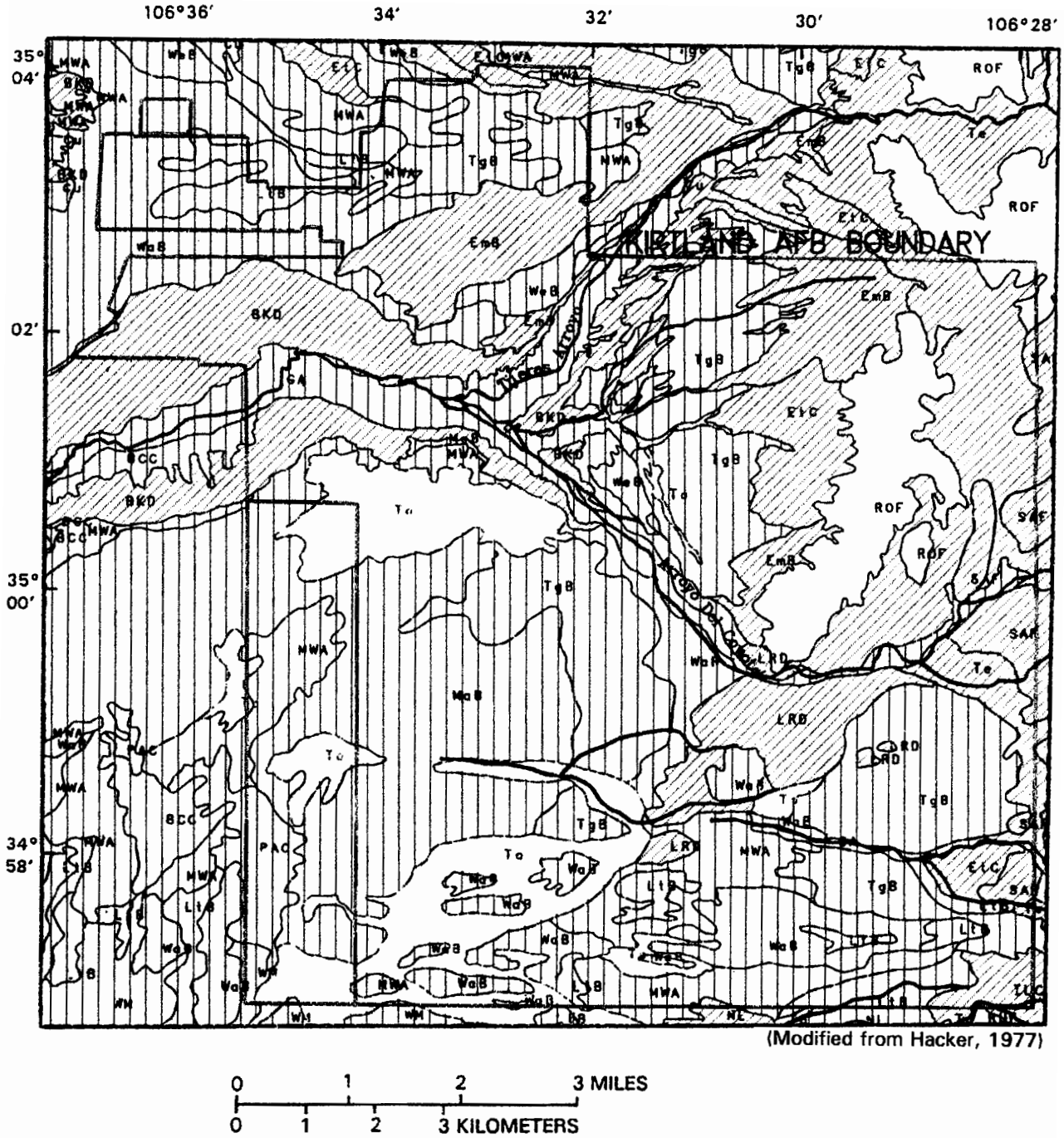
Mapped soil units at Kirtland AFB are shown in Figure 2-5. Although soil is described by series, soil is highly variable in the field, and mapping units generally include areas that have more than one soil series.

2.5 Hydrogeology

2.5.1 Groundwater Occurrence and Movement

Three potential groundwater aquifers are present at Kirtland AFB: fractured bedrock, shallow alluvial deposits, and unconsolidated and semiconsolidated sedimentary deposits of the Santa Fe Group. Wells east of Kirtland AFB typically penetrate fractured or naturally permeable rock for water. Along the Rio Grande flood plain, the shallow alluvial deposits are used as a source of potable water.

The stratigraphy of the basin fill is divided into the Lower, Middle, and Upper Santa Fe Group (SNL, 1994). The majority of the water supply wells for the City of Albuquerque and Kirtland AFB is completed within the Upper Santa Fe Group, and a few extend into the Middle Santa Fe Group. The



LEGEND

- FINE AND SANDY LOAM--Mapping unit To
- LOAMY SAND AND SAND--Mapping units Bcc, Cu, GA, LtB, MaB, MWA, PAC, TgB. WaB, WM, WeB
- GRAVELLY SANDY LOAM AND STONEY SOIL---Mapping units BKD, EmB, EtC, ILC, LRD, NL, SAF, Te
- ROCK OUTCROP--Mapping unit ROF

Figure 2-5. Soil of Kirtland Air Force Base

majority of the RFI study sites overlies this aquifer. The sediments of the Upper Santa Fe Group attain local depths of 1,500 ft (USGS, 1993a).

The Santa Fe aquifer is recharged by groundwater underflow from adjacent areas; by infiltration of precipitation; seepage from streams, drains, canals, and surface reservoirs; and infiltration of applied irrigation water. Groundwater in the valley fill is generally under water table (unconfined) or semi-confined conditions.

The regional potentiometric surface in the Albuquerque-Belen Basin slopes northwest diagonally from the bases of the Sandia and Manzano Mountains on the east toward a groundwater depression, or trough, about 8 mi west of the Rio Grande. The water table beneath the Rio Grande slopes southwest at approximately the same gradient as the river. A localized groundwater depression has formed in the eastern part of Albuquerque north of Kirtland AFB as the result of pumping from city wells. Extensive pumping has produced a localized reversal of the regional groundwater gradients within Kirtland AFB. The depth to groundwater varies widely within the basin. The depth to water is less than 10 ft in many parts of the Rio Grande Valley. In areas east and west of the valley, the depth to groundwater commonly exceeds 300 ft; in some areas of the West Mesa, the depth to groundwater is almost 900 ft (Anderholm, 1987). Figure 2-6 shows the regional potentiometric surface. Figure 2-7 shows the water table elevations below Kirtland AFB.

The fault system that forms the eastern boundary of the Albuquerque-Belen Basin trisects the area occupied by Kirtland AFB (Figure 2-8). The north-south striking Sandia Fault enters the base from the north; almost colinearly the Hubbell Springs Fault extends to the south, and the Tijeras Fault cuts the base diagonally from the northeast. The fault complex divides the local groundwater system into three distinct hydrogeologic regions (Figure 2-9): the region west of the fault complex is identified as Hydrogeologic Region I (HR1); the region straddling the fault complex is identified as Hydrogeologic Region II (HR2); and the region east of the fault complex is identified as Hydrogeologic Region III (HR3). HR1 has been divided into two subareas: Subarea 1, in the northwest portion of the base, and Subarea 2, in the southwest portion of the base. HR2 has been designated Subarea 3 and is in the central portion of the base. HR3, designated Subarea 4, is in the east-southeast portion of the base (SNL, 1994).

The HR1 saturated zone setting is within the Upper Santa Fe Group sediments. Groundwater is generally assumed to be unconfined in the upper portion of the aquifer. Depth to groundwater in this subregion varies from approximately 490 ft below ground surface (bgs) near the southeast edge of the subregion to approximately 350 ft bgs at the west edge (Figure 2-10). The water level in this region ranges from about 4,935 ft amsl on the east boundary of the subregion to 4,880 ft amsl on the west. Over the 5-mi distance that separates these points, the gradient is about 11 ft/mi, or 0.002 ft/ft. This determination of the water table gradient is based on readings from monitor wells installed by SNL that are completed to the local water table. Given the heterogeneity associated with aquifer sediments, flow directions within the aquifer may vary considerably at the local scale.

HR2 straddles the Tijeras/Hubbell Springs/Sandia Fault complex. The saturated zone hydrology is characterized by the juxtaposition of high- and low-permeability materials as a result of vertical offset due to faulting (Thorn *et al.*, 1993). East of the fault zone, depth to groundwater is relatively shallow and static water-level elevation is about 5,710 ft amsl (Figure 2-7). Immediately to the west of the inferred fault trace, depth to water is considerably greater, with water levels recorded at 485 ft bgs, corresponding to elevations of 4,935 ft amsl and 4,920 ft amsl, respectively. Very little is known about groundwater flow in this subregion.

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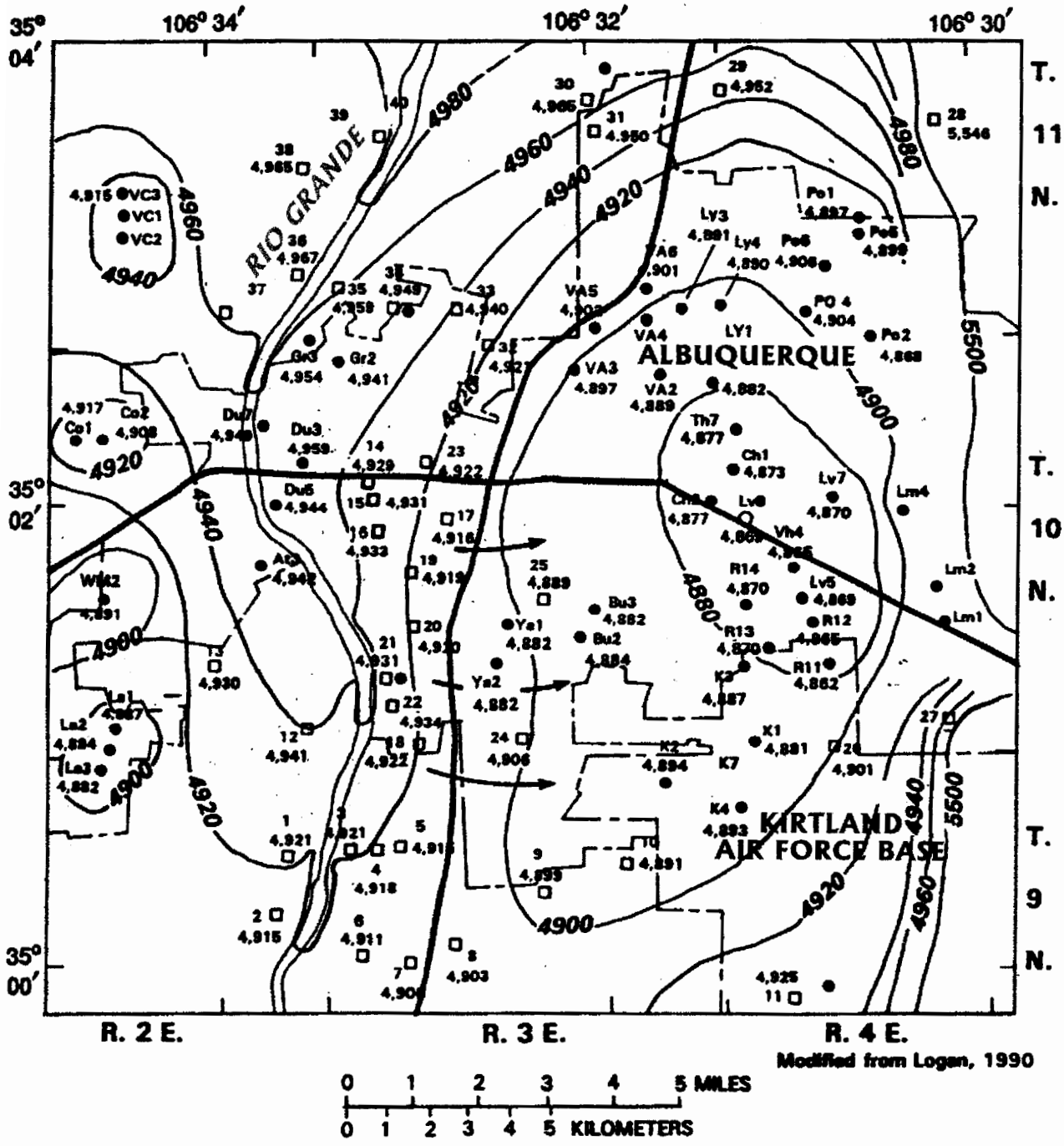


Modified from Logan, 1990

LEGEND

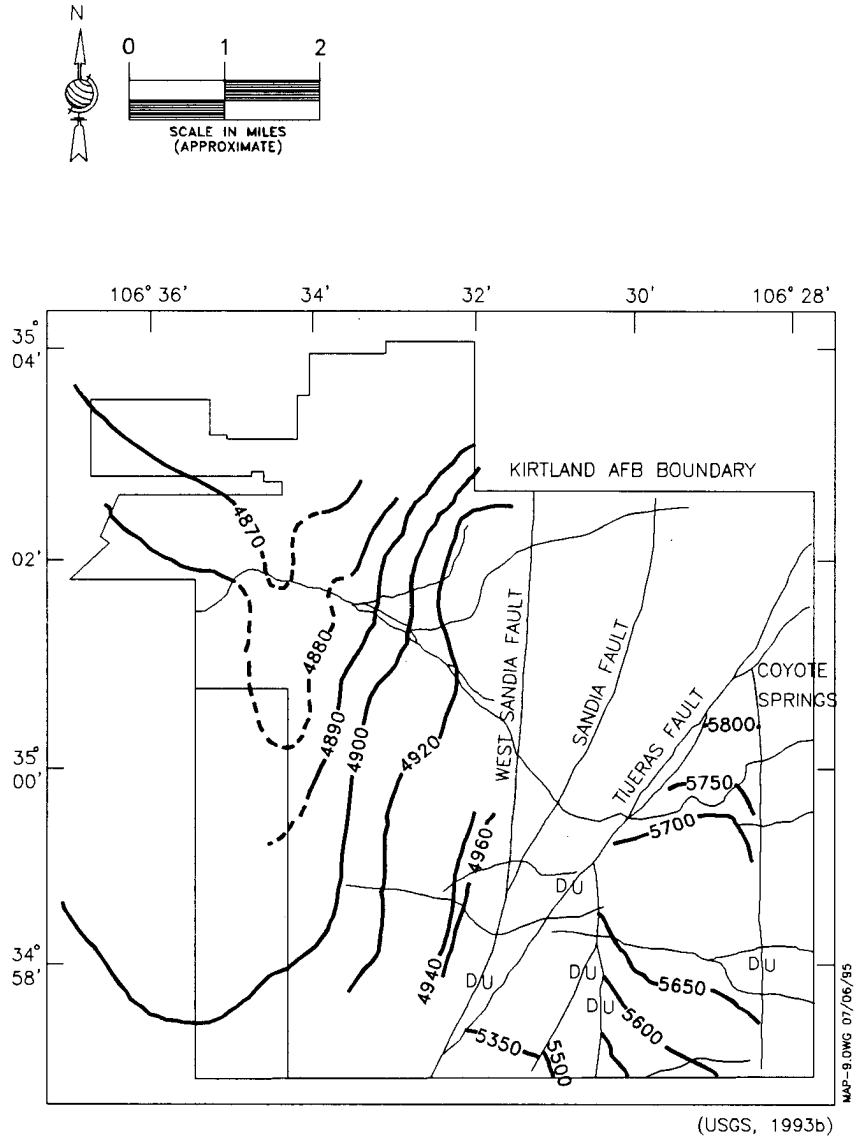
4920 — WATER-TABLE CONTOUR--Shows altitude of water table, winter 1988-89. Dashed where approximately located. Contour interval 20 ft and variable above 4960. Datum is sea level.

K4 ● 4,893 — DEEP WELL AND IDENTIFICATION CODE--4,893 is altitude of water level. Datum is sea level.

7 □ 4,906 — SHALLOW WELL AND IDENTIFICATION CODE--4,906 is altitude of water level.

→ DIRECTION OF GROUNDWATER FLOW

Figure 2-6. Regional Potentiometric Surface Map



(USGS, 1993b)

Figure 2-7. Generalized Water Table Elevations (September 1992), Kirtland AFB

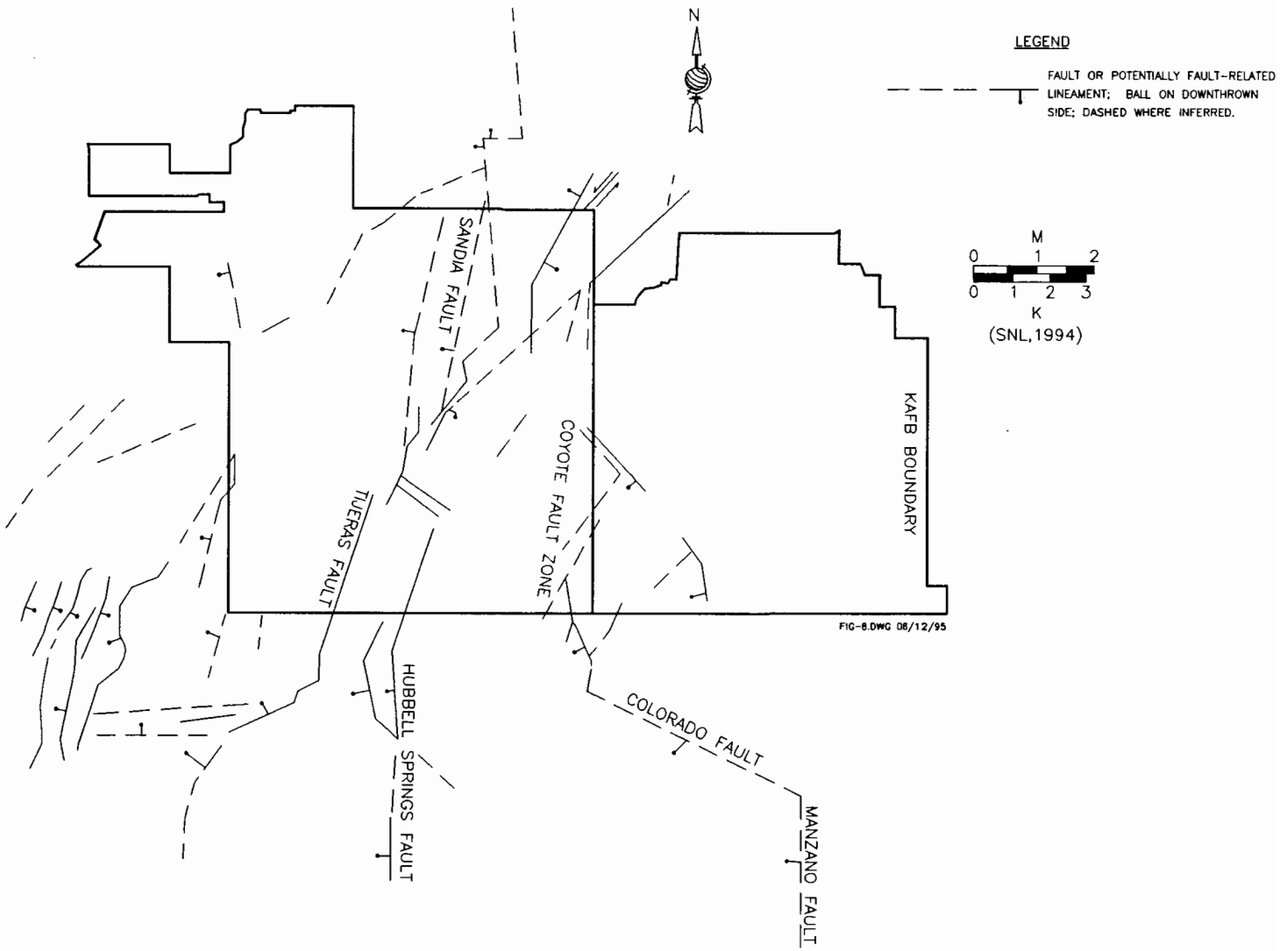


Figure 2-8. Geologic Faults Within Kirtland AFB and Vicinity

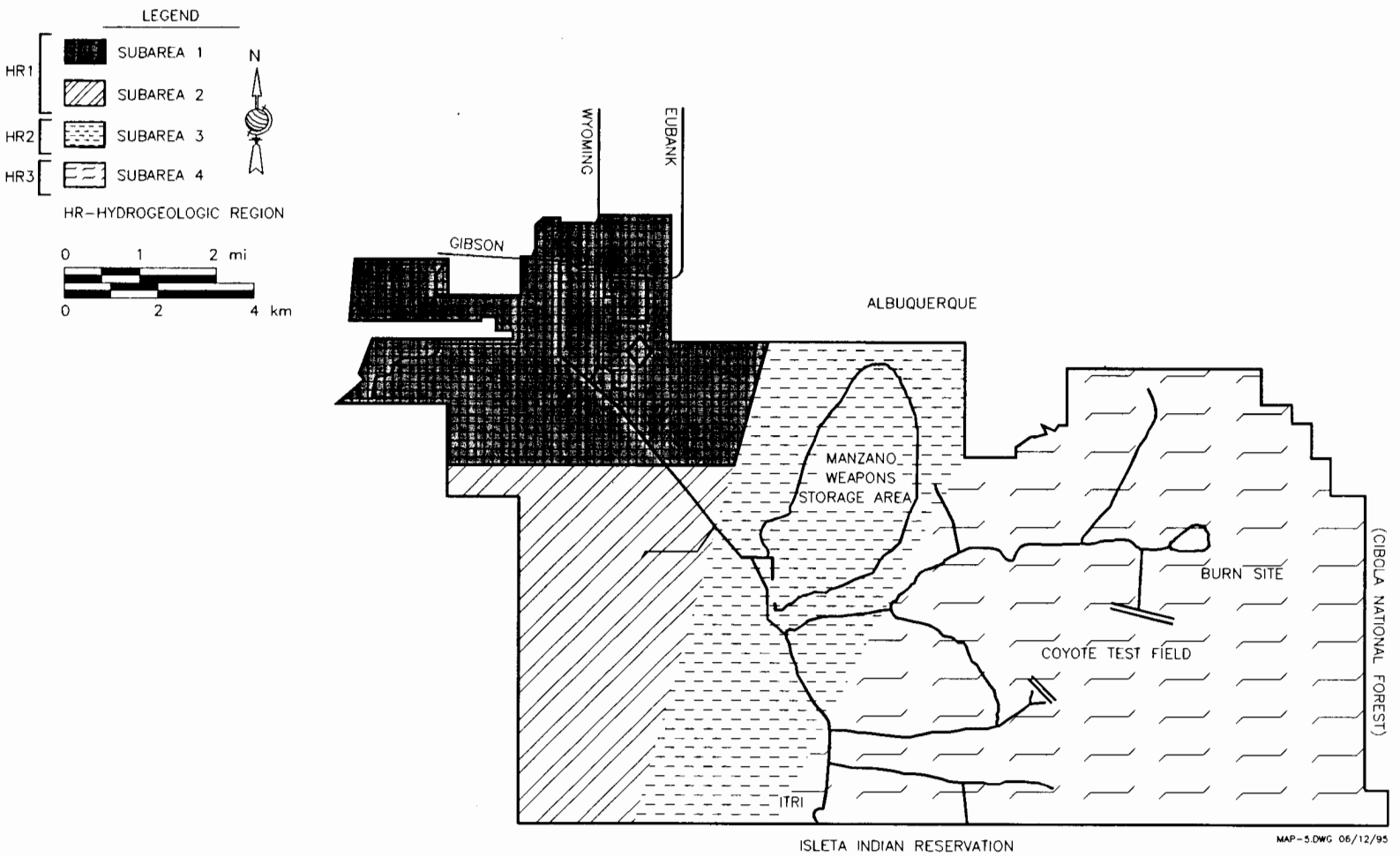


Figure 2-9. Locations of Hydrogeologic Zones at Kirtland AFB

complexity of the environmental setting of the Kirtland AFB area, detailed basewide flow and transport processes in the vadose zone are still poorly understood.

2.6 Potable Water Supply

Groundwater is pumped from wells for public, irrigation, industrial, commercial, domestic, and livestock uses. Wells having large yields usually penetrate at least 200 ft into water-bearing materials. The municipal water system of the City of Albuquerque is supplied from wells ranging in depth from 65 to 1,284 ft. In 1985, the average daily pumpage in Albuquerque was 274 acre-ft. Several schools, hotels, hospitals, public buildings, and government installations in and near Albuquerque are supplied with water from privately and institutionally owned wells. Many industries and commercial institutions obtain their water from private wells. Many wells are used to irrigate small farms and gardens. An inventory of large-capacity wells owned by Kirtland AFB and the City of Albuquerque was taken in the Phase I study. At the base, 98 percent of the water used is groundwater pumped by Kirtland AFB production wells from the Upper Santa Fe Group Aquifer. The remainder of the water used on base is purchased from the City of Albuquerque. Locations of Kirtland AFB production wells and monitoring wells are shown in Figure 2-11.

2.7 Population and Land Use

Kirtland AFB is bounded on the north and west by the City of Albuquerque and its suburbs, to the south by the Isleta Indian Pueblo, and to the east by the Cibola National Forest. Land use in the vicinity of Kirtland AFB varies from urban to open rangeland (Figure 2-12). The area immediately north of the base is predominantly urban. Open spaces and forest land are northeast and east. Land west of Kirtland AFB is a mix of urban, industrial, and agricultural areas. The Isleta Pueblo land to the south and southeast is mostly open space and forest.

Population density in the vicinity of Kirtland AFB is shown in Figure 2-13. In 1990, the population of the Albuquerque metropolitan area was about 480,000. The unincorporated Rio Grande Valley to the south of Albuquerque and west of Kirtland AFB had a population of about 36,000. The population is extremely sparse on the Isleta Pueblo to the south, and to the east in the Cibola National Forest and Manzano Mountains. Most of the Isleta Pueblo population is concentrated about 8 to 12 mi southwest of Kirtland AFB.

Kirtland AFB contains over 52,000 acres of land with more than 800 buildings and 5.6 million sq ft of floor space (USAF, 1981). The 377 ABW employs more than 2,500 individuals who support the nearly 21,000 employees in Kirtland's 150 associate units (USAF, 1994a).

2.8 Biological Resources

2.8.1 Vegetation

The vegetation on the upper slopes of Kirtland AFB can be classified into two basic ecological associations: the Piñon-Juniper Association and the Grassland Association. The vegetation on the lower slopes of the Manzano Mountains is primarily the Piñon-Juniper Association. The Piñon-Juniper

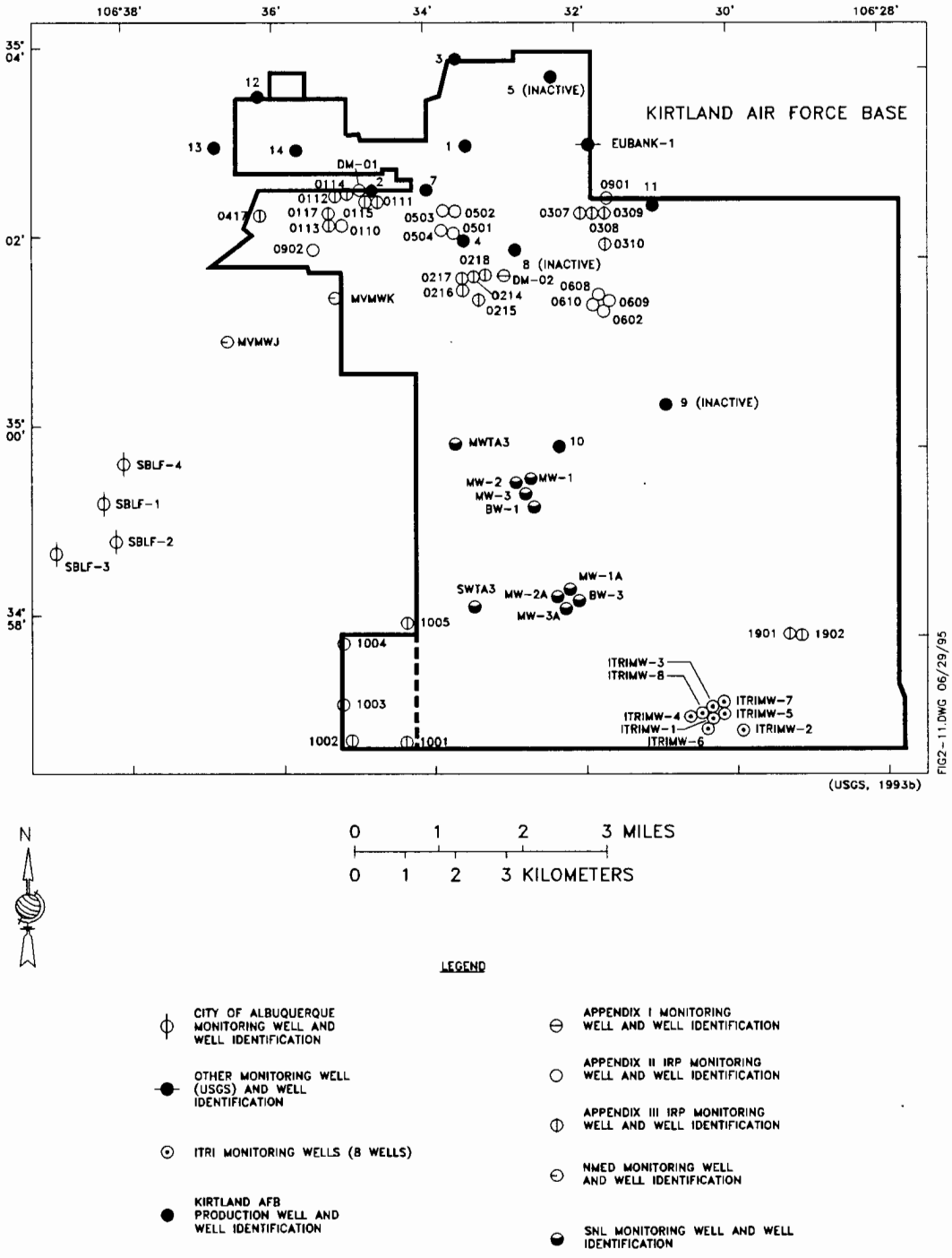


Figure 2-11. Locations of Monitoring Wells and Production Wells at Kirtland AFB

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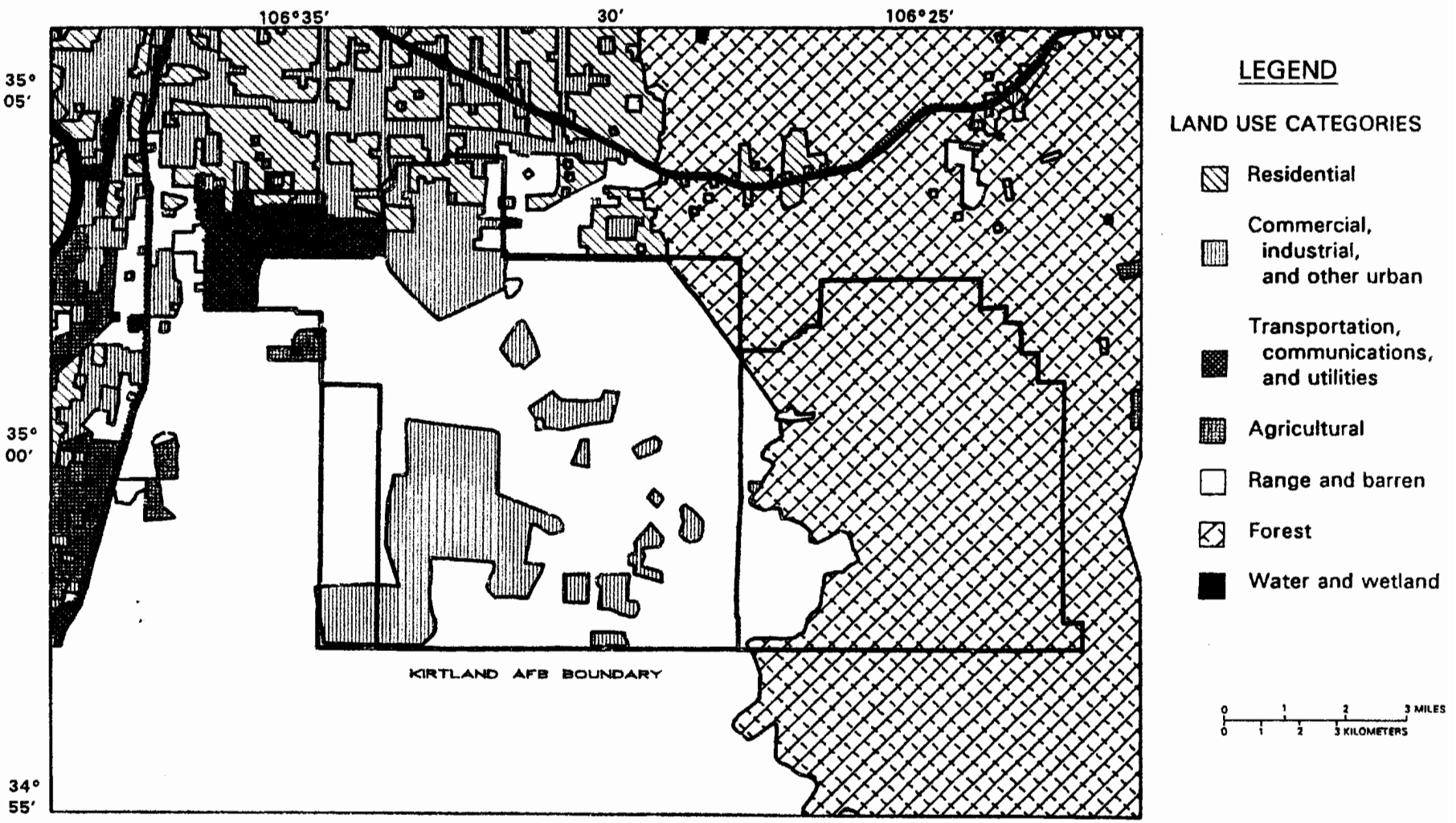


(USGS, 1990)

Figure 2-12. Land Use in the Vicinity of Kirtland AFB

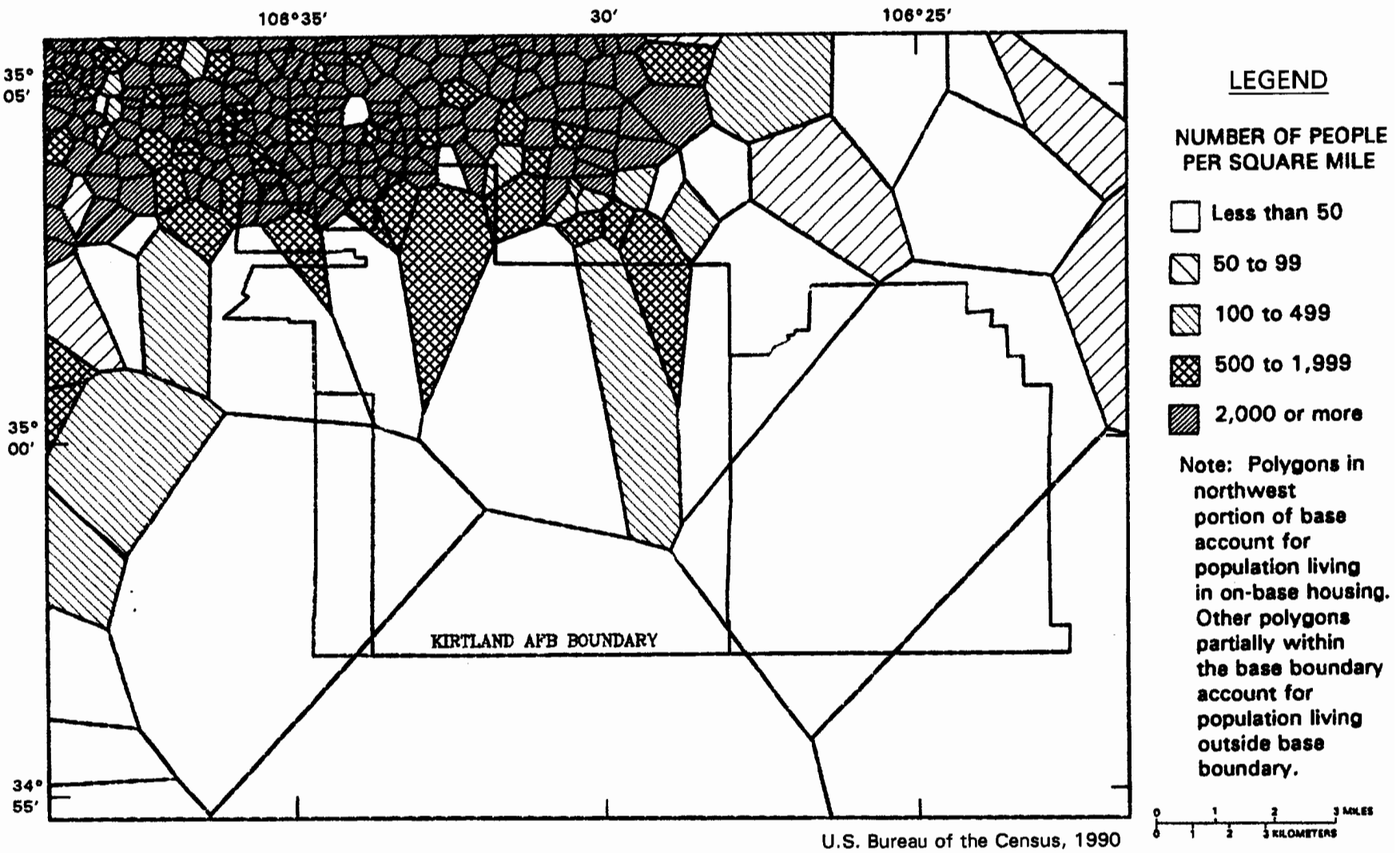


Figure 2-13. Population Density in the Vicinity of Kirtland AFB

co-dominants in this association. The understory in this association is dominated by grasses and shrubs. The Grassland Association has an upper elevation limit of 5,800 ft. Within this association are more than 50 species of grasses; however, only a small number of these are abundant. Dominant species include black grama, sand muhly, threeawn, Indian ricegrass, six-weeks grama, fluff grass, and spike dropseed. Several shrubs are also common in the Grassland Association.

2.8.2 Wildlife

Wildlife on and in the vicinity of Kirtland AFB is associated with xeric habitats, which seasonally support a narrow range of species. In light of the lack of competition from livestock, animal populations that feed on grasses and other range plants are abundant. Evidence supporting this contention is apparent in the sightings of numerous rodent burrows and mule deer, which descend in this zone from higher elevations in winter. Below the Manzano Mountains foothills (part of the base), occasional sightings of coyotes occur.

Birds are the most commonly seen wildlife on Kirtland AFB. In the Grassland Association, horned larks, meadowlarks, thrashers, predatory birds (hawks, owls, vultures), several species of sparrows, scaled quail, and mourning doves are the most-often seen species. Scrub jays, plain titmouse, bushtits, woodpeckers of several species, and warblers occur in the Piñon-Juniper Association as year-round residents.

2.8.3 Threatened and Endangered Species

An endangered and threatened species survey was conducted by the Nature Conservancy (UNM, 1995). The potential habitat was surveyed for four plant species of concern; animal species surveys were conducted for the presence of northern goshawk and gray vireo. The peregrine falcon was initially included in the survey, but was removed as an endangered species by the Federal government. Grama grass cactus, a native New Mexican sensitive species, was found in several areas throughout the base. The final report, dated April 1995, is available from the Kirtland AFB Natural Resources Manager. An endangered and threatened species management action plan is in progress.

The plant species survey included potential habitat within undeveloped portions of land on the main base and the western foothills of the Manzano Mountains. Species considered rare included *Pediocactus papyracanthus*, *Mammillaria wrightii*, *Neolloydia intertexta*, and *Amsonia fugatei*. These species were surveyed on 2,240 acres.

Rare plant data under consideration for this RFI were extracted from the 1995 UNM report. Most of the Appendix III sites were located within the urban/industrial area of Kirtland AFB; the remaining sites were at the Manzano Weapons Storage Area (MWSA) and the Civil Engineering Research Facility (CERF). The 1995 UNM report did not included a survey at the urban/ industrial area or at the quadrats (a 320-acre plot) where the nonurban/industrial Appendix III sites are located.

The animal species surveys were conducted in phases. Methods of study used to identify habitat included the examination of aerial photographs and topographic maps, as well as site reconnaissance.

The gray vireo is listed by the State of New Mexico as an endangered species. Its habitat, the arid scrub woodland on foothills and mesas, has a highly localized occurrence in the state. All habitats considered to be potential for breeding gray vireos were surveyed. Male and female gray vireos were sighted on

Kirtland AFB and the Forest Service Withdrawn Area. Summering gray vireos were found in ungrazed Juniper woodland at the base of the foothills (elevation 5,900 to 6,600 ft) of the Manzano Mountains.

Northern goshawk are uncommon breeders in central New Mexico; generally, they require mature stands of large conifers with a fairly closed canopy and open understory. During 2 days of surveys, no evidence of northern goshawk nesting was found (UNM, 1995). Overall, it appears that no suitable goshawk habitat exists on Kirtland AFB.

2.8.4 Sensitive Habitat

Sensitive habitat includes wetlands, plant communities that are unusual or of limited distribution, and important seasonal use areas for wildlife (such as migration routes, breeding areas, or crucial summer or winter habitats).

No streams or lakes exist on Kirtland AFB, and moist habitat is essentially nonexistent for either breeding or migrating wildlife. Sensitive habitat does not appear to be prevalent at Kirtland AFB.

3

3.0 Investigation Procedures

3.1 Field Procedures

The field investigation procedures and the analytical results provide a basis for assessing the environmental conditions and the presence or absence of environmental contamination. This section presents the general sampling operations and procedures used during the field portion of the Kirtland AFB Appendix III RFI.

All activities were conducted to meet the data quality objectives (DQOs) and quality assurance/quality control (QA/QC) requirements in the EPA-approved IRP Work Plan for Appendix III Sites (submitted as Stage 2C RFI Wasteline Investigation Work Plan) at Kirtland AFB (USAF, 1994b). The QA/QC requirements are detailed in the IRP RFI Data Collection Quality Assurance Plan (DCQAP) (USAF, 1994), and the IRP Health and Safety Plan (Halliburton NUS, 1994) for the Appendix III site (also submitted as Stage 2C documents). For consistency, all plans submitted as Stage 2C documents will be referred to as Appendix III documents in this report. Deviations from the approved plans are described in Section 3.2.

3.1.1 Sampling Investigations

Field investigation activities included surface and subsurface soil sample collection and sediment sample collection. Table 3-1 lists the number of boreholes and samples collected at each site. Table 3-2 lists the sample preparation and analyses performed on soil and sediment samples collected at each site.

3.1.1.1 Surface and Subsurface Soil Sampling

During the Appendix III RFI, 122 sites were investigated. Surface and subsurface soil samples were collected for lithologic description and laboratory analysis. Because of the short line lengths or proximity to other sampling locations, sampling was not performed at 29 of the 122 sites. Surface soil samples (0-1 ft in depth) were collected using stainless steel spatulas. Subsurface soil samples (0-25 ft in depth) were collected using a Geoprobe.

Soil samples collected were initially screened for volatile organic compounds (VOCs) using portable organic vapor analyzers (PID), a flame ionization detector (FID), and radiation monitoring instruments (gamma and beta-gamma meters, each with a sodium iodide (NaI) detector). Field instrument readings were recorded in the field logbook and on borehole logsheets. Field-screening instruments were calibrated daily.

The following describes equipment and procedures used for collecting soil samples. Sample collection equipment was decontaminated prior to each sample-collection event according to procedures described in Section 3.1.1.4.

Table 3-1. Drilling and Sampling Activity Summary, Appendix III RFI

Oil/Water Separators, Sediment Traps, and Holding Tank Inflow and Outflow Lines

SWMU No.	Kirtland AFB No.	Boreholes Drilled	Subsurface Soil Samples Collected
10-7	ST-201	2	2
10-7	ST-202	0	0
10-7	ST-203	6	7[a]
10-7	ST-204	0	0
10-7	ST-205	0	0
10-7	ST-206	7	8[a]
10-7	ST-207	6	7[a]
10-7	ST-208	3	3
10-7	ST-210	5	6[a]
10-7	ST-211	4	4
10-7	ST-212	5	6[a]
10-7	ST-215	1	1
10-7	ST-216	0	0
10-7	ST-217	14	16[a]
10-7	ST-218	14	15[a]
10-7	ST-219	2	2
8-13	ST-221	8	9[a]
10-7	ST-222	1	2[a]
10-7	ST-225	0	0
10-7	ST-226	3	4[a]
10-7	ST-227	0	0
10-7	ST-230	1	1
10-7	ST-231	0	0
10-7	ST-234	2	2
10-7	ST-235	0	0
10-7	ST-236	1	1
10-7	ST-238	0	0
10-7	ST-239	4	4
10-7	ST-240	0	0
10-7	ST-241	3	4[a]
8-26	ST-242	3	3
8-26	ST-243	1	1
10-7	ST-244	3	3
10-7	ST-245	0	0
10-7	ST-246	11	12[a]

a. Including replicate samples

Table 3-1. Drilling and Sampling Activity Summary, Appendix III RFI (Continued)

Oil/Water Separators, Sediment Traps, and Holding Tank Inflow and Outflow Lines (Continued)

SWMU No.	KAFB No.	Boreholes Drilled	Subsurface Soil Samples Collected
10-7	ST-247	2	2
10-7	ST-248	3	4[a]
8-28	ST-250	6	7[a]
8-29	ST-251	5	6[a]
8-31	ST-252	0	0
8-31	ST-253	2	2
10-7	ST-254	2	2
10-7	ST-255	0	0
10-7	ST-256	5	5
10-7	ST-257	0	0
10-7	ST-258	0	0
10-7	ST-260	0	0
8-47	ST-261	2	2
8-55	ST-262	4	4
10-7	ST-263	2	2
10-7	ST-264	5	5
10-7	ST-72	0	0
10-7	ST-267	3	3

Drain Lines

SWMU No.	KAFB No.	Boreholes Drilled	Subsurface Soil Samples Collected
WP-38	WP-38	2	3[a]
8-6	WP-47	3	3
10-7	ST-213	0	0
10-2BC	ST-220	8	9[a]
10-7	ST-224	2	2
10-7	ST-228	0	0
10-2	ST-233	0	0
10-7	ST-237	0	0
10-7	ST-259	0	0
10-2	ST-266	1	1

a. Including replicate samples

Table 3-1. Drilling and Sampling Activity Summary, Appendix III RFI (Continued)

Septic Tanks, Leach Fields, and Lines

SWMU No.	KAFB No.	Boreholes Drilled	Subsurface Soil Samples Collected
ST-273	ST-273	4	4
10-21	ST-287	4	4
10-21	ST-288	4	5[a]
10-21	ST-289	7	8[a]
10-21	ST-290	3	3
10-21	ST-291	3	3
10-21	ST-292	4	4
10-21	ST-293	3	4[a]
10-21	ST-294	4	4
10-21	ST-295	4	4
10-21	ST-296	4	5[a]
10-21	ST-297	4	4
10-21	ST-298	4	4
10-21	ST-299	4	4
10-21	ST-300	4	4
10-21	ST-301	4	5[a]
10-21	ST-302	4	4
10-21	ST-303	4	5[a]
10-21	ST-304	4	5[a]
10-21	ST-305	4	5[a]
10-21	ST-306	0	0
10-21	ST-307	4	5[a]
10-21	ST-308	4	4
10-21	ST-309	4	4
10-21	ST-310	4	4
10-21	ST-311	4	4
10-21	ST-312	4	4
10-21	ST-313	4	4
10-21	ST-314	7	10[a]
10-21	ST-315	3	3
10-21	ST-316	4	4
10-21	ST-317	4	5[a]
10-21	ST-318	4	5[a]
10-21	ST-319	4	4
10-21	ST-320	4	4
10-21	ST-322	3	4[a]

a. Including replicate samples

Table 3-1. Drilling and Sampling Activity Summary, Appendix III RFI (Concluded)

Septic Tanks, Leach Fields, and Lines (Continued)

SWMU No.	Kirtland AFB No.	Boreholes Drilled	Subsurface Soil Samples Collected
10-21	ST-323	4	4
10-21	ST-324	4	4
10-21	ST-330	3	4[a]
10-21	ST-333	4	5[a]
ST-340	ST-340	3	4[a]

Sanitary Sewer Systems

SWMU No.	Kirtland AFB No.	Boreholes Drilled	Subsurface Soil Samples Collected
10-1A	ST-278	27	30[a]
10-1B	ST-279	0	0
10-1B	ST-280	0	0
10-1B	ST-281	5	5
10-1B	ST-282	11	12[a]
10-1B	ST-283	11	12[a]
10-1B	ST-284	8	8
10-1H	ST-327	11	12[a]

Storm Sewer Systems

SWMU No.	Kirtland AFB No.	Boreholes Drilled	Surface Soil/Sediment Samples Collected
10-2H	ST-285	0	1/4[a]
10-2I	ST-286	0	1/3
10-2AF	ST-325	0	0/3
10-2G	ST-331	0	0/1
10-2D	ST-329	0	0

Miscellaneous Wasteline Units

SWMU No.	Kirtland AFB No.	Boreholes Drilled	Soil Samples Collected[a]
10-2D	ST-209	0	0
10-7	ST-223	2	2
10-2	ST-229	10	11[a]
10-2	ST-232	0	0

a. Including replicate samples

Table 3-2. Extraction and Analytical Method Summary, Appendix III RFI

Parameter	Extraction	Analysis
Volatiles (solid)	SW-5030	SW-8240
Volatiles (aqueous)	SW-5030	SW-8240
Semivolatiles (solid)	SW-3550	SW-8270
Semivolatiles (aqueous)	SW-3510	SW-8270
Polynuclear aromatic hydrocarbons	SW-3550	SW-8310
ICP metals (solid)	SW-3050	SW-6010
ICP metals (aqueous-total, dissolved)	SW-3005	SW-6010
Pesticides/PCBs (solid)	SW-3550	SW-8080
Pesticides/PCBs (aqueous)	SW-3510	SW-8080
Herbicides	N/A	SW-8150
Total petroleum hydrocarbons (solid)	SW-5030/3550	SW-8015
Total petroleum hydrocarbons (aqueous)	SW-5030/3510	SW-8015
Antimony	SW-3050	7041(S)
Arsenic	SW-3050	7060(S)
Chromium	SW-3050	7191(S)
Lead	SW-3050	7421(S)
Selenium	SW-3050	7740(S)
Thallium	SW-3050	7841(S)
Gross alpha/beta	N/A	SW-9310
Gamma spectra	N/A	A701c
Radium-226	N/A	904.0
Radium-228	N/A	E903.0
Mercury	N/A	SW-7471
Toxicity characteristic leading procedure (TCLP)	N/A	SW-1311
Mercury (soil)	N/A	SW-7470
pH (soil)	N/A	SW-9045
Moisture	N/A	ASTM-2218
Ignitability	N/A	SW-1010

N/A-not applicable

Geoprobe Sampling

A Geoprobe was used to collect subsurface soil samples at 90 of the 122 sites investigated during the Appendix III RFI. These sites included underground storage/holding tanks lines, sediment trap lines, area drains and lines, sewage ejector lines, OWSs, leach fields, and sanitary and storm sewer lines. Samples were collected adjacent to the SWMU lines at depths equal to the base of the line and 5 ft below. Sample points were finalized after considering access restrictions and underground utility locations. For sites located on paved areas, a concrete corer was subcontracted to core holes to access borehole locations.

Geoprobe Description

The Geoprobe is a hydraulically driven, truck-mounted soil sampling system that uses static force and percussion to drive sampling tools into the subsurface to collect soil samples with minimal waste generation. A steel sampling tube (24-in. long, 1.375-in. inside diameter) is the core sample collection device (i.e., large-bore sampler). Hollow probe rods (36-in. long, 1-in. outside diameter) are attached to the large-bore sampler in succession to advance the sampler to the desired depth. While it is being driven to the desired sampling depth, the sampler is kept closed by a piston tip that is held in place by a reverse-threaded stop-pin located at the tail end of the sampler. When the sampler is at the desired sample collection depth, the piston stop-pin is removed, allowing the piston tip to remain stationary as the sample tube is advanced downward. The sampler is subsequently driven an additional 24 in. for collection of the desired soil interval.

Prior to collecting a sample, an assembly of four decontaminated brass tubes (each 6 in. long) wrapped in an acetate sheath is placed inside the large-bore sampler. This setup permits a soil collection interval of 24 in. per advancement. A 24 in.–long, clear, acetate sleeve is used in place of the brass tubes when soil is collected for lithologic description at alternate 5-ft intervals.

Samples for lithologic description and laboratory analysis are field-screened with a FID and a beta-gamma meter. Instrument readings are recorded in the field log book and on borehole logsheets. If field-screening indicates possible contamination, the brass tube exhibiting the highest FID reading is designated for VOC analysis.

Brass tubes are used for collecting and shipping samples for laboratory analysis for all parameters. Following sample screening, the individual brass tube ends are covered with 2-in. square sheets of 0.003-in.-thick Teflon® and sealed with vinyl caps. Samples are then individually placed in sealable plastic bags and stored on ice in a cooler.

3.1.1.2 Sediment Sampling

Eleven sediment samples and two surface soil samples were collected from the storm sewer systems and associated discharge points. A high-density polyethylene (HDPE) bottle attached to an extension rod was used to collect a sediment sample from the bottom of the drains.

3.1.1.3 Decontamination Procedures

In accordance with the DCQAP, which is based on IRP Handbook guidance, all sampling equipment was fully decontaminated prior to use for sample collection. The water for field decontamination activities was provided from base potable water sources. A semi-permanent decontamination pad was used for all decontamination activities.

There were several activities for general decontamination of large pieces of equipment. For the Geoprobe and drilling rods, all external surfaces were washed with high-pressure hot water (potable) and Liquinox® detergent. A high-pressure hot water rinse followed the washing, and subsequent air-drying completed the Geoprobe decontamination process. To minimize the potential for cross-contamination, this decontamination procedure was performed prior to mobilizing the Geoprobe to successive site locations.

Prior to use, decontamination activities for sampling equipment (e.g., large-bore samplers, brass tubes) were conducted as follows:

- Washing with a solution of potable water and Liquinox® detergent, followed by a potable water rinse.
- A triple rinse, consisting of an American Society of Testing Materials (ASTM) Type II water rinse, pesticide-grade methanol rinse, and finally a pesticide-grade hexane rinse.
- Air-drying of all sampling equipment, which was subsequently wrapped in aluminum foil for storage.

3.1.1.4 Borehole Abandonment

Following borehole completion, boreholes were backfilled with bentonite pellets to approximately 1 in. below ground surface and allowed to hydrate. The borehole was completed to the surface using a cement-sand mixture (e.g., quick-setting concrete or Quikrete®), and an approximate 4-in. length of polyvinyl chloride (PVC) (2-in. outside diameter) pipe was placed in the concrete for sample identification. Boreholes drilled at concrete cored locations on the flightline were similarly backfilled; the exception was that following completion the Kirtland AFB Civil Engineers Squadron required flightline borehole locations to be recast using a high-compressive-strength concrete. All abandoned boreholes were checked 24 to 48 hours after backfilling for settling.

3.1.2 Sample Handling

All samples were obtained in accordance with the requirements of the DCQAP. In addition to sample custody responsibilities, sample handling included the selection of appropriate containers and preservatives, collection of required sample volume, and the management of holding times required of the analyses requested. The DCQAP, Section 1 (Table 1), provided specifications for sample containers (deviations are described in Section 3.2), volume requirements, preservatives, and allowable holding times per analyses requested. Table 3-2 summarizes the analytical methods used for Appendix III RFI samples. Specific analytical parameters applicable to each site investigated are presented in the statement of work (Appendix A).

3.1.2.1 Sample Identification System

During the Appendix III RFI, unique sample identification system was used to identify each sample submitted for analysis to ensure sample traceability. At the time of sample collection, each sample container was affixed with an adhesive-backed sample label indicating the Air Force Center for Environmental Excellence (AFCEE) sample code (where appropriate), location, date and time of collection, analyses requested, and any preservative (for water samples collected in laboratory containers). This coding nomenclature included specific information pertaining to site number, borehole number, and sample depth. For QC samples (e.g., equipment blanks, ambient condition blanks, trip blanks, and replicates), other unique identifiers were included in the sample code. All replicate samples were sent blind to the laboratory. As samples were received by the laboratory for analysis, each was assigned a unique laboratory identification number through a computerized laboratory information management system (LIMS). Hard copy and electronic data provided by the laboratory included both field and laboratory identification codes.

3.1.2.2 Sample Packaging, Shipping, and Documentation

Samples were packaged and shipped in accordance with EPA, U.S. Department of Transportation (DOT), and 1993 IRP Handbook standards. Samples were sent to the laboratory in coolers packed with vermiculite and Blue Ice™. A sealed container of distilled water was placed in each cooler shipped to the laboratory to serve as a temperature blank to monitor compliance with EPA sample preservation protocol (i.e., <4°C). The temperature was measured upon receipt at the laboratory and recorded on the chain-of-custody form. Custody seals were affixed to each cooler, and strapping tape was applied to the lid and drainage port. Each sample shipment included a completed chain-of-custody form and the AFCEE sample logsheet.

The Field Team Leader (FTL) was responsible for the completion of the following forms:

- Sample labels
- Chain-of-custody forms
- AFCEE sample log forms
- Shipping labels
- Chain-of-custody seals
- Federal Express™ airbills

Sample custody was maintained and documented according to the Kirtland AFB Appendix III RFI DCQAP, Section 1.6. Visual inspection and notation of anomalies, with subsequent documentation on chain-of-custody forms and verbal notification, were found to meet project data quality requirements. Use of the custody seals ensured that any tampering with samples during shipment to the laboratory would be detected; no such occurrences were noted. Copies of the chain-of-custody forms generated during the field investigation are in Appendix E.

3.1.3 Land Surveying

All Appendix III RFI soil sample borehole and sediment sampling locations were surveyed after sampling was completed. A New Mexico-registered land surveyor was contracted to conduct a third-order survey of all sampling locations. Each soil boring location was surveyed to the nearest 0.10 ft horizontally and vertically. Existing survey monuments within Kirtland AFB were used as reference points. Vertical elevations were referenced to the 1929 National Geodetic Vertical Datum (NGVD29). Horizontal locations were surveyed to the Kirtland AFB coordinates that are tied to the New Mexico State Plane Coordinate System. Appendix D includes the ground survey report for all surveyed locations.

3.1.4 Waste Handling

Waste soil (i.e., soil not used for site analytical characterization) was generated during the Kirtland AFB Appendix III RFI soil sampling activities (e.g., Geoprobe). Liquid waste was generated when sampling equipment was decontaminated. The following sections describe the management of field investigation-derived waste.

3.1.4.1 Waste Soil

Generated waste soil was minimal during Geoprobe sampling. Waste from each Geoprobe borehole, primarily soil related to lithologic description, was placed in sealable, 1-gallon plastic bags and labeled. All of the 1-gallon bags of waste soil from one site were then placed in one large sealed plastic bag. The larger plastic bag was labeled with the corresponding site number and placed in a 55-gallon DOT-approved drum. Waste soil from several sites was stored in the same drum. Each 55-gallon drum of waste soil was sealed and clearly labeled with the following information:

- Site numbers corresponding to the bags contained in the drum
- Drum contents (i.e., soil cuttings)
- Dates covering the collection period
- Point of contact (POC) name and telephone number
- The words "pending sample analysis"

All drums were stored in a Kirtland AFB accumulation point pending sampling and analysis prior to final disposition. Final disposition of Geoprobe drilling waste will depend on the analytical results for each borehole or site. Upon review of the waste characterization analytical results, drums or plastic bags containing nonhazardous soil will be disposed of, at the discretion of the POC, either off-base at an approved landfill or on-base in a manner specified by the POC.

3.1.4.2 Wastewater

Equipment decontamination wash and water rinsate fluids were collected and containerized in DOT-approved 55-gallon drums. All drums were sealed and clearly labeled with the following information:

- Drum contents and date filled
- Drums of Geoprobe sampling-related decontamination water were sequentially numbered upon collection
- POC name and telephone number
- The words "pending sample analysis"

All drums were stored in a Kirtland AFB accumulation point pending sampling and analysis prior to final disposition. Fluids generated during Geoprobe decontamination activities will be sampled for the analytical parameters required by the City of Albuquerque Sewer Use and Wastewater Control Ordinance, Chapter 8, Article 9. Nonhazardous drum contents will be disposed of by discharge to the sanitary sewer system on base, which discharges to the City of Albuquerque publicly owned treatment works (POTW).

If samples submitted for waste characterization are determined to contain RCRA hazardous constituents, waste manifestation documents will be prepared and submitted to the Kirtland AFB Environmental Management Office, the Contracting Officer's Representative, and the POC.

3.2 Work Plan Deviations

There were no major deviations from the Work Plan (USAF, 1994b) that would compromise data quality regarding decision-making. Deviations were discussed with and approved by the EPA through verbal or written communication (Appendix G). Deviations are described below:

- Ten percent of the data was validated. To reduce cost and effort associated with data validation, the 100-percent validation frequency was replaced by a 10-percent validation frequency. Upon delivery, the data were screened for results in excess of the human health risk-based (HHRB) action levels to prioritize areas of concern. Analytical results at or above the HHRB action levels were validated.

- The Appendix III RFI Wasteline Work Plan called for samples to be collected from septic tank/leach field locations at depths extending to 12 ft below the base of the leach field, if contamination was detected. Rather, where field-screening detected no contamination, samples were collected at depths extending to 5 ft below the leach field. At sites where contamination was detected through laboratory analysis, additional sampling will be required as a phased approach to site characterization. It is noted that field instrumentation detected no contamination at any of the septic tank/leach field locations.

- The Appendix III RFI Wasteline Work Plan called for samples to be collected from the discharge location of the storm sewers. The construction of a concrete weir at the discharge location of ST-325 prevented collection of samples here. Sampling was performed at all other proposed storm sewer sampling locations.

3.3 Data Quality Objectives

Data Quality Objectives (DQOs) are programmatic sample collection and management activities and sample analysis accuracy and precision requirements applied to environmental sample measurement as the result of the DQO process (EPA, 1993), which is a series of planning steps based on scientific method. These steps are designed to ensure the type, quantity, and quality of environmental data used in decision-making are appropriate for the intended application. EPA policy and regulations emphasize that environmental data must be of known quality to achieve that goal. Code of Federal Regulations Title 40 Part 300 (40 CFR 300), the National Oil and Hazardous Substances Pollution Contingency Plan (NCP), mandates the development of a Sampling and Analysis Plan (SAP), which specifies acceptable data quality goals, defines responsibility for achieving these goals, and includes as its key elements a field sampling plan and a DCQAP under CERCLA. Aside from 40 CFR 265 Subpart F, which requires a SAP for the investigation of potential groundwater contamination, programmatic QA planning documents are not required under RCRA. However, their development and use is advised in RCRA guidance documents to maximize investigation efficiency and minimize costs.

DQOs for the Appendix III RFI included analytical method precision and accuracy requirements, instrument detection limits, and control limits for matrix spike and matrix spike duplicate recovery (historical) and relative percent difference (method-specific requirements) (USAF, 1993c). Environmental measurement data were of acceptable quality to enable the following decisions regarding site disposition: (1) recommendation for no further action and removal from the RCRA Part B Permit, (2) initiation of monitoring or further investigation, and (3) corrective measure studies and remediation.

The Appendix III RFI was performed in conformance with the DCQAP of the RFI (USAF, 1994d). Deviations are described in Section 3.2. The quality objectives to meet data uses stated in the Appendix III RFI Work Plan were as follows:

- Data collection and management performed in accordance with EPA and IRP guidance.
- Data generation and reporting that are scientifically and legally defensible.
- Data acceptability, as determined by precision, accuracy, representativeness, and completeness, that enables decision-making (e.g., further action/no further action).

3.4 Quality Assurance and Quality Control

3.4.1 Quality Assurance

Quality assurance is an integrated system of data management activities used to develop and implement procedures for field sampling, chain-of-custody, laboratory analysis, and reporting to provide environmental monitoring data of known acceptable quality. The procedures, stipulated in the approved Appendix III RFI DCQAP, were used to provide acceptable and representative data to satisfy project DQOs and to enable appropriate decision-making regarding subsequent site disposition. During initial stages of the RFI, the QA officer was onsite daily observing all aspects of sample collection activity (e.g., daily calibration of field monitoring instruments, sample collection and packaging for shipment to the laboratory, chain-of-custody record-keeping, decontamination, collection of field QC samples) to ensure appropriate, scientifically sound quality control. No deficiencies were noted. Minor deviations from the DCQAP were verbally communicated to the FTL and immediately rectified.

Quality assurance for laboratory analytical results was achieved by the laboratory Quality Assurance Program (QAP) and applicable Standard Operating Procedures (SOPs). The laboratories used standard RCRA, SW-846, and ASTM analytical methods.

3.4.2 Quality Control

Quality control is the overall system of technical activities that measures the attributes and performance of a process, item, or service against defined standards to verify that they meet the established requirements.

3.4.2.1 QC Samples

The QC samples are control checks introduced into the process to monitor the performance of the sample data collection system. Several types of internal QC samples were used to evaluate system performance. For the purpose of this report, system quality control checks were classified as field QC samples or laboratory QC samples. QC samples included blanks (e.g., trip, equipment, ambient, and laboratory), replicates, spikes, analytical standards, and surrogates which were used to assess different phases of the data collection and analytical processes beginning with sampling and continuing through transportation, storage, and analysis. These QC samples and the frequency of use are described below.

3.4.2.2 Field QC Samples

Field QC samples included equipment blanks, field replicates, trip blanks, and ambient conditions blanks. Each type of field QC sample is defined below.

Equipment (Rinsate) Blanks

Equipment blanks were obtained every day sampling was conducted under representative field conditions by running Type II reagent-grade water through sample collection equipment (e.g., brass tubes used with the Geoprobe) after decontamination and prior to use for field sample collection. The rinsate was collected and analyzed for the same parameters as environmental samples collected that day and was analyzed on an every-other-day-basis. Equipment blanks were used to assess the effectiveness of decontamination procedures.

Field Replicate

Ten percent of all soil samples were field replicates. Replicate samples were identified so laboratory personnel were unable to distinguish them from normal field samples. Replicates were analyzed for the same laboratory parameters as the normal environmental field sample. Field replicates are normally used to evaluate field sampling and laboratory QA protocol in conjunction with laboratory QC sample results; however, soil inhomogeneity makes definitive programmatic QA assessment difficult.

Trip Blanks

Trip blanks were included in every shipping or sample collection cooler that contained samples to be analyzed for VOCs regardless of sample matrix. Trip blanks, consisting of two 40-ml VOA vials, were obtained at the beginning of each day and subjected to the same field conditions as field environmental samples. They were used to evaluate possible environmental sample contamination resulting from sample handling and were provided by the laboratory.

Ambient Condition Blanks

Ambient condition blanks were collected when potential VOC sources existed upwind from sample collection or packaging locations. Ambient condition blanks were used to assess possible environmental sample contamination resulting from an external source (e.g., vapors from refueling operations, heavy traffic).

3.4.2.3 Laboratory QC Samples

The laboratories of Halliburton NUS (Pittsburgh, Pennsylvania) were used to provide analytical results for the Kirtland AFB Appendix III RFI. The laboratories were audited by the EPA and are participating in Contract Laboratory Program and DOD environmental restoration projects and are AFCEE approved. The QA for laboratory analytical results was achieved through strict adherence to the laboratory Quality Assurance Program (QAP) and applicable SOPs. Additional procedures were implemented for laboratory QC control checks, including analytical standards, method blanks, and surrogate recovery checks. The laboratory QC samples are defined as follows:

Analytical Standards

An analytical standard is comprised of constituent(s) at a known concentration. The standard may be a reference material certified by the National Institute of Standards and Technology (NIST). The laboratory stipulated use of certified analytical standards in its Quality Assurance Program. To evaluate measurement system precision and accuracy control, analytical standards used included:

- ***Calibration standard***, to determine instrument response factors and linear range. Used on a method-specific frequency or as system conditions necessitate (e.g., post-maintenance, out-of-control check standards).

- ***Calibration check standard***, at or near the midpoint of the standard calibration curve, analyzed each day of analysis for appropriate parameters. Results must fall within method-specific acceptance criteria. If not, results are flagged and corrective action is taken to recover system control.

- ***Internal standards***, usually isotopes of organic compounds of interest used for target compound quantitation.

Method Blanks

The method blank is an analytical control sample that contains either distilled/deionized water or control solid, and other reagents (e.g., surrogates, internal standards). The method blank is carried through the entire analytical procedure (preparation and analysis).

Surrogates

Surrogates are organic compounds similar to analytes of interest in chemical composition and physical behavior, but not normally present in environmental samples. These compounds were added to all blanks, calibration and check standards, samples (including normal environmental samples, replicates, and QC samples), and spiked samples prior to sample processing. By calculating percent recovery, surrogates are used to monitor extraction efficiency. Method-specific percent recoveries are required for obtaining valid results. When surrogate recovery was outside method acceptance criteria, results were flagged by the laboratory. Samples were re-analyzed where appropriate.

Matrix Spike

A matrix spike (MS) is a separate aliquot of a sample spiked with the analyte(s) of interest and analyzed with the environmental sample. The results of MS analyses are used to measure method accuracy (as defined by percent recovery). Spike recovery was compared to laboratory matrix-specific historical statistical recovery criteria. Spike recovery outside laboratory QA acceptance criteria is flagged. Spike recovery may identify interference in complex matrices causing analytical bias. A matrix spike duplicate (MSD) (a second spiked aliquot of the same matrix and spiking solution) is analyzed and percent spike recovery calculated. The relative percent difference between the MS and MSD is calculated to determine matrix-specific, project-specific analytical precision. Analytical methods for organic constituents have specific MS/MSD precision requirements. When results were outside of method criteria, results were flagged and re-analysis performed where appropriate. MS/MSDs were used for both organic and inorganic analyses at a frequency of 1 set per 20 environmental samples. Laboratory control sample

(LCS) and LCS duplicate—solid or liquid matrices—may be substituted for MS/MSD samples, per AFCEE IRP guidance.

Field samples and field QC samples were analyzed in conjunction with laboratory QC samples. The combined results of field and laboratory control samples were used to enable an overall quality assessment of measurement data.

3.4.3 Laboratory Analysis Activities

The Halliburton NUS laboratory used standard EPA methodology and QA/QC protocol to ensure the reliability, consistency, and comparability of reported results. Sample analysis was performed for required parameters (e.g., VOCs, SVOCs, petroleum hydrocarbons, inorganics) and target compounds identified in the Appendix III RFI Work Plan by the described EPA analytical methodology. The SW-846/8240 VOC was analyzed by the laboratory using a capillary column (SW-846/8260). Instrument detection limits (IDLs) and QC acceptance criteria for analytes of interest, in soil, for the laboratory are provided in Appendix K, as required by the EPA and Air Force IRP Guidance (AFCEE, 1994). Laboratory QC sample acceptance criteria are based on either method-specific requirements or on historical laboratory matrix-specific statistical criteria. Analytical results not meeting applicable criteria are flagged by the laboratory and discussed in the case narrative. Historical laboratory acceptance criteria for laboratory used in the Appendix III RFI environmental sample analysis effort are also available in laboratory QA/QC reports, the Appendix III RFI Work Plan (USAF, 1994b), and Appendix K.

QC acceptance criteria related to field QC replicate samples are identified in Section 3.4.2.2 and shown in Table 3-4.

Table 3-3. Acceptance Criteria for Field Replicate Samples

Method	QC Sample Frequency	Acceptance Criteria
SW-846/8240/8260 (Volatile organics)	1 set per 10 samples	RPD <30%
SW-846/8270 (Semivolatile organics)	1 set per 10 samples	RPD <30%
SW-846/6010 (Inorganics by ICP)	1 set per 10 samples	RPD <40%
SW-846/7471 (Mercury by GFAA)	1 set per 10 samples	RPD <40%
SW-846/8015b (TPH)	1 set per 10 samples	RPD <40%
SW-846/8080 (Pesticides and PCBs)	1 set per 10 samples	RPD <30%
SW-846/8150 (Herbicides)	1 set per 10 samples	RPD <30%
Gross alpha and beta	1 set per 10 samples	RPD <30%

3.5 Data Validation and Evaluation

The following describes practices used for data validation and reporting of the environmental data resulting from the Appendix III RFI.

Data validation was performed on 10 percent of the analytical results of the environmental samples collected during this investigation (USAF, 1994d). Data validation was conducted according to the following EPA national protocols and *Test Methods for Evaluating Solid Waste Physical/Chemical Methods* SW-846 method-specific criteria:

- Laboratory Data Validation Functional Guidelines for Evaluating Organic Analyses (EPA, 1994a)
- Laboratory Data Validation Functional Guidelines for Evaluating Inorganic Analyses (EPA, 1994b)
- SW-846, Method 8240/8260: *Volatile Organic Analysis*
- SW-846, Method 8270: *Semivolatile Organic Analysis*
- SW-846, Method 6010: *Inductively Coupled Plasma (ICP) Inorganic Analysis*
- SW-846, Method 7471: *Manual Cold-Vapor Technique for Mercury Analysis*
- SW-846, Method 7040: *Graphite Furnace Atomic Absorption (GFAA) Technique for Antimony*
- SW-846, Method 7060: *GFAA Technique for Arsenic*
- SW-846, Method 7190: *GFAA Technique for Chromium*
- SW-846, Method 7421: *GFAA Technique for Lead*
- SW-846, Method 7740: *GFAA Technique for Selenium*
- SW-846, Method 7841: *GFAA Technique for Thallium*

In accordance with EPA national protocols, organic and inorganic data were evaluated based on the following criteria:

- Data completeness
- Holding times
- Initial and continuing calibration verification
- Blank analyses
- Interference check sample results (inorganic data only)
- Matrix spike/matrix spike duplicate analyses
- Field replicate results (where appropriate)
- Laboratory control spike results
- Detection limits
- Sample quantitation results
- Laboratory duplicate results

- Surrogate recoveries
- Internal standard results

In addition to the organic and inorganic data validation mentioned above, data from total petroleum hydrocarbon (TPH) analyses were also validated. However, this analysis is a screening method and was validated according to QA2 criteria (EPA/450/G-90/004) which requires evaluating the sample documentation, holding time, calibration data, method blank, and blank spike analysis results.

The result of validation is summarized in a technical report consisting of a memorandum, a section of qualified analytical results, and supporting documentation providing the rationale for changes and/or qualification of the data. The memorandum identifies and provides a detailed explanation of the results of the data validation review. The support documentation is provided as raw data to verify that the qualification of the data was warranted. Based on results of the validation review, qualifiers have been added to the data to alert the data user of the limitations associated with the sample results. The following definitions provide brief explanations of the nationally-used qualifiers assigned to sample results in the data review process:

U The analyte was analyzed for, but was not detected above the reported sample quantitation limit. Nondetected results from the laboratory are reported in this manner. This qualifier can be added to a positive result (reported by the laboratory) if the detected concentrations attributed to contamination introduced by sampling or laboratory analysis.

J The analyte was positively identified; however, the associated numerical value is an approximate concentration of the analyte in the sample.

UJ The analyte was not detected above the sample quantitation limit. However, the reported quantitation limit is approximate and may or may not represent the actual limit of quantitation necessary to accurately and precisely measure the analyte in the sample.

R The sample results are rejected due to major deficiencies in the ability of the laboratory to verify the presence or absence of the analyte.

Results and conclusions of this formal data validation process were submitted to the project manager in the form of data validation memoranda. The data validation memoranda explain the findings of the data evaluation process, include a summary of the qualifiers assigned, and provide justification for actions taken on the data.

Data quality control concerns are summarized in Section 3.5.1.

3.5.1 Data Quality Assurance/Quality Control

Data validation protocol gives a representative indication of overall analytical control. If a particular problem related to analytical control is identified frequently, the data user will be alerted to the limitations associated with that particular constituent in the data validation memorandum. Ten percent of the data was formally validated; results indicate data to be generally good quality for site assessment.

Only those specific occurrences which resulted in qualification of the associated data are addressed in the following summary.

3.5.1.1 Organic Analyses Data Evaluation Summary

The following paragraphs summarize the limitations of the data from organic analyses based upon the formal data validation review for 10 percent of the data packages. Most data reviewed were acceptable, but qualifiers were assigned to some analyte results in the 10-percent population. This summary is intended to alert the data user to either general data considerations regarding specific analytes or analyte results in identified sample delivery groups, on samples submitted for analysis. The findings may impact other samples in that group or at that site. Deficiencies noted were minor (resulting in estimated values) with the exception of reported nondetects for several organic compounds which were rejected in several of the reviewed data packages. Other problems identified were not considered significant because the analytes were not detected in the environmental samples. (Details of the data validation review are presented in Appendix K). Data use for decision-making purposes is not impacted.

- Initial or continuing calibration relative response factors (RRFs) for 2-chloroethyl vinyl ether tended to be less than the 0.050 minimum quality control criteria. Nondetects for this compound in the affected samples (approximately 63 of the 69 validated samples) were unreliable and therefore rejected, R.

- Initial and continuing calibration quality control statistical parameters exceeded the 50-percent QC criteria for the VOCs acetone, methylene chloride, and 2-chloroethyl vinyl ether, in several data packages. Positive results and/or nondetects for these affected compounds in the affected data packages were estimated, J and UJ, respectively, unless previously rejected.

- Initial and continuing calibration quality control statistical parameters exceeded the 50-percent QC criteria for the SVOCs benzyl alcohol, 2,4-dinitrophenol, 4,6-dinitro-2-methylphenol, bis(2-chloroisopropyl)ether, and 4-nitrophenol. Nondetects for these affected compounds in the affected data packages were estimated, J and UJ, respectively.

- Some positive results for methylene chloride were estimated, J, because of initial calibration percent relative standard deviations (%RSDs) greater than the 30-percent QC criteria. These statistical exceedances indicate that the laboratory had difficulty in maintaining consistent responses for these compounds, but the problem was not severe enough to cause uncertainty on associated nondetects.

- Methylene chloride occasionally was present as a laboratory method blank contaminant during the validation review. Results for this compound reported at concentrations less than the validation action level were considered to be false positives and were qualified as undetected, U.

- The surrogate percent recoveries (%Rs) for 2-fluorobiphenyl and terphenyl-d14 exceeded quality control limits. Positive results of the semivolatile base-neutral fraction for sample 295C-02-0305 were estimated, J. Nondetect results are unaffected by high surrogate recovery noncompliances.

- MS/MSD %Rs for vinyl acetate associated with data package PKG13 were below QC criteria. The nondetect for this compound in the unspiked sample was qualified as estimated, UJ. This noncompliance is indicative of matrix interferences resulting in uncertainty of quantitation.

- MS/MSD %Rs for di-n-butylphthalate associated with data package PKG13 exceeded QC criteria. Nondetects for this compound in the unspiked sample was qualified as estimated, J. This noncompliance is indicative of matrix interferences resulting in uncertainty of quantitation.

- Positive results and nondetects of the semivolatile fraction for three samples in data package PKG29 were qualified as estimated, J and UJ, respectively because internal standard areas used to quantitate these results failed to meet QC criteria. Since sample results are quantitated based on internal standard responses, the exact level of quantitation/detectability for these compounds is uncertain.

- LCS results for the VOC o-xylene associated with data package PKG29 and the SVOC di-n-butylphthalate associated with data package PKG13 were outside quality control limits. Positive results for these compounds in the affected data package were estimated, J. Failure to meet LCS quality control criteria indicates imprecision/lack of consistency in instrumental responses for the affected compounds.

- The field duplicate relative percent difference (RPD) for bis(2-ethylhexyl)phthalate exceeded 50 percent. Positive results for this compound in the field duplicate pair were qualified as estimated, J. Inconsistencies associated with field duplicate imprecision indicates the inability to reproduce the process of sample collection during field investigations. This is very common in the collection of soil samples due to the nonhomogeneous nature of the sample matrix.

- Positive results for several compounds in the SVOC fraction were estimated because they were reported at concentrations which exceeded the instrumental linear calibration range. Samples with linear calibration range exceedances were diluted and analyzed in attempt to bring the affected compound within calibration range. The dilution results were used, when possible, in place of the original results.

A review of laboratory data for blank contamination was also performed. The review was to identify constituents that may have been introduced from sources outside the site being investigated. The two primary origins of external contamination include the laboratory and the field environment. Contamination from these sources are identified through the evaluation of laboratory and field quality control blanks. Laboratory method blanks are used to monitor laboratory introduced contamination. The laboratory blanks undergo the same sample preparation and analytical procedures as the environmental samples; therefore, they can be used to identify contaminants introduced during the analytical process. Field investigation procedures are monitored through use of ambient blanks, equipment blanks, and trip blanks. These blanks are used to monitor the environmental setting, decontamination procedures, and the shipping environment for possible contamination introduced prior to receipt of the samples at the laboratory.

Analyses of equipment blanks revealed the presence of gasoline at a maximum concentration of 170 ug/l. Analyses of trip blanks revealed methylene chloride at a maximum concentration of 31 ug/l. Sample results for methylene chloride less than 10 times this maximum concentration and gasoline compounds less than 5 times this maximum concentration are indicative of blank contamination. The organic constituents found in the blanks were found at concentrations significantly below HHRB action levels. The detection of these constituents in environmental samples may be the result of cross-contamination similar to the cross-contamination of blank samples and not necessarily indicative of the actual presence of these constituents in the sampled media.

3.5.1.2 Inorganic (Metals) Analyses Data Evaluation Summary

The following paragraphs summarize the limitations from the data from inorganic analyses based upon the formal data validation review for 10 percent of the data packages. Most data reviewed were acceptable, but qualifiers were assigned to some analyte results in the 10-percent population. This summary is intended to alert the data user to either general data considerations regarding specific analytes or analyte results in identified sample delivery groups, on samples submitted for analysis. The findings may impact other samples in that group or at that site. Deficiencies noted were minor (resulting in estimated values) with the exception of reported nondetects for several organic compounds which were rejected in several of the reviewed data packages. Other problems identified were not considered significant because the analytes were not detected in the environmental samples. (Details of the data validation review are presented in Appendix K). Data use for decision-making purposes is not impacted.

- The continuing calibration verification (CCV) %Rs for arsenic, chromium, lead, and thallium exceeded QC limits. Positive results for these compounds were qualified as estimated, J, in the affected samples. Additionally, CCV %Rs for antimony, arsenic, selenium, and thallium were below QC limits. Positive results and/or nondetects for these analytes were qualified as estimated, J and UJ, respectively, in the affected samples.

- Qualifications based on laboratory method and/or field quality control blank contamination were made for copper in data packages PKG 29 and PKG32; for sodium in data packages PKG13, PKG29, and PKG32, and for zinc in data package PKG13.

Affected positive results reported at concentrations below the associated validation action levels were qualified as undetected, U. These results are considered to be false positives due to blank contamination.

Several other analytes were also present as blank contaminants in various data packages; however, no data qualifications were necessary since all affected sample results were either nondetects or were reported at concentrations above the validation action levels.

Negative concentrations for calcium and sodium were reported for the laboratory method blanks at levels which exceeded the absolute value of the IDL. These occurrences in the affected data packages indicated instrumental drift (base-line fluctuations) which caused readings to be inconsistent. Positive results and nondetects for these affected analytes in the affected samples of the affected data packages were qualified as estimated, J and/or UJ, respectively.

- Positive results for cadmium, cobalt, copper, sodium, and/or zinc in several samples were estimated, J, because instrumental responses for these analytes were elevated based on evidence associated with the interference check sample (ICS) results. Interferences were also noted for these analytes in the affected data packages as a result of high calcium and iron concentrations within the sample matrix.

- LCS results for chromium exceeded quality control criteria for the aqueous matrix for sample batch group associated with Lot 219 in data package PKG29. Positive results for this analyte were qualified as estimated, J. Failure to meet LCS quality control criteria indicates imprecision/lack of consistency in instrumental responses for the affected analytes.

- MS %Rs for barium, chromium, copper, lead, and potassium exceeded quality control limits for data package PKG13. Positive results for these analytes were qualified as estimated, J. These noncompliances are a result of interferences associated with the matrix of the sample.

- MS %Rs for barium, chromium, copper, lead, and potassium exceeded quality control limits for data package PKG13. Positive results for these analytes were qualified as estimated, J. These noncompliances are a result of interferences associated with the matrix of the sample.

- MS %Rs for antimony, manganese, selenium, silver, chromium, iron, lead, magnesium, and manganese were below QC limits. Positive results and/or nondetects for these analytes were qualified as estimated, J and/or UJ, respectively. These noncompliances are a result of interferences associated with the matrix of the sample.

- Graphite Furnace Atomic Absorption (GFAA) post-digestion spikes (PDSs) %Rs for arsenic, selenium, and/or thallium were below quality control limits in the affected data packages. Positive results for these analytes were qualified as estimated, J, in the affected samples. Nondetects for selenium and thallium were qualified as estimated, UJ, in the affected samples.

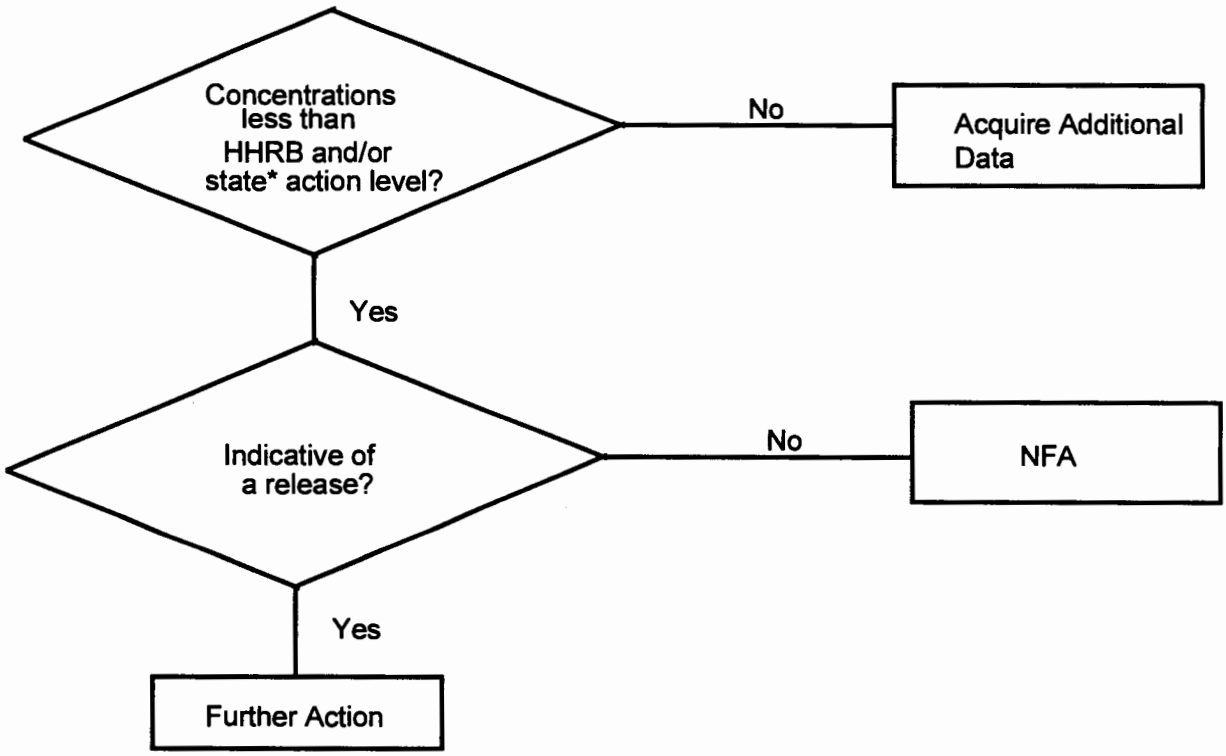
- Field duplicate imprecision was noted for aluminum, arsenic, barium, beryllium, calcium, chromium, cobalt, copper, iron, lead, manganese, nickel, potassium, vanadium, and zinc because RPDs for these analytes exceeded 50 percent. Inconsistencies associated with field duplicate imprecision indicates the inability to reproduce the process of sample collection during field investigations. This is very common in the collection of soil samples due to the inhomogeneous nature of the sample matrix.

3.5.2 Decision Criteria for Proposing a Course of Action Based on Organic Contaminants

The primary objective of the Appendix III RFI at Kirtland AFB was to characterize the nature and extent of contamination in site media, and to determine the overall environmental impact from any contaminant release to either soil or groundwater. Because of the shallow depth of soil borings (< 50 ft), this RFI was limited to soil investigation only. The soil was primarily analyzed for VOCs, SVOCs, diesel range organics (DRO), gasoline range organics (GRO), polynuclear aromatic hydrocarbons (PAH), and metals (discussed in Section 3.5.3). After characterizing the specific-site media, specific actions were proposed through the assessment of current site conditions. Three specific actions are typically associated with an RFI: NFA, resampling of environmental media to better define the extent of any contamination, or a Corrective Measures Study (CMS).

Figure 3-1 presents the decision criteria used to select a recommended course of action for the Appendix III RFI sites investigated. This decision criteria is based on the comparison between analytical soil results for a specific site and HHRB action levels. The standard approach to evaluate a site and to propose a further course of action is to use HHRB action levels for selected chemicals. If the specific site analytical results exceed the action levels, a CMS would be recommended. A NFA would be proposed for sites where analytical data are below the HHRB action levels and are not indicative of a release. Further investigation would be proposed if analytical results (indicative of a release) are below the HHRB action levels.

The HHRB action levels used for evaluation during this assessment are risk-based concentrations calculated for a residential scenario. These concentrations were obtained from the widely accepted EPA Region 3 Risk-Based Concentration Table (EPA, 1995). Action levels for DRO and GRO were taken from the New Mexico Environment Department Underground Storage Tank (UST) Regulations (NMED, 1991).



* No HHRB action level is applicable to GRO and DRO; state action level is the criteria to evaluate GRO and DRO concentrations

Figure 3-1. Decision Criteria for Proposing a Course of Action Based on Organic Contaminants

3.5.3 Decision Criteria for Proposing a Course of Action Based on Metal Contamination

The decision criteria for metals is more complex than that previously described for organic contamination because of the natural occurrence of metals in soil; it is difficult to distinguish between naturally occurring (background) concentrations and contamination. With the exception of arsenic, beryllium, and manganese, as discussed in Section 4.2.2, if metal results are in excess of HHRB action levels, a further investigation for a site would be proposed. Metal concentrations greater than two times the upper tolerance limit (UTL) and associated with organic concentrations not attributable to laboratory contamination would also result in proposing further investigation or a CMS at a site. Metal concentrations greater than two times the UTL but not associated with organic contamination were considered to be anomalous occurrences due to the nonhomogeneous nature of alluvial soil underlying Kirtland AFB.

4.0 Facility-Wide Results Summary

4.1 Overview of Contaminants Detected

More than 430 environmental samples were collected in the investigation of 122 wasteline sites during the Appendix III RFI. Table 4-1 lists the organic constituents, metals, and radiological isotopes detected in these samples. The table also includes the range of measured concentrations and the location of the maximum detected concentrations.

A variety of organic compounds was detected in samples collected during the RFI, most at concentrations less than 1 mg/kg. Based on a review of QC sample results, some organic compounds detected were attributed to field and laboratory contamination (Section 3.5.1.1). Hazardous organic constituents, detected at higher concentrations, were found at four sites: ST-221, lines associated with an OWS at a wash rack; ST-285 and ST-286, the west and east storm sewers, respectively, both of which collect runoff from areas where automotive and heavy equipment repair and maintenance, jet engine repair and maintenance, equipment washdown operations, and fueling operations occur; and ST-295, a leach field associated with a fire station septic tank. Details of specific contaminants detected and concentrations are discussed in site-specific investigation sections (Sections 5.0 through 10.0).

A summary of metals detected in environmental samples and the range of concentrations is presented in Table 4-1. Metals are discussed relative to Kirtland AFB site wide background levels in Section 4.2, and are subsequently addressed in site-specific sections, 5.0 through 10.0.

4.2 Statistical Analysis of Background Data

During the wasteline and non-wasteline portions of the Appendix III RFI, 78 background soil samples were collected at Kirtland AFB in areas away from any known or suspected contamination near the sites investigated. For the most part, metal concentrations in these samples are well below the calculated HHRB action levels (Table 4-2); however, beryllium, manganese, and arsenic are present in some samples at concentrations exceeding HHRB action levels. These results are consistent with background levels detected during the Stage 2B RFI (USAF, 1995). This section outlines the methodology used to determine background metal concentrations for the Appendix III RFI sites.

Background concentrations were calculated to distinguish naturally occurring metal concentrations from concentrations that may indicate contamination. Statistical analysis results are used to support the conclusion that concentrations of beryllium, manganese, and arsenic exceeding HHRB action levels are naturally occurring.

4.2.1 Methodology for Determining Background Concentrations

The upper tolerance limit (UTL) method of calculating an upper level of background concentrations (Lieberman, 1958) provides a useful benchmark for comparison purposes. Using this method, a concentration is calculated to separate expected background concentrations for a particular metal from those that indicate potential contamination. UTLs were calculated using all 70 background soil samples for which metal analyses were performed. These samples were collected basewide during the wasteline and non-wasteline portions of the Appendix III RFI. The basewide background approach was chosen

Table 4-1. Summary of Concentration Data for Constituents Detected in Soil, Appendix III Wasteline RFI (all concentrations in mg/kg)

Constituent	No. of Detections	Range	Mean	Median	Location of Maximum Value
Volatiles					
Acetone[a]	9	0.0031–0.064	0.032	0.017	ST-340C-03
Methyl ethyl ketone[a]	1	0.0048–0.0048	0.0048	0.0048	ST-247C-01
Methylene chloride[a]	127	0.0031–0.038	0.0083	0.007	ST-219C-01
Tetrachloroethene	1	0.029–0.029	0.029	0.029	ST-219C-02
Toluene	1	0.0047–0.0047	0.0047	0.0047	ST-247C-02
Trichloroethylene	2	0.007–0.007	0.007	0.007	ST-219C-02
M,p-xylenes, sum of isomers	2	0.056–0.13	0.093	0.093	ST-219C-01
O-xylene	2	0.037–0.061	0.049	0.049	ST-219C-01
Semivolatiles					
Acenaphthylene	1	0.6–0.6	0.6	0.6	ST-286C-02
Acenaphthene	3	2.3–24	9.8	3	ST-295C-02
Anthracene	3	3–24	10.1	3.2	ST-295C-02
Benzo(a)anthracene	5	0.54–44	11.3	3.2	ST-295C-02
Benzo(a)pyrene	5	0.48–41	10.6	3.2	ST-295C-02
Benzo(b)fluoranthene	5	0.42–46	11.7	3.2	ST-295C-02
Benzo(g,h,i)perylene	3	3–29	11.7	3.2	ST-295C-02
Benzo(k)fluoranthene	5	0.49–21	6.8	3.2	ST-295C-02
Benzyl butyl phthalate	24	0.35–25	1.9	0.78	ST-286C-03
Bis(2-ethylhexyl) phthalate[a]	23	0.35–3.2	1.2	0.71	ST-285C-03
Chrysene	5	0.58–51	22.1	10	ST-286C-02
Di-n-butylphthalate[a]	144	0.37–5	1.6	1.4	ST-278C-02
Di-n-octylphthalate[a]	1	0.64–0.64	0.64	0.64	ST-285C-02
Dibenz(a,h)anthracene	1	8.2–8.2	8.2	8.2	ST-295C-02
Dibenzofuran	3	0.96–12	5.32	3	ST-295C-02
Fluoranthene	8	0.55–140	54.0	9.7	ST-285C-01
Fluorene	3	1.9–20	8.3	3	ST-295C-02
Indeno(1,2,3-c,d) pyrene	3	3–26	10.7	3.2	ST-295C-02
2-Methylnaphthalene	7	0.49–7.4	3.2	3	ST-295C-02
Naphthalene	7	1.2–18	5	3	ST-295C-02
Phenanthrene	5	1.1–140	57.7	4	ST-285C-01
Phenol	11	0.39–1.4	0.79	0.82	ST-314C-03
Pyrene	7	0.46–130	53.1	19	ST-286C-02

Table 4-1. Summary of Concentration Data for Constituents Detected in Soil, Appendix III Wasteline RFI (all concentrations in mg/kg) (Continued)

Constituent	No. of Detections	Range	Mean	Median	Location of Maximum Value
Petroleum Hydrocarbons					
Diesel fraction	116	4.3–1600	66.3	7.7	ST-285C-03
Gasoline fraction	14	0.24–7500	538	0.29	ST-221C-07
Metals					
Aluminum	433	1050–20200	7490	7040	ST-299C-01
Antimony	10	0.51–4	1.2	0.73	ST-285C-03
Arsenic	416	0.4–12.5	3.1	2.8	ST-324C-01
Barium	433	22.5–2500	212	147	ST-211C-03
Beryllium	292	0.3–1.4	0.44	0.41	ST-299C-01
Cadmium	137	0.51–28.2	1.1	0.73	ST-285C-03
Calcium	433	551–218000	56900	43400	ST-287C-03
Chromium, total	433	1.7–116	9.1	6.7	ST-285C-03
Cobalt	433	1.4–26.8	6.0	4.8	ST-312C-02
Copper	433	5.3–928	50.6	28.7	ST-309C-02
Iron	433	2820–40000	10900	9340	ST-319C-03
Lead	433	1.5–902	13.1	4.7	ST-229C-08
Magnesium	433	524–20400	4770	4270	ST-312C-02
Manganese	433	36–1020	196	153	ST-319C-03
Mercury	25	0.08–4.7	0.36	0.12	ST-207C-04
Molybdenum	4	5.4–66	21.2	6.7	ST-314C-01
Nickel	418	2.1–334	11.2	6.25	ST-284C-03
Potassium	433	177–8410	1440	1250	ST-319C-03
Selenium	1	0.48–0.48	0.48	0.48	ST-295C-02
Silver	6	2.1–38.9	8.9	3.1	ST-309C-04
Sodium	433	33.8–1880	206	132	ST-324C-01
Thallium	137	0.1–0.63	0.15	0.14	ST-319C-03
Vanadium	433	5.1–71.9	26.8	24.8	ST-319C-03
Zinc	433	7.6–356	42.4	32.1	ST-285C-03
Radioactive Isotopes (concentrations in pCi/g)					
Gross alpha	2	14–15	14.5	14.5	ST-314C-07
Gross beta	4	21–24	22.5	22.5	ST-314C-07
Radium-226	4	0.6–1.2	0.85	0.8	ST-314C-06

a. Common laboratory contaminant

Table 4-2. Summary of Appendix III RFI Wasteline and Non-Wasteline Background Concentrations for Metals in Soil (all concentrations in mg/kg)

Metal	No. of Samples	No. of Detections	Range	Mean	Median	UTL	Proposed HHRB Action Level
Aluminum	70	70	1410–20200	7950	7780	14700	78000
Antimony	70	0	<0.255	N/A	N/A	N/A	31
Arsenic	70	68	0.31–12.5	3	2.65	6.5	0.37
Barium	70	70	23.2–1610	217	152	735	5500
Beryllium	70	59	0.155–1.4	0.47	0.42	0.84	0.15
Cadmium	70	25	<0.51–1.6	0.84	0.73	N/A[a]	39
Calcium	70	70	842–154000	48600	37550	121000	N/A
Chromium, total	70	70	1.8–35.4	9.4	7.3	21.6	390
Cobalt	70	70	1.5–20.7	7	5.95	15.4	4700
Copper	70	70	10.6–600	61	38.15	223	2900
Iron	70	70	3700–28200	12600	12100	23800	N/A
Lead	72	72	1.8–30.6	6.1	5.45	17.5	400
Magnesium	70	70	683–12500	5460	5210	10400	N/A
Manganese	70	70	53.5–675	249	210	549	390
Mercury	70	4	<0.04–0.24	0.16	0.13	N/A[a]	23
Molybdenum	66	2	<5.1–66	35.7	35.7	N/A[a]	390
Nickel	70	69	<2.1–659	26.2	8.3	188	1600
Potassium	70	70	269–4740	1710	1565	3590	N/A
Selenium	70	0	<0.205	N/A	N/A	N/A	390
Silver	70	0	<0.51	N/A	N/A	N/A	390
Sodium	70	70	49.6–1880	263	176.5	787	N/A
Thallium	70	27	<0.1–0.42	0.16	0.14	N/A[a]	N/A
Vanadium	70	70	7–63.8	30.3	29.4	55.3	550
Zinc	70	70	15.3–265	48.3	39.65	114	23000

a. Value not considered valid because of low number of detections

because of the need for at least three samples to calculate a UTL, and at least eight samples to calculate a meaningful UTL (EPA, 1989a). The disadvantage of combining all background samples is that spatial variability in the natural concentrations of metals may obscure site-specific elevated concentrations because of contamination. For example, if natural concentrations of a particular metal are high at the north end of the base but low at the south end, the calculated UTL could be too high to recognize potential contamination in southern sites. Conversely, some northern sites with concentrations above the UTL could be falsely identified as contaminated. Despite this disadvantage, the calculation of the UTL using all background values is the best approach because of the following:

- Vertical stratigraphic variability (including that resulting from excavation and fill activities during installation of the investigated units) can make direct comparison between site-specific background samples and other boreholes at the site inconclusive.
- No consistent horizontal variability in background concentrations of metals has been identified.
- In general, characteristics of Appendix III RFI sites suggest that metal contamination would be accompanied by organic contamination. This reduces the likelihood that significant metal contamination would go undetected.

It must be recognized that in comparison with the UTL, which is approximately the 95th percentile of the background concentration, about 5 percent of values can be expected to exceed the UTL within the background or other noncontaminated samples. With more than 430 environmental samples and 10,000 individual analyses for metals, comparison with the UTL yields a significant number of false positives.

4.2.2 Beryllium, Manganese, and Arsenic Concentrations

Beryllium, manganese, and arsenic were detected in numerous soil samples collected at Appendix III RFI sites across Kirtland AFB at levels approaching or exceeding the calculated HHRB action levels. Because of the presence of these three metals in elevated concentrations, several statistical analyses were performed during the Stage 2B RFI to determine whether these were possibly the result of contamination (USAF, 1995):

- T-test comparison between background metals values and those from individual sites.
- Correlation between metals concentrations and depth.
- Correlation between metals concentrations and TPH concentrations.

These tests indicated that concentrations of beryllium, manganese, and arsenic above HHRB action levels were naturally occurring. Appendix III RFI background sampling results are similar to those from the Stage 2B RFI (Table 4-3) lending further support to this conclusion. Because of the similarity between Stage 2B RFI and Appendix III RFI results, these statistical analyses were not performed on Appendix III RFI data.

Table 4-3. Comparison of Stage 2B (Appendix II) and Appendix III RFI Background Concentrations for Arsenic, Beryllium, and Manganese (all concentrations in mg/kg)

Metal	Investigation	Range	Mean	Median	UTL
Arsenic	Stage 2B	<3–11.9	3.7	3	7.7
	Appendix III	0.58–12.5	2.9	2.6	6.5
Beryllium	Stage 2B	<0.01–0.92	0.47	0.44	0.82
	Appendix III	0.22–1.4	0.43	0.41	0.84
Manganese	Stage 2B	3.2–528	237	229	435
	Appendix III	53.5–675	252	216	551

4.2.3 Organic Constituents

Kirtland AFB personnel sampled background soil for organic constituents. Diesel fraction hydrocarbons were detected in 32 percent of these background samples at a median concentration of 8.5 mg/kg. While the source of these concentrations has not been specifically identified, it is probably unrelated to possible releases from SWMUs given the placement of background borings 50 ft or more from the SWMUs and the high incidence of detection in background samples. These results point to a ubiquitous TPH presence (probably from naturally occurring organics in the soil), or laboratory-related contamination or artifacts of analysis. In general, TPH concentrations up to 10 mg/kg range were not considered, by themselves, as evidence of a release from the SWMU and are well below the 100 mg/kg NMED TPH action level.

4.3 Nature of Contamination

The sites investigated in the Appendix III RFI consisted primarily of the lines servicing OWSs, waste oil and fuel USTs, area drains associated with aircraft and vehicle maintenance, and the sanitary sewer and septic systems. Potential contaminants consist primarily of petroleum hydrocarbon fuels, VOCs, SVOCs (including PAHs and phthalates which are fuel combustion residuals), and metals.

Details of the nature of contamination are presented on a site-specific basis in Sections 5.0 through 10.0. Each subsection contains an analytical result summary of the organic and inorganic compounds detected in environmental samples collected during the 1995 investigation at that site. Full analytical results for all environmental samples collected at Kirtland AFB are provided as Appendix F.

4.3.1 Fate and Transport

The fate and transport of site contaminants are determined on the basis of various chemical and physical properties. Literature or calculated values for such properties as specific gravity, vapor pressure, and solubility can indicate a contaminant's potential interaction with other environmental media (e.g., soil, water, and air), particularly if site-specific lithology and soil properties are known.

This section contains general discussions about physical properties of contaminants detected during site investigations at Kirtland AFB, and the fate and transport for related classes of chemicals detected. Site-specific discussions of contaminants detected and release mechanisms are provided in the appropriate site investigation sections.

4.3.1.1 Chemical and Physical Properties of Detected Contaminants

Organic constituents, including petroleum hydrocarbons, VOCs, and SVOCs were detected in samples collected during the Appendix III RFI. Petroleum hydrocarbons were measured in environmental soil samples from five sites at concentrations greater than 100 mg/kg and up to 7,500 mg/kg. All VOC concentrations were less than 1 mg/kg. SVOCs detected at maximum concentrations of greater than 1 mg/kg were acenaphthene (24 mg/kg), anthracene (24 mg/kg), benzo(a)anthracene (44 mg/kg), benzo(a)pyrene (41 mg/kg), benzo(b)fluoranthene (46 mg/kg), benzo(g,h,i)perylene (29 mg/kg), benzo(k)fluoranthene (21 mg/kg), benzyl butyl phthalate (25 mg/kg), bis(2-ethylhexyl)phthalate (3.2 mg/kg), chrysene (51 mg/kg), di-n-butylphthalate (5 mg/kg), dibenz(a,h)anthracene (8.2 mg/kg), dibenzofuran (12 mg/kg), fluoranthene (140 mg/kg), fluorene (20 mg/kg), indeno(1,2,3-c,d)pyrene (26 mg/kg), 2-methylnaphthalene (7.4 mg/kg), naphthalene (18 mg/kg), phenanthrene (140 mg/kg), phenol (1.4 mg/kg), and pyrene (130 mg/kg). Low-level (<1 mg/kg) organic constituents detected in environmental samples at three or more sites were: acetone, methyl ethyl ketone, methylene chloride, tetrachloroethylene, toluene, trichloroethylene, m,p-xylenes, o-xylene, acenaphthylene, and di-n-octylphthalate. Metals detected above calculated HHRB action levels were beryllium, manganese, and arsenic (these concentrations are addressed in Section 4.2.2).

Chemical and physical properties for all organic constituents detected at Kirtland AFB are provided in Table 4-4. Properties for the inorganic constituents detected are summarized in Table 4-5. A brief summary of each property (e.g., specific gravity, solubility, etc.) and its significance to the fate and transport of the identified compounds or compound class is given below. Many properties are water-related and may not impact the current investigation; however, they are presented for information as they may be considered during a CMS in reference to site-specific constituents.

Specific Gravity

Specific gravity is temperature dependent and is the ratio of the weight of a given volume of chemical (in its pure state) to the weight of distilled water at the same volume. Constituents having specific gravities <1 will float, while compounds with specific gravities >1 will sink. This property can be used to help predict the interaction of compounds in groundwater and soil moisture. Soil was the medium investigated during the Appendix III RFI.

Of all the organic compounds detected in the soils at the 16 Kirtland AFB sites recommended for further investigation or a CMS in this study, those having specific gravities less than one include acetone, toluene, ethylbenzene, xylenes, and bis(2-ethylhexyl)phthalate. These compounds will have a greater tendency to volatilize and impact air quality; however, worst case soil concentrations should result in negligible air quality impact.

Vapor Pressure

Vapor pressure is temperature dependent and is the amount of pressure exerted on the atmosphere by a compound in its gaseous state. This property is a measure of a compound's ability to volatilize. A compound with a higher vapor pressure is more volatile than a compound with a lower vapor pressure. Vapor pressure is important when evaluating the migration of contaminants from environmental interfaces (e.g., soil/air). Inorganics are not considered volatile. Halogenated aliphatic hydrocarbons, ketones, and monocyclic aromatics are more volatile than PAHs.

Table 4-4. Environmental Fate and Transport Parameters for Organic Compounds

CAS Number	Chemical	Molecular Weight[a,b,d,e] (g/mole)	Specific Gravity[b,d] (20/4°C)	Vapor Pressure[a,d,e] (mm Hg @ 20°C)	Water Solubility[a,d,e] (mg/l @ 20°C)	Octanol/Water Partition Coefficient[e] (K_{ow})	Organic Carbon Partition Coefficient[e] (K_{oc})	Henry's Law Constant[e] (atm-m^3/mole)	BCF[a] (L/kg)
Halogenated Aliphatic Hydrocarbons									
75-09-2	Methylene chloride	84.93	1.327	362	20,000	20	8.8	2.03×10^{-3}	5
127-18-4	Tetrachloroethylene	165.83	1.626	18	150	398	364	2.59×10^{-2}	30.6
Ketones									
67-64-1	Acetone	58.08	0.7899	270	1.0×10^{-6}	0.57	2.2	2.06×10^{-5}	N/A
78-93-3	Methyl ethyl ketone	72.11	0.8054	77	268,000	1.95	1.8	2.74×10^{-5}	0
591-78-6	2-Hexanone	100.16	0.8113	2	35,000	24	75	1.75×10^{-3} [b]	N/A
108-10-1	Methyl isobutyl ketone	100.16	0.7978	10	19,100	15.4	113	1.49×10^{-5} [b]	N/A
Monocyclic Aromatics									
108-90-7	Chlorobenzene	112.56	1.1058	11.7	466 (25°C)	690	330	3.72×10^{-3}	10.3
100-41-4	Ethylbenzene	106.16	0.8670	7	152	1,412	1,100	6.43×10^{-3}	37.5
95-50-1	1,2-Dichlorobenzene	147	1.3048	1.0	100	3.6×10^{3}	1.7×10^{3}	1.93×10^{-3}	N/A
541-73-1	1,3-Dichlorobenzene	147	1.2884	2.28 (25°C)	123 (25°C)	3.6×10^{3}	1.7×10^{3}	3.61×10^{-3}	N/A
106-46-7	1,4-Dichlorobenzene	147	1.2475	1.18 (25°C)	79 (25°C)	3.6×10^{3}	1.7×10^{3}	3.1×10^{-3}	N/A
108-88-3	Toluene	92.13	0.8669	28	534.8 (25°C)	537	300	6.66×10^{-3}	10.7
108-95-2	Phenol	94.11	1.070	0.341 (25°C)	93,000(25°C)	29	14.2	4.54×10^{-7}	1.4
1330-20-7	Xylenes	106.16	0.870	10	998	1,820	240	7.04×10^{-3}	N/A
Phthalate Esters									
84-74-2	Di-n-butylphthalate	278.3	1.0465	1.0×10^{-5} (25°C)	13 (25°C)	398,000	170,000	2.82×10^{-7}	89
117-84-0	Di-n-octylphthalate	390.57	0.978	1.4×10^{-4}	3.0 (25°C)	7.4×10^{9}	3.6×10^{9}	1.7×10^{-5}	N/A
117-81-7	Bis(2-ethylhexyl) phthalate	391	0.99 (20/20°C)	2×10^{-7}	0.4 (25°C)	4.1×10^{9}	2.0×10^{9}	3×10^{-7}	130

Table 4-4. Environmental Fate and Transport Parameters for Organic Compounds (Continued)

CAS Number	Chemical	Molecular Weight[a,b,d,e] (g/mole)	Specific Gravity[b,d] (20/4°C)	Vapor Pressure[a,d,e] (mm Hg @ 20°C)	Water Solubility[a,d,e] (mg/l @ 20°C)	Octanol/Water Partition Coefficient[e] (K_{ow})	Organic Carbon Partition Coefficient[e] (K_{oc})	Henry's Law Constant[e] (atm-m^3/mole)	BCF[a] (L/kg)
Polynuclear Aromatic Hydrocarbons (PAHs)									
83-32-9	Acenaphthene	154.2	N/A	1.55×10^{-3} (25°C)	3.42 (25°C)	9.6×10^{3}	4.6×10^{3}	9.1×10^{-5}	N/A
120-12-7	Anthracene	178.23	1.283 (25/4°C)	1.95×10^{-4} (25°C)	1.3 (25°C)	2.8×10^{4}	1.4×10^{4}	8.6×10^{-5}	N/A
191-24-2	Benzo(g,h,i)perylene	276	N/A	1.03×10^{-10} (25°C)	2.6×10^{-4} (25°C)	3.2×10^{6}	1.6×10^{6}	1.44×10^{-7}	N/A
207-08-9	Benzo(k)fluoranthene	252.32	N/A	9.6×10^{-11}	5.5×10^{-4} (25°C)	1.15×10^{6}	5.5×10^{5}	3.87×10^{-5}	N/A
53-70-3	Dibenzo(a,h)anthracene	278.35	1.282	1.0×10^{-10} (25°C)	5.0×10^{-4} (25°C)	6.9×10^{6}	3.3×10^{6}	7.3×10^{-8}	N/A
193-39-5	Indeno(1,2,3-cd)pyrene	276.34	N/A	1.0×10^{-10} (25°C)	6.2×10^{-2}	3.2×10^{6}	1.6×10^{6}	6.95×10^{-8}	N/A
56-55-3	Benzo(a)anthracene	228.3	1.274	2.2×10^{-8}	5.7×10^{-3}	3.98×10^{7}	1.36×10^{6}	1×10^{-6}	30
50-32-8	Benzo(a)pyrene	252	1.351	5.6×10^{-9} (25°C)	3.8×10^{-3} (25°C)	1.15×10^{6}	5.5×10^{6}	4.9×10^{-7}	30
205-99-2	Benzo(b)fluoranthene	252.3	N/A	5×10^{-7}	0.014 (25°C)	1.15×10^{6}	550,000	1.22×10^{-5}	30[c]
218-01-09	Chrysene	228.3	1.274	6.3×10^{-9} (25°C)	1.8×10^{-3} (25°C)	410,000	200,000	1.05×10^{-6}	30[c]
206-44-0	Fluoranthene	202.3	1.252	5×10^{-6}	0.26 (25°C)	79,000	38,000	6.5×10^{-6}	1,150
86-73-7	Florene	116.2	1.202	7.1×10^{-4}	1.69 (25°C)	15,800	7,300	6.4×10^{-5}	1,500
91-57-6	2-Methylnaphthalene	142.2	1.0058	10 (105°C)	26 (25°C)	0.46	2.2/3.82	4.99×10^{-4}	N/A
91-20-3	Naphthalene	128.2	1.162	0.087 (25°C)	31.7 (25°C)	1,950	940	4.6×10^{-4}	10.5
85-01-08	Phenanthrene	178.2	0.9800	6.8×10^{-4}	1.00 (25°C)	28,800	14,000	1.59×10^{-4}	2630
129-00-0	Pyrene	202.3	1.271 (23/4°C)	2.5×10^{-6} (25°C)	0.13 (25°C)	75,900	38,000	5.04×10^{-6}	30[c]

Table 4-4. Environmental Fate and Transport Parameters for Organic Compounds (Concluded)

CAS Number	Chemical	Molecular Weight[a,b,d,e] (g/mole)	Specific Gravity[b,d] (20/4°C)	Vapor Pressure[a,d,e] (mm Hg @ 20°C)	Water Solubility[a,d,e] (mg/l @ 20°C)	Octanol/Water Partition Coefficient[e] (K_{ow})	Organic Carbon Partition Coefficient[e] (K_{oc})	Henry's Law Constant[e] (atm-m^3/mole)	BCF[a] (L/kg)
Pesticide Organic Compounds									
72-54-8	4,4'-DDD	320	1.476	1.0×10^{-6} (30°C)	1.6×10^{-1} (24°C)	1.6×10^{6}	7.7×10^{5}	2.2×10^{-5}	N/A
72-55-9	4,4'-DDE	318	N/A	6.5×10^{-6}	0.04	9.1×10^{6}	4.4×10^{6}	2.3×10^{-5}	N/A
50-29-3	4,4'-DDT	354.5	1.56 (15/4°C)	1.9×10^{-7} (25°C)	1.0×10^{-3} (25°C)	8.1×10^{6}	3.9×10^{6}	3.89×10^{-5}	N/A
Miscellaneous Organic Compounds									
132-64-9	Dibenzofuran	168.1	1.09	N/A	<1	4,000	11,000	N/A	1,350
75-15-0	Carbon disulfide	76.14	1.263	360	2,940	100	54	1.23×10^{-2}	0

N/A Not Available
a Superfund Public Health Evaluation Manual, 1986.
b Handbook of Chemistry and Physics, 1995.
c The Bioconcentration Factor (BCF) for this PAH is assumed to be the same as the BCF for benzo(a)pyrene.
d Handbook of RCRA Ground-Water Monitoring Constituents: Chemical & Physical Properties (Appendix IX to 40 CFR 264), EPA, 1992.
e Aquatic Fate Process Data for Organic Priority Pollutants (EPA, 1982).

Table 4-5. Environmental Fate And Transport Parameters For Inorganic Compounds

Analyte	Molecular Weight (g/mole)	Soil/Water Distribution Coefficient (K^d)[a] (ml/g)	Bioconcentration Factor (BCF)[b] (L/kg)
Antimony	121.75	N/A	N/A
Arsenic	74.92	1.0–8.3	44
Barium	137.34	N/A	N/A
Beryllium	9.01	N/A	19
Cadmium	112.4	1.3–27	64
Chromium (total)	52	470–150,000	16
Cobalt	58.93	0.2–3,800	N/A
Copper	63.54	1.4–333	36
Lead	207.19	4.5–7,640	N/A
Manganese	54.94	0.2–10,000	N/A
Mercury	200.59	10	N/A
Nickel	58.71	N/A	N/A
Thallium	204.37	N/A	116
Vanadium	50.94	N/A	N/A
Zinc	65.38	0.1–8,000	47

N/A Not Available.

a Distribution ranges are presented (Dragun, 1988).

b The BCF for each chemical reported as N/A is assumed to be 1.0 (EPA, 1991).

Solubility

Solubility is the maximum amount of mass of an organic compound or element that will dissolve into a given volume of solvent or water. The rate at which a constituent is leached by infiltrating precipitation is directly proportional to its water solubility. More soluble compounds/elements are more readily leached than less soluble chemicals.

Most of the volatile organics detected at Kirtland AFB, especially methyl ethyl ketone, 2-hexanone, and methyl isobutyl ketone, are highly soluble compared to PAH compounds.

Octanol/Water Partition Coefficient

The octanol/water partition coefficient (K_{ow}) is a measure of the extent of partitioning between octanol and water at equilibrium. The K_{ow} can be used to predict the bioconcentration of a chemical in aquatic organisms since a linear relationship exists between the K_{ow} and the uptake of chemicals by fatty tissues of animals and humans (Lyman *et al.,* 1990). The K_{ow} is also useful in characterizing the sorption of compounds by organic soil where experimental values are not available. Generally, chemicals with higher K_{ow} values prefer the sorbed phase rather than the dissolved phase.

Of all the organic compounds detected in environmental media at Kirtland AFB, benzene-related compounds and PAHs have the highest octanol/water partitioning coefficients.

Organic Carbon Partition Coefficient

The organic carbon partition coefficient (K_{oc}) defines the extent of partitioning between organic carbon and water at equilibrium. The K_{oc} can be used to predict the rate of mobility of a contaminant in groundwater. Those chemicals with higher K_{oc} values are more inclined to bind to organic soil and sediment.

Several PAHs and monocyclic aromatics were detected in the soil at Kirtland AFB. The K_{oc} values for these chemicals are relatively high; therefore, these contaminants are expected to be less mobile in the environment.

Henry's Law Constant

The Henry's Law constant, which is the ratio of the vapor pressure and water solubility, is a measure of the extent of partitioning between air and water at equilibrium. This property characterizes the volatility of a particular chemical and can be used to determine the likelihood of migration of groundwater and surface water contaminants to the surrounding atmosphere. Chemicals with higher Henry's Law constants are more volatile; chemicals with Henry's Law constants greater than 5×10^{-3} are expected to be found in the atmosphere or the soil gas.

Ethylbenzene, toluene, benzene, tetrachloroethylene, and trichloroethylene are soil contaminants at Kirtland AFB which have relatively high vapor pressures and Henry's Law constants greater than 5×10^{-3}. These compounds are expected to migrate through the soil as soil gas.

Bioconcentration Factor

The bioconcentration factor (BCF) is the ratio of aquatic-animal-tissue concentration to water concentration and is both chemical- and species-specific. BCFs indicate the ability of a chemical to accumulate in living tissue. The higher the BCF the greater the accumulation. When site-specific values are not measured, literature values are used or the BCF is estimated from the K_{ow}.

Distribution Coefficient

The distribution coefficient (K_d) is a measure of the equilibrium partitioning between soil and water of a chemical or ion. The distribution of organic chemicals is a function of both the K_{oc} and the amount of organic carbon in soil. The K_d for an inorganic constituent present in its ionic state is the ratio of the concentration adsorbed on soil surfaces to the concentration in water. Coulomb's Law predicts that the ion with the smallest hydrated radius and the largest charge will be preferentially accumulated over ions with larger radii and smaller charges. Consequently, the K_d values for metals can vary greatly depending on ionic states and the amount of organic carbon in the soil. Elements with higher K_d values are more likely to bind to soil rather than disperse or dissolve in water.

4.3.1.2 Persistence of Detected Contaminants

The persistence of various classes of organic compounds identified above and in site-specific discussions (Sections 5.0 through 10.0) are included in this section. Several transformation and release mechanisms affect contaminant persistence (e.g., hydrolysis, photolysis, biodegradation, volatilization, oxidation/ reduction). The following general classes of organic compounds and elements are discussed:

- Halogenated aliphatic hydrocarbons.
- Ketones.
- Monocyclic aromatics.
- Phenols.
- Phthalate esters.
- Polynuclear aromatic hydrocarbons.
- Inorganics.

Halogenated Aliphatic Hydrocarbons

The presence of halogenated solvents including trichloroethylene and tetrachloroethylene is apparently related to their former use on the base in vehicle and fuel system cleaning and maintenance. Volatilization is an important mechanism of contaminant release when discussing this class of chemicals. The life of trichloroethylene and tetrachloroethylene is 3 to 5 months in a reducing atmosphere, under anaerobic bacterial activity, where they degrade to isomers of dichloroethene, trichloroethane, tetrachloroethane, dichloroethane, and finally vinyl chloride, which is the most persistent (approximately

10 years). However, in arid, basic soils at Kirtland AFB, the degradation process is significantly impeded (Lyman *et al.,* 1990), accounting for the limited detection of degradation products.

Ketones

Ketones are highly soluble in water. Volatilization of ketones is significant. The volatilization from soil depends on vapor pressure, while the volatilization from water depends on Henry's Law constant. Biodegradation is an important fate process for acetone in soil. It should be noted that most ketones detected in environmental samples were at very low concentrations and were probably the result of laboratory contamination (e.g., acetone and related impurities and breakdown products from sample preparation, methyl ethyl ketone, methyl isobutyl ketone, 2-hexanone).

Monocyclic Aromatics

Monocyclic aromatics such as benzene, toluene, ethylbenzene, and xylenes are not considered to be persistent compounds in the environment compared to PAHs and metals. In general, the most significant fate process for these compounds is volatilization or microbial degradation. The biodegradation of these compounds in the soil matrix is dependent on the abundance of microflora, macronutrient availability, soil pH, and temperature. While these compounds are amenable to microbial degradation, it is not anticipated that degradation will occur naturally at an appreciable rate as the arid soil characteristics at Kirtland AFB do not readily support natural degradation.

Phenols

Nonhalogenated phenolic compounds are relatively susceptible to biodegradation in unsaturated soil. The presence of phenols in the environment is relatively uncommon because their use is limited, they have a high solubility in water, and they demonstrate high susceptibility to microbial degradation. Phenols may have been used at Kirtland AFB in the past for various aircraft maintenance activities, predominantly as a paint remover.

Phthalate Esters

Phthalate esters are considered to be relatively persistent environmental contaminants and are usually detected at very high concentrations associated with industrial landfills. However, they are also common laboratory contaminants, which is the more probable cause for the low levels detected in Appendix III RFI samples. Although numerous studies have demonstrated that phthalate esters undergo biodegradation, the process is slow. Certain microorganisms have been shown to excrete products that increase the solubility of phthalates and enhance their biodegradation (Gibbons and Alexander, 1989). Biodegradation is an important fate mechanism, as is bioaccumulation. Hydrolysis of phthalate esters is slow, with calculated half-lives of 3 to 2,000 years (bis-2(ethylhexyl)phthalate) (EPA, 1979). Similarly, photolysis is considered to be an insignificant degradation mechanism (EPA, 1982).

Polynuclear Aromatic Hydrocarbons

PAHs are common constituents of oil and grease. Solubilities of PAHs are generally low. Volatilization from a given media is a more significant fate process for PAHs with low molecular weights (e.g., fluorene, fluoranthene, phenanthrene) than for higher molecular weight PAHs (such as

benzo(a)anthracene). Once PAHs have become entrained in organic matter in soil, they become less mobile in the environment. PAHs do not contain functional groups susceptible to hydrolytic interaction, making hydrolysis an insignificant mechanism. While susceptible to photolytic degradation, subsurface contamination precludes natural photolysis. Studies have demonstrated that PAHs are amenable to microbial degradation in soil matrices (EPA, 1979). PAH concentration levels are low and were detected at a limited number of sites investigated. Since it is probable that nutrient availability at contaminated sites is low, microbial populations may be small.

Inorganics

Metals are considered to be persistent contaminants in soil and sediment matrices. Adsorption to organic matter in soil is indicated by K_d values. Lead is the most strongly adsorbed inorganic. The relative retention of several metals in soil is, from most to least; lead, antimony, copper, chromium, zinc, nickel, cobalt, cadmium.

Inorganics can become soluble and may leach into groundwater under certain conditions (i.e., low pH of the leaching solution and low organic matter content of soil). Specific conditions increasing the possibility of the leaching of inorganic analytes include high contaminant concentrations, the presence of soluble chelating agents, and acid rain. High soil pH and predominantly low or absent organic contaminants at a site would seem to preclude leaching of any inorganic contaminants. The geology at Kirtland AFB is variable and the soil is naturally enriched with heavy metals including arsenic, beryllium, and uranium (New Mexico Bureau of Mines and Mineral Resources, 1994).

5.0 Oil/Water Separator, Sediment Trap, and Holding Tank Inflow and Outflow Lines

This section of the RFI Report addresses the investigation of the surrounding soil inflow and outflow lines at 46 OWS units, two sediment trap units, and five holding tanks at Kirtland AFB. All but five of the units are still active. Discharge from the OWS and sediment trap units is either to the sewer (sanitary or storm) or to holding tanks. The inflow and outflow lines serving these units have been identified as potential sources to soil contamination if line leaks were present.

OWSs are used throughout Kirtland AFB to remove liquids with different specific gravities than water. These liquids include oils, solvents, and lubricants. The OWSs receive wastewater from wash racks, shop areas, aircraft and vehicle maintenance facilities, cleaning facilities, and runoff from waste and material storage areas. The subnatant (water) from these separators is discharged to the sewer (sanitary or storm) or holding tanks. The accumulated oily wastewater may contain JP-4 fuel, motor oil, hydraulic fluid, cleaning solvents, detergents, and paint thinners. The accumulated oil (supernatant) is either periodically pumped out and disposed of by a subcontractor or is discharged to a storage tank for reuse or disposal.

There are two sediment traps classified as SWMUs at the base. The sediment traps are located in the concrete apron east of Building 333. Each trap discharges to an OWS and the lines are located in the urban/industrial zone. The sediment trap lines could carry such contaminants as mineral base hydraulic fluids, reciprocating aircraft engine oils, Argas 100LL, battery spillage, lubricants, solvents, degreasers, and cleaners.

Five holding tanks, classified as SWMUs, are in the industrial areas served by sanitary sewer A. Reportedly the holding tanks do not discharge to the sanitary sewer, but are vacuumed as necessary, and the contents are shipped offsite for recycling, treatment, and/or disposal. The tanks, underground and in-ground units, are normally adjacent to or near OWSs and are used to store the oil-phase from the units. It is believed the lines from the OWS units to the holding tanks need further investigation.

The OWS, sediment trap, and holding tank units were addressed in the Stage 2B Work Plan (USAF, 1993c). This document addresses only the inflow and outflow lines and outlines an investigation plan that consists of soil borings and soil samples in the immediate vicinity of the units. Subsections 5.1 through 5.53 contain information on the OWS, sediment trap, and holding tank inflow and outflow lines. Each subsection contains a description of each site, its environmental setting, historical analytical information from previous sampling events, data gaps, work plan, and rationale.

The general investigative plan for the inflow and outflow lines is shown on Figure 5-1. The RFI Appendix III procedure is to determine the length of the inflow and outflow lines. Initially, if the lines are less than 50 ft long, the results of the Stage 2B RFI work will be used to characterize the site. However, if the lines are greater than 50 ft long, subsurface soil samples will be collected. If little or no contamination is detected during the field sampling (where lines are longer than 50 ft) or no contamination is detected during the Stage 2B RFI field sampling (where lines are less than 50 ft long), No Further Action (NFA) will be proposed. If, however, contamination is detected, either additional investigation or a Corrective Measures Study will be performed to define the nature and extent of contamination.

Summary information about the OWS, site locations, sediment trap, and holding tank inflow and outflow lines is presented in Table 5-1; general site locations are also shown on Figure 1-3. Maps of each specific site where subsurface samples were collected (inflow and outflow lines) are presented in this section.

Figure 5-1.
Investigative Plan for Oil/Water Separator,
Sediment Trap, and Holding Tank Inflow and Outflow Lines

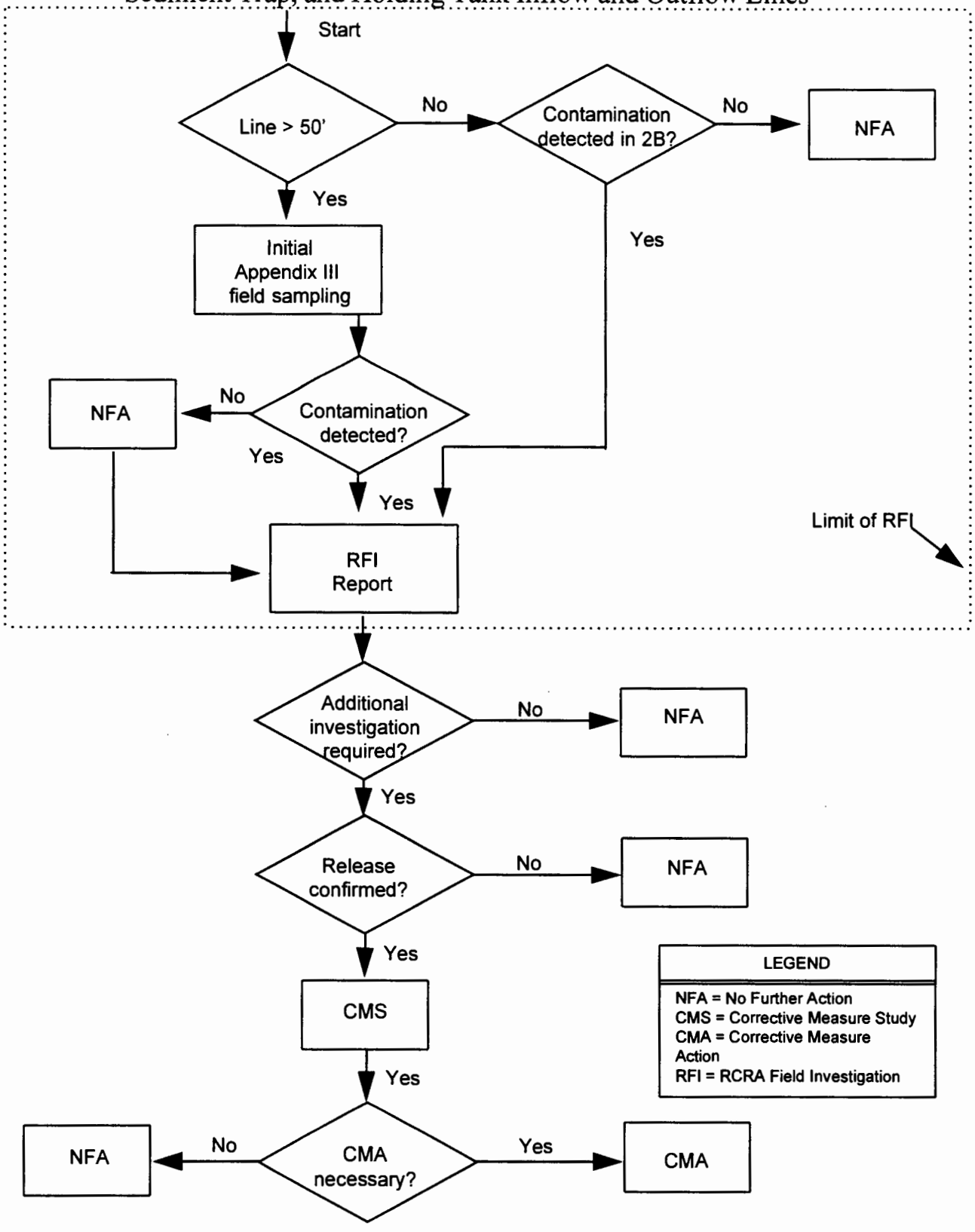


Table 5-1. Summary of Appendix III RFI OWS, Sediment Trap, and Holding Tank Inflow and Outflow Lines

SWMU No.	Kirtland AFB No.	Unit Name	Location	Use	Inflow Line Length	Outflow Line Length
8-5	ST-201	Building 255 OWS lines	Outside, 70 ft SW of Building 255, in fuels dispatch area	Active underground unit serving the tanker truck parking area S of Building 255	~10 ft	100 ft N
10-7	ST-202	Buildings 333/334 sediment trap lines	Outside, ~50 ft E of Building 333, NE of Aero Club maintenance shop	Active underground unit serving the flightline ramp	N/A Receives surface flow	~10 ft to ST-203
10-7	ST-203	Building 334 OWS lines	Outside, ~50 ft E of Building 334, NE of Aero Club maintenance shop	Active underground unit serving the flightline ramp (via ST-202) and possibly Building 333	~10 ft from ST-202	~10 ft N to west storm sewer lateral (ST-285)
10-7	ST-204	Building 334 OWS lines	Outside, ~120 ft E of Building 334	Active underground unit serving the flightline ramp	~10 ft from ST-205	~10 ft N to west storm sewer lateral (ST-285)
10-7	ST-205	Building 334 sediment trap lines	Outside, ~120 ft E of Building 334, NE of Aero Club maintenance shop	Active underground unit serving the flightline ramp	Receives surface flow from flightline ramp	~10 ft to ST-204
10-7	ST-206	Building 336 OWS lines	Outside, ~12 ft N of NW corner of Building 336, AC jet engine shop	Out-of-service underground unit formerly connected to the W floor drains in Building 336	~300 ft from Building 336	~25 ft SE to west storm sewer
10-7	ST-207	Building 336 OWS lines	Outside, ~25 ft NE of NE corner of Building 336, jet engine shop	Active underground unit connected to E floor drains of Building 336, jet engine shop	~415 ft from Building 336	~20 ft W, to sanitary sewer A

Table 5-1. Summary of Appendix III OWS, Sediment Trap, and Holding Tank Inflow and Outflow Lines (Continued)

SWMU No.	Kirtland AFB No.	Unit Name	Location	Use	Inflow Line Length	Outflow Line Length
10-7	ST-208	Building 336 OWS Lines	Outside, ~1 ft N of Building 336	Active underground unit; drop box on outflow line from wash rack inside Building 336	~80 ft from ST-206	~150 ft NE to ST-285, west storm sewer
10-7	ST-210	Building 377 OWS Lines	Outside, ~10 ft NW of Building 377, fuel tanker maintenance shop	Active underground unit serving area drains in Buildings 377/378	~40 ft from Building 377 and ~155 ft from Building 378	~100 ft NE to ST-278, storm sewer
10-7	ST-211	Building 381 OWS lines	Outside, ~30 ft E of Building 381, AGE Shop	Active underground unit serving ST-213 (wash rack drain) on parking lot E of 381	~165 ft from ST-213	Formerly discharged ~200 ft S to ST-235, west storm sewer; now discharges ~100 ft E to ST-270, sanitary sewer A
10-7	ST-212	Building 381 OWS lines	Outside, ~7 ft S of Building 381, AGE Shop	Active underground unit serving area trench drain inside Building 381	~10 ft from Building 381; distance to source drains is 60 ft	~250 ft E to ST-278, sanitary sewer A
10-7	ST-215	Building 471 OWS lines	Inside, centrally located in the middle bay of Building 471, a former service station	Removed underground dual compartment unit, formerly serving the garage bays of Building 471	No inflow pipe; unit captured surface spills and washdowns from area drain	~60 ft SW to ST-278, sanitary sewer A

Table 5-1. Summary of Appendix III OWS, Sediment Trap, and Holding Tank Inflow and Outflow Lines (Continued)

SWMU No.	Kirtland AFB No.	Unit Name	Location	Use	Inflow Line Length	Outflow Line Length
10-7	ST-216	Building 471 OWS lines	Inside, at S portion of bay in Building 471, a former service station	Removed underground unit formerly serving the garage bay of Building 471	No inflow pipe; unit captured surface spills and washdowns from area drain	15 ft to the discharge line of ST-215
10-7	ST-217	Building 481 OWS lines	Outside, ~5 ft NE of Building 481	Out-of-service underground unit previously serving the hangar area of Building 481	Inflow line network ~700 ft line length	~50 ft N to the sanitary sewer
10-7	ST-218	Building 482 OWS lines	Outside, immediately adjacent and N to Building 482	Active underground unit serving the hangar area of Building 482	Inflow line network ~700 ft	~10 ft N to ST-278, sanitary sewer A
10-7	ST-219	Buildings 481/482 OWS lines	Outside, adjacent to the flightline between Buildings 481/482	Removed underground unit serving flightline area between Buildings 481/482	65 ft S from area drain; 55 ft E from area drain	~10 ft N to the sanitary sewer
8-13	ST-221	Buildings 1001/1002 OWS Lines	Outside, on the flightline between Buildings 1001/ 1002	Active underground unit serving wash rack area between Buildings 1001/ 1002	~400 ft N	~10 ft E to a gate valve tied into ST-278, sanitary sewer A, and ST-325, central storm sewer
10-7	ST-222	Building 1031 OWS lines	Outside, between Building 1031 and the AC Engine Test Cell	Active underground unit serving drain ST-224 and Building 1031	~45 ft from ST-224 and ~20 ft from Building 1031	6.7 ft SE to ST-225 and 8 ft S to ST-223

Table 5-1. Summary of Appendix III OWS, Sediment Trap, and Holding Tank Inflow and Outflow Lines (Continued)

SWMU No.	Kirtland AFB No.	Unit Name	Location	Use	Inflow Line Length	Outflow Line Length
10-7	ST-225	Building 1031 holding tank lines	Outside, between Building 1031 and the AC Engine Test Cell	Active underground unit receiving oil-phase discharge from OWS ST-222	6.7 ft NE from ST-222	No discharge
10-7	ST-226	Building 1037 OWS lines	Outside, ~16 ft N of Building 1037, a fuel systems maintenance facility	Active underground, 3-compartment unit serving Building 1037	~25 ft from floor drains inside Building 1037	Oil-phase discharge 9 ft SE to holding tank ST-227; water-phase discharge ~150 ft to the east to ST-278 sanitary sewer A
10-7	ST-227	Building 1037 holding tank lines	Outside, ~6 ft N of Building 1037, a fuel systems maintenance facility	Active underground receiving oil-phase discharge from ST-226	~10 ft NW from ST-226	No discharge
10-7	ST-230	Building 1046 OWS lines	Outside, ~3.6 ft W of Building 1046, NMANG Weapons Shop	Active underground unit serving Building 1046	50 ft E from area drain in hazardous materials storage unit	~25 ft W to ST-231 and 25 ft NW to ST-232
10-7	ST-231	Building 1046 holding tank lines	Outside, ~30 ft W of Building 1046, NMANG Weapons Shop	Active underground unit receiving oil-phase discharge from ST-230	~25 ft to the E from ST-230	No discharge
10-7	ST-234	Building 1051 OWS lines	Outside, ~10 ft E of Building 1051	Active underground unit serving area drains ST-228 and ST-237	50 ft S from ST-237 and 125 ft N from ST-228	20 ft S to sanitary sewer A
10-7	ST-235	Building 1051 OWS lines	Outside, ~5 ft S of Building 1051	Active underground unit serving plan wash rack, ST-247 and Building 1051	~100 ft S from ST-247 and ~40 ft W from ST-236	~50 ft E to ST-278, sanitary sewer A

Table 5-1. Summary of Appendix III OWS, Sediment Trap, and Holding Tank Inflow and Outflow Lines (Continued)

SWMU No.	Kirtland AFB No.	Unit Name	Location	Use	Inflow Line Length	Outflow Line Length
10-7	ST-236	Building 1051 OWS Lines	Outside, ~1 ft S of Building 1051	Active underground unit serving Building 1051	~60 ft N from area drains in Building 1051	~70 ft E to ST-235
10-7	ST-238	Building 1058 OWS lines	Outside, ~6 ft W of Building 1058	Active underground unit serving the wash rack area W of Building 1058, the NMANG Vehicular Service Shop	Receives surface flow from wash rack; no inflow lines	~15 ft N to sanitary sewer A
10-7	ST-239	Building 1058 OWS lines	Inside, at the E bay of Building 1058	Active underground unit receiving surface drainage from the E bay and floor drains in Building 1058	10 ft N and S of unit from drains	~200 ft to ST-240
10-7	ST-240	Building 1058 holding tank lines	Outside, ~17 ft N of Building 1058	Active underground unit receiving oil-phase discharge from ST-239	~200 ft SE from ST-239	No discharge
10-7	ST-241	Building 1061 OWS lines	Outside, ~1.5 ft S of Building 1061	Active underground unit serving Building 1061	~10 ft from area drains in service shop	~25 ft W and 150 ft N to ST-278, sanitary sewer A
8-26	ST-242	Building 1063 OWS lines	Outside, ~9 ft S of Building 1063	Active underground unit serving Building 1063	~150 ft from area drains in Building 1063	~5 ft W to ST-243
8-26	ST-243	Building 1063 OWS lines	Outside, ~9 ft S of Building 1063	Active underground unit serving Building 1063	~5 ft E from ST-242	~100 ft W to ST-278, sanitary sewer A
10-7	ST-244	Building 1064 OWS lines	Outside, ~17 ft E of Building 1064	Active underground unit serving Building 1064	~50 ft E from area drains in Building 1064	~1 ft W to holding tank, ST-245; ~100 ft N to ST-278

Table 5-1. Summary of Appendix III OWS, Sediment Trap, and Holding Tank Inflow and Outflow Lines (Continued)

SWMU No.	Kirtland AFB No.	Unit Name	Location	Use	Inflow Line Length	Outflow Line Length
10-7	ST-245	Building 1064 holding tank lines	Outside, ~21 ft W of Building 1064	Active underground unit receiving oil-phase discharge from ST-244	1 ft E from ST-244	No discharge
10-7	ST-246	Building 1070 OWS lines	Outside, at the fuel tanker parking area	Active underground, unit serving fuel tanker parking area	~550 ft N and E from area drains	Unit was formerly contained with no discharge lines; unit now discharges to ST-278, sanitary sewer A
10-7	ST-247	Building 2637 OWS lines	Outside, ~25 ft W of Building 2637	Active underground unit serving wash rack area	Surface drainage from wash rack area	~100 ft N to ST-235
10-7	ST-248	Building 20205 OWS lines	Outside, ~7 ft N of Building 20205	Active underground unit serving Building 20205	50 ft N from area drains in Building 20205	100 ft S to ST-282, sanitary sewer E
8-28	ST-250	Building 20338 OWS lines	Outside, ~4.5 ft N of Building 20338	Active underground unit serving Building 20338	~300 ft from Building 20338 floor drains	10 ft N to ST-282, sanitary sewer E
8-29	ST-251	Building 20344 OWS lines	Outside, ~6.5 ft N of Building 20344	Active underground unit serving Building 20344	~200 ft from area drains inside building	10 ft N to ST-292, sanitary sewer E

Table 5-1. Summary of Appendix III OWS, Sediment Trap, and Holding Tank Inflow and Outflow Lines (Continued)

SWMU No.	Kirtland AFB No.	Unit Name	Location	Use	Inflow Line Length	Outflow Line Length
8-31	ST-252	Building 20348 OWS lines	Outside, ~34.5 ft S of Building 20348, the tire shop	Active underground unit serving adjacent wash rack	Surface flow from wash rack on S side of building	~20 ft E to discharge line of ST-253
8-31	ST-253	Building 20348 OWS lines	Outside, ~10 ft S of Building 20348, the tire shop	Active underground unit serving adjacent wash rack	Surface flow from wash rack on S side of building	~100 ft NE to ST-282, sanitary sewer E
10-7	ST-254	Building 20365 OWS lines	Outside, ~10 ft S of Building 20348, the tire shop	Active underground unit serving car wash facility Building 20365; formerly served car maintenance facility to the W	~4 ft from car wash bay area drains; ~50 ft from trench drain at former car maintenance facility	~75 ft N to ST-282, sanitary sewer E
10-7	ST-255	Building 20375 OWS lines	Inside Building 20375, E side	Active underground unit serving bays 1-7 of the auto hobby shop	Surface flow 75 ft long drainage channel; no lines present	~25 ft to discharge line of ST-256
10-7	ST-256	Building 20375 OWS lines	Inside Building 20375, NE area	Active underground unit serving bays 8-11 of the auto hobby shop	Surface flow via 5-ft-long drainage channel; no lines present	~250 ft to ST-282, sanitary sewer E
10-7	ST-257	Building 20375 OWS lines	Inside, Building 20375, NW area	Active underground unit serving bays 8-11 of the auto hobby shop	Surface flow via 55-ft-long drainage channel; no inflow lines	~30 ft S to discharge line of ST-256
10-7	ST-258	Building 20375 OWS lines	Outside, adjacent to Building 20375 to the N at wash rack	Active underground unit serving the wash rack outside of the auto hobby shop	Surface flow from the wash rack	~30 ft S to discharge line of ST-256

Table 5-1. Summary of Appendix III OWS, Sediment Trap, and Holding Tank Inflow and Outflow Lines (Continued)

SWMU No.	Kirtland AFB No.	Unit Name	Location	Use	Inflow Line Length	Outflow Line Length
10-7	ST-260	Building 20422 OWS lines	Outside, ~21 ft W of Building 20422	Active underground unit serving the wash rack W of Building 20422	8 ft from wash rack drain ST-259	25 ft E to nonregulated sanitary sewer D identified by manholes C270-1 to C27-14F; formerly to sewage treatment lagoon
8-47	ST-261	Building 20423 OWS lines	Inside, in the SE corner of Building 20423	Active underground unit serving area drain in Building 20423 and wash rack	Surface flow from the wash rack; ~15 ft inflow line lengths from area drain	~100 ft N to sanitary sewer D at a tie location
8-55	ST-262	Building 20698 OWS lines	Outside, ~6.8 ft W of Building 20698, centrally located in a wash rack	Active underground unit serving wash rack and possibly area drains in Building 20698	~10 ft from wash rack	~200 ft N to sanitary sewer D, formerly discharging to sewage treatment lagoon
10-7	ST-263	Building 23226 OWS lines	Outside, ~65 ft NW of Building 23226	Active dual underground unit serving wash rack (note that wash rack is no longer used)	Surface flow from wash rack; no inflow lines	75 ft W to storm sewer
10-7	ST-264	Building 30142 OWS lines	Inside, at the N portion of the tool crib in Building 30142, the vehicle maintenance shop at the MWSA	Active underground unit serving area drains within Building 30142	~200 ft of inflow lines from area drains inside Building 30142	~50 ft NW to sanitary sewer at the MWSA

Table 5-1. Summary of Appendix III OWS, Sediment Trap, and Holding Tank Inflow and Outflow Lines (Concluded)

SWMU No.	Kirtland AFB No.	Unit Name	Location	Use	Inflow Line Length	Outflow Line Length
10-7	ST-265	Building 30146 OWS lines	Inside, at SE corner of the N bay, Building 30146, Manzano security police garage	Active underground dual compartment unit serving area drains in Building 30146	~25 ft from area drain lines inside Building 30146	~10 ft E to the sanitary sewer
10-7	ST-267	Building 57007 OWS lines	Outside, ~8.5 ft NW of Building 57007, the Civil Engineering Research Facility	Active underground unit serving wash rack adjacent to Building 57007	Surface flow from wash rack	~150 ft S to open drainage channel

* Line lengths where noted were obtained from information in the Stage 2B Work Plan or taken from drawings provided by the base. When taken from drawings, distances were measured to scale.

5.1 SWMU 8-5, Building 255, OWS Lines (ST-201)

5.1.1 Site Background and Environmental Setting

ST-201 is in the fuel dispatch area, approximately 70 ft southwest of Building 255, in the northwest portion of Kirtland AFB. The general location of the unit and its associated lines are shown on Figure 5-2. The inflow line receives flow from two area drains located in the fuel tanker truck parking area south of the building. The inflow line is approximately 13 ft long and enters ST-201 from the south. The outflow line exits ST-201 from the north side, where it extends approximately 100 ft north, and ties into sanitary sewer A.

The lines serving OWS ST-201 are located in the urban/industrial zone, which is discussed in Section 2.0. The nearest production wells to this site are KAFB-13, 1,550 ft west; KAFB-12, 2,900 ft north-northeast; and KAFB-14, 3,700 ft east.

5.1.2 Study Area Investigation

5.1.2.1 Previous Investigations

During the Stage 2B RFI, subsurface soil samples were collected from the perimeter of OWS ST-201. Analytical results were not indicative of a release from this unit. These results are presented in the Stage 2B RFI Report (USAF, 1995).

5.1.2.2 Data Gaps

Prior to the Appendix III RFI, no data were available to determine if a release occurred from the ST-201 OWS lines.

5.1.2.3 RFI Field Investigation

The objective of the investigation was to determine the presence or absence of contamination in soil adjacent to the wastelines. Line location and sample borehole designation were completed prior to the soil sampling effort. The soil investigation was limited to the shallow subsurface.

Analytical results from soil samples collected during Stage 2B RFI were used to characterize the soil adjacent to the OWS inflow and outflow lines within a 50-ft length of ST-201. The inflow line length is estimated at 13 ft; therefore, the analytical data from Stage 2B RFI were used to characterize the soil in the area of the inflow line. The outflow line length is estimated to be 100 ft. Subsurface line locations were confirmed using methods described in Section 3.0.

On December 29, 1994, two boreholes were drilled and sampled using a Geoprobe. The sample interval at each borehole extended from the depth of the line to 5 ft below the line. From this interval, two samples were collected: one at a depth equal to the base of the line, the other from 3 ft below the base of

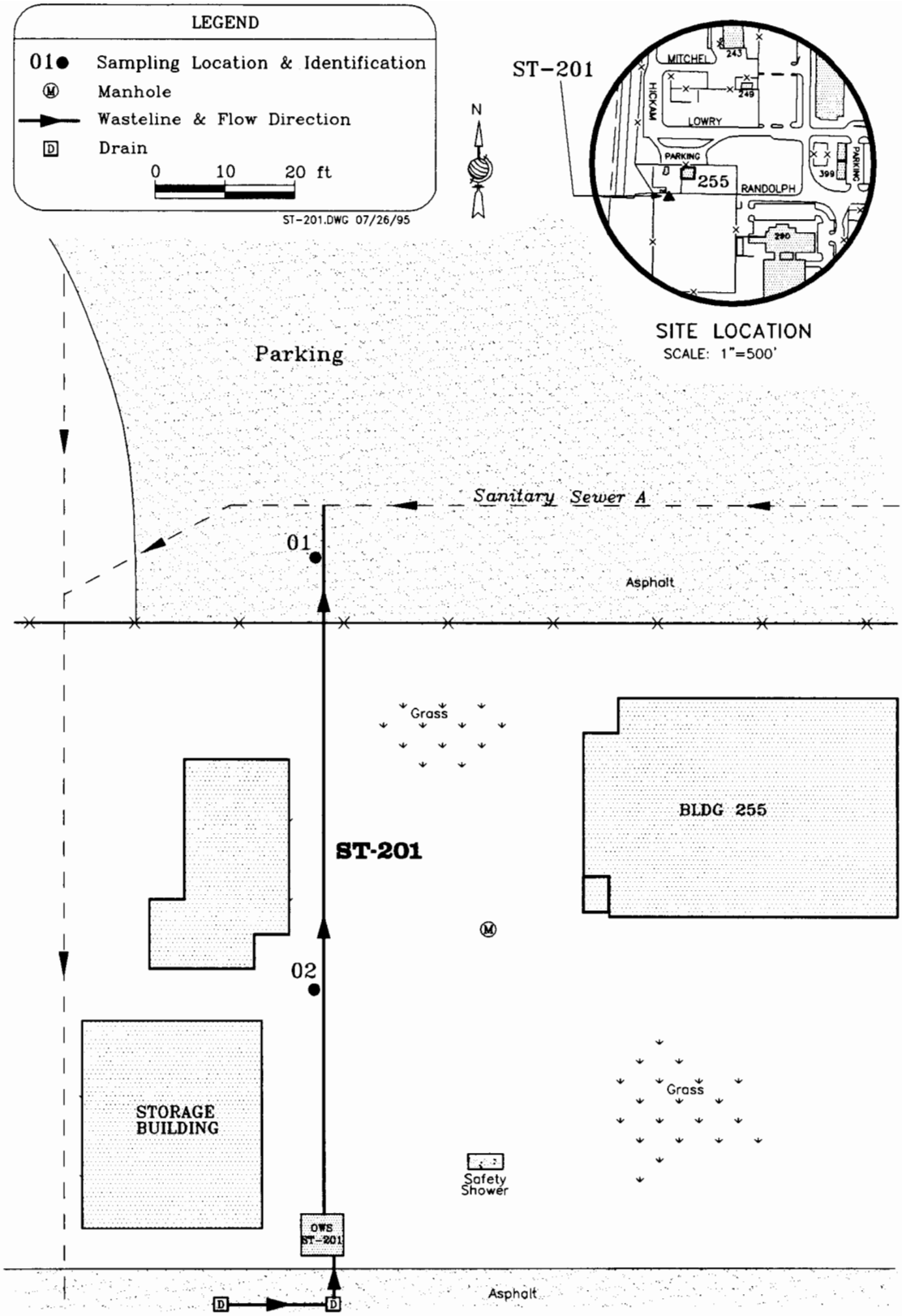


Figure 5-2. Soil Sampling Locations at SWMU 8-5, Building 255, OWS Lines (ST-201)

Kirtland AFB is complicated by the presence of numerous production wells (Figure 2-11). It is probable that uniform groundwater conditions do not exist in this region. Local cones of depression associated with groundwater withdrawal have altered the groundwater flow direction in the vicinity of the well fields (Figure 2-7).

The gradient is probably east at this site. Three production wells are located in this area: KAFB-12 is cross-gradient 2,900 ft north-northeast, KAFB-13 is cross-gradient 1,550 ft west, and KAFB-14 is 3,700 ft east downgradient (Figures 2-7 and 2-11). Depth to groundwater is estimated to be 350 ft below grade (Figure 2-10); however, shallower perched water zones may occur. Hydraulic conductivity within HR1 is estimated at 2 to 171 ft/day (SNL, 1994). A general discussion of the hydrogeology at Kirtland AFB is presented in Section 2.5.

5.1.4 Nature and Extent of Contamination

The following section describes the nature and extent of contamination based on the analytical results for soil samples submitted for analysis from ST-201. Analytical results are summarized in Table 5-3, where only the reportable concentrations are listed. Full analytical results are presented in Appendix F and laboratory validation reports are presented in Appendix K.

Organic Compounds

Methylene chloride was the only VOC analyte detected in both of the soil samples submitted for analysis from ST-201. The detected concentrations of this compound were equal to 0.006 mg/kg. This concentration does not exceed the HHRB action level of 8.5 mg/kg (Table 5-3).

The SVOC analyte di-n-butylphthalate was detected in one of the soil samples submitted for analysis from ST-201. The concentration of the compound was equal to 0.48 mg/kg. This value does not exceed the HHRB action level of 7,800 mg/kg (Table 5-3).

Petroleum Hydrocarbons

There were no petroleum hydrocarbons detected in either of the soil samples submitted for analysis at ST-201.

Metals

Table 5-3 lists all metal concentrations reported at ST-201 and the respective UTL and HHRB action level concentrations. Arsenic was detected in both of the soil samples at concentrations above the HHRB action level of 0.37 mg/kg but below the UTL of 6.5 mg/kg. The two samples had arsenic concentrations equal to 2.9 and 3.8 mg/kg. Beryllium was detected in both of the soil samples at concentrations of 0.44 and 0.47 mg/kg; these concentrations appear to be naturally occurring at Kirtland AFB as discussed in Section 4.2.2.

Soil pH and Moisture

Soil pH values were 9.1 and 8.5 in these samples. Soil moisture values were 8.8 and 15.4 (Table 5-3).

Table 5-3. Summary of Reportable Concentrations for Soil Analyses at SWMU 8-5, Building 255, OWS Lines (ST-201)[1]
(Concentrations mg/kg)

Chemical Class	Analyte	HHRB Action Level[2]	PQL UTL	Borehole Number and Sample Depth Interval (ft)	
				ST201C-01	*ST201C-02*
				9–11	6–8
VOC	Methylene chloride	85.0	0.005	0.006	0.006
SVOC	Di-n-butylphthalate	7,800	0.70	0.48	ND
METALS	Aluminum	78,000	14,700	8,250	9,270
	Arsenic	0.37	6.5	2.9	3.8
	Barium	5,500	735	27.9	173
	Beryllium	0.15	0.84	0.44	0.47
	Calcium	N/A	121,000	12,000	110,000
	Chromium, total	390	21.6	7.3	6.7
	Cobalt	4,700	15.4	5.2	5.6
	Copper	2,900	223	12.3	10.4
	Iron	N/A	23,800	10,800	9,120
	Lead	400	17.5	7.2	5.0
	Magnesium	N/A	10,400	3,750	5,650
	Manganese	390	549	180	179
	Nickel	1,600	188	6.8	6.5
	Potassium	N/A	3,590	1,660	1,410
	Sodium	N/A	787	365	125
	Vanadium	550	55.3	28.4	28.6
	Zinc	23,000	114	29.4	24.6
OTHER	pH			9.1	8.5
	Moisture (%)			8.8	15.4

FOOTNOTES

1	Complete laboratory analytical results and method detection limits are presented in Appendix K.
2	Action level of RCRA Proposed Rule Subpart S (55 FR 30814, 7/27/90).
*	TPH action level is 100 mg/kg adopted from NMED UST regulations (NMED, 1990). SW-8015 analyzes volatile and semivolatile petroleum hydrocarbon fractions separately. The total concentration of the two fractions analyzed under SW-8015 will be used to assess compliance with stipulated action levels for the purpose of this RFI.
#	Denotes TCLP analysis, results in mg/l.
--	No Data.
FR	Field Replicate.
HHRB	Human health risk based.
J	Estimated value.
N/A	Not Applicable.
NA	Not Analyzed.
ND	Not detected above the method detection limit.
pCi/g	picocuries per gram.
PQL	Practical quantitation limits (defines VOC, SVOC, and TPH).
R	Reject NDs due to interference.
RAD	Radionuclides.
RE	Resample.
SVOC	Semivolatile organic compounds.
TPH	Total petroleum hydrocarbons.
U	Accept data (positive results may be influenced by lab contamination).
UJ	Estimated nondetect.
UTL	Upper tolerance limits (defines metals).
VOC	Volatile organic compounds.

5.1.5 Conclusions and Recommendations

Conclusions

- One VOC and one SVOC were detected in soil samples collected from this site; all concentrations were below HHRB action levels.
- No gasoline or diesel range hydrocarbons were detected at concentrations above the NMED action levels in the soil samples submitted from this site.
- Arsenic and beryllium were the only metals detected at concentrations exceeding the HHRB action level; these concentrations appear to be naturally occurring throughout Kirtland AFB.
- The analytical results at the lines of ST-201 are not indicative of a release from this site.

Recommendations

- Based on the findings of the RFI, no further action is necessary; therefore, ST-201 does not require further investigation. A No Further Action proposal should be prepared.

5.2 SWMU 10-7, Buildings 333/334, Sediment Trap Lines (ST-202)

5.2.1 Site Background and Environmental Setting

ST-202 is near the northeast corner of Building 334, which is associated with Building 333, a hangar that houses the Aero Club and base operations offices in the Kirtland AFB flightline area. The inflow to ST-202 consists of the surface flow from the flightline ramp. ST-202 outflows to OWS ST-203 8 ft north. During a cross-connection survey conducted by the Kirtland AFB Compliance Branch, it was discovered that ST-202 is erroneously connected to the west storm sewer (ST-285). A project is scheduled for Fiscal Year 1996 to connect this site to sanitary sewer A.

The lines serving ST-202 are in the urban/industrial zone. The nearest production wells to this site are KAFB-14, 2,900 ft east-northeast, KAFB-13, 3,000 ft northwest, and KAFB-12, 3,700 ft north.

5.2.2 Study Area Investigation

5.2.2.1 Previous Investigations

During the Stage 2B RFI, subsurface soil samples were collected from the perimeter of ST-202. Analytical results from soil samples indicated that a release may have occurred and the site was recommended for further characterization. These results are presented in the Stage 2B RFI Report (USAF, 1995).

5.2.2.2 Data Gaps

Prior to the Appendix III RFI, no data were available to determine if a release occurred from the outflow line of ST-202.

5.2.2.3 RFI Field Investigation

The inflow source to ST-202 is the surface flow from the flightline ramp east of Building 333. The outflow destination is OWS ST-203, approximately 8 ft north. The samples collected for the sediment trap and the OWS unit during the Stage 2B RFI were used to characterize the soil adjacent to line lengths within 50 ft from the unit(s). In this instance, samples collected during the 2B RFI should adequately characterize soil conditions surrounding the outflow line. Line location activities were performed as described in Section 3.0.

5.2.3 Conclusions and Recommendations

Conclusions

- The analytical results from the Stage 2B RFI indicated a release may have occurred at the vicinity of ST-202 and, consequently, in the vicinity of the outflow line of the unit.

Recommendations

- Based on the findings of the RFI, further soil sampling in the vicinity of unit ST-202 is recommended. The soil sampling is scheduled to be performed during the Phase II RFI for Appendix II SWMUs.

5.3 SWMU 10-7, Building 334, OWS Lines (ST-203)

5.3.1 Site Description and Environmental Setting

ST-203 is approximately 50 ft east of the northeast corner of Building 334, which is associated with Building 333, a hanger that houses the Aero Club and base operations offices in the Kirtland AFB flightline area. The general location of the unit and its associated lines are shown on Figure 5-3. According to engineering drawings, the inflow to ST-203 is from sediment trap ST-202, which catches surface flow from the flightline ramp and from the floor drains in Building 333. The outflow from ST-203 runs to the storm sewer lateral along the north side of Buildings 333 and 334. This lateral drains west into the main sanitary sewer system (Figure 5-3). During a cross-connection survey conducted by the Kirtland AFB Compliance Branch, it was discovered that ST-203 is erroneously connected to the west storm sewer (ST-285). A project is scheduled for Fiscal Year 1996 to connect this site to sanitary sewer A.

The lines serving ST-203 are located in the urban/industrial zone, which is discussed in Section 2.0. The nearest production wells are KAFB-14, 2,900 ft east-northeast; KAFB-13, 3,000 ft northwest; and KAFB-12, 3,700 ft north.

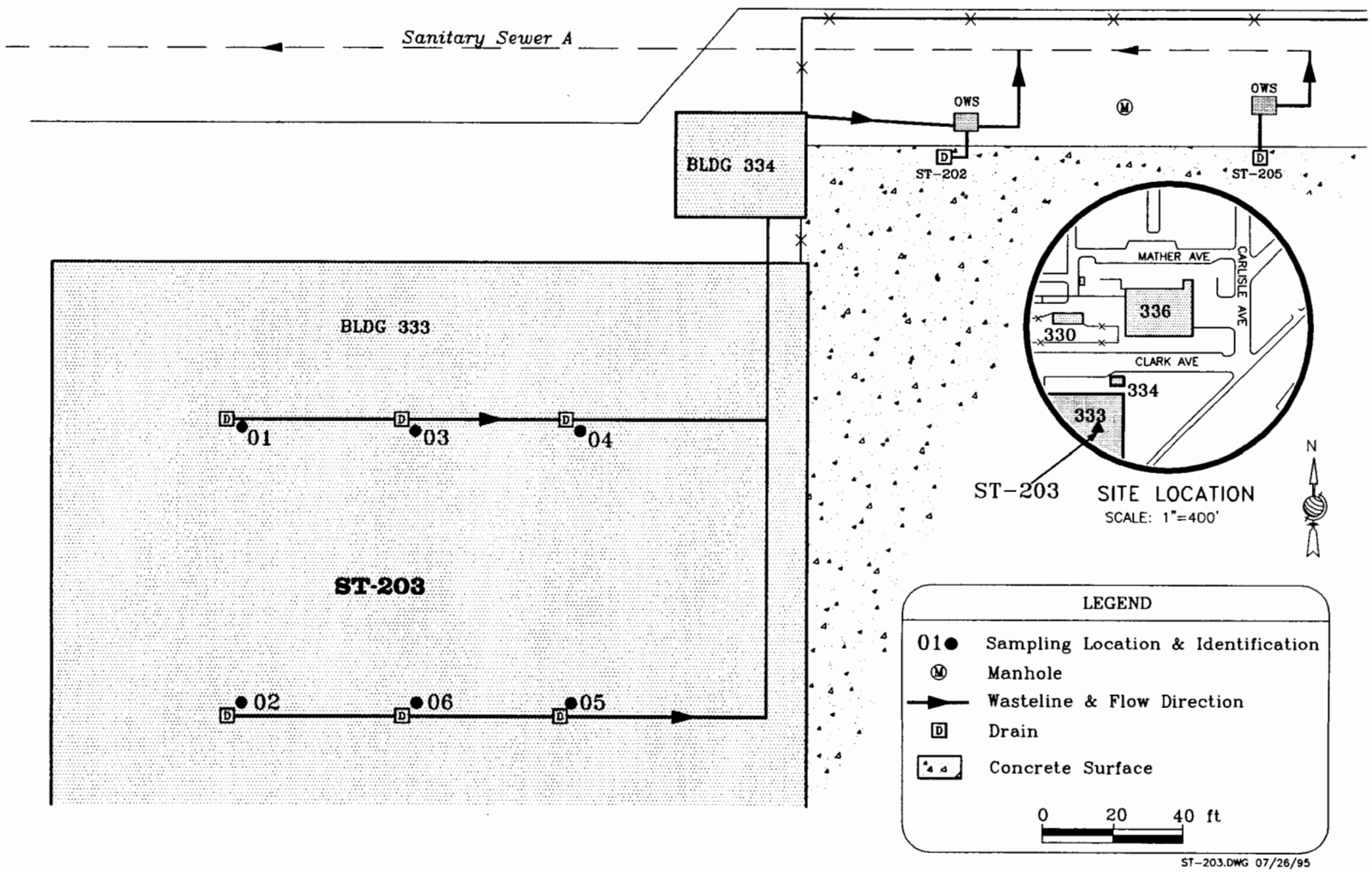


Figure 5-3. Soil Sampling Locations at SWMU 10-7, Building 334, OWS Lines (ST-203)

5.3.2 Study Area Investigation

5.3.2.1 Previous Investigation

During the Stage 2B RFI, subsurface soil samples were collected from the perimeter of OWS ST-203. Analytical results were indicative of a possible release from this unit. These results are presented in the Stage 2B RFI Report (USAF, 1995).

5.3.2.2 Data Gaps

Prior to the Appendix III RFI, no data were available to determine if a release occurred from the ST-203 OWS lines.

5.3.2.3 RFI Field Investigation

The objective of the investigation was to determine the presence or absence of contamination in the soil adjacent to the wastelines. Line location and sample borehole designation were completed prior to the soil sampling effort. The soil investigation was limited to the shallow subsurface.

Analytical results from soil samples collected during the Stage 2B RFI were used to characterize the soil adjacent to the OWS inflow and outflow lines within a 50-ft length of ST-203. Based on engineering drawings, two parallel inflow lines to ST-203 run east approximately 150 ft collecting flow from the floor drains inside Building 333; the lines turn north underneath the hanger doors to join together and run under Building 334. The line then turns east for approximately 40 ft to enter OWS ST-203. The ST-203 outflow line runs east about 10 ft before turning north and running 20 ft to the sanitary sewer lateral. Subsurface line location activities were performed in accordance with Section 3.0

On December 30, 1994, six boreholes were sampled using a Geoprobe. The sample interval at each borehole extended from the depth of the line to 5 ft below the line. From this interval, two samples were collected: one at a depth equal to the base of the line, the other from 3 ft below the base of the line (i.e., 1 to 3 ft and 4 to 6 ft below grade). Both samples were field-screened with a FID organic vapor meter; only the sample with the highest FID reading was submitted to the laboratory for analysis. If no FID readings were detected, the sample collected at the depth closest to the base of the line was submitted for analysis. Along the lines serving ST-203, seven soil samples, including one replicate sample, were collected and submitted for laboratory analysis during the Appendix III RFI.

The analytical results from borehole sample ST-203-01, collected during the Stage 2B RFI, were used as background concentration data for the samples collected at ST-203 during Appendix III RFI.

Sampling operations and sample handling procedures are described in Section 3.0. Sample depths, borehole locations, and replicate samples collected during the Appendix III RFI are listed in Table 5-4. Soil boring logs for the boreholes drilled and sampled at ST-203 are in Appendix C.

Table 5-4. Boreholes and Samples Analyzed from SWMU 10-7, Building 334, OWS Lines (ST-203)

Borehole	Borehole Location	Sample Depths (ft)
01	Inside, 54 ft E and approx. 40 ft S of NW corner of Building 333	1-3
02	72 ft S of borehole 01	1-6[a]
03	50 ft E of borehole 01	1-3
04	50 ft E of borehole 03	1-3
05	72 ft S of borehole 04	1-3
06	50 ft E of borehole 02	1-3

a. Replicate sample also collected at this interval.

5.3.2.4 Laboratory Analysis

The soil samples were analyzed for VOCs, SVOCs, TPH, metals, mercury (the potential contaminants associated with normal operations at this site), soil pH, and soil moisture. The four brass tubes in each 2-ft sample interval were field-screened for possible contamination using a beta-gamma meter and a FID. All field-screening instrument readings remained at background levels throughout the ST-203 drilling and sampling activities.

5.3.3 Site Characteristics

5.3.3.1 Geology

Buildings 333/334 are underlain by unconsolidated alluvial sediment that is predominantly silty sand to very fine-grained to fine-grained sand. Six boreholes, 6 ft deep, were drilled along the ST-203 inflow lines. No borehole penetrated into the Santa Fe Group sediments that presumably underlie this area. A discussion of the general geology at Kirtland AFB is presented in Section 2.4.

As a result of ST-203 line installation, it is probable that backfill material is present adjacent to each line to a depth at least equal to the total depth of each line. Borehole logs for this area are presented in Appendix C.

5.3.3.2 Hydrogeology

Groundwater beneath the Building 333/334 area is found within the Upper Santa Fe sediments and is generally thought to be unconfined in the upper portion of the aquifer. This area is within the HR1 saturated zone setting as defined by SNL studies (Figure 2-9) (SNL, 1994). Hydrogeologic characterization in this portion of Kirtland AFB is complicated by the presence of numerous production wells (Figure 2-11). It is probable that uniform groundwater conditions do not exist in this region. Local cones of depression associated with groundwater withdrawal have altered the groundwater flow direction in the vicinity of the well fields (Figure 2-7).

The gradient is probably northeast at this site. Three production wells are located near Buildings 333/334: KAFB-14 is downgradient 2,900 ft northeast, KAFB-13 is cross-gradient 3,000 ft

northwest, and KAFB-12 is cross-gradient 3,700 ft north (Figures 2-7 and 2-11). Depth to groundwater is estimated to be 350 ft below grade (Figure 2-10); however, shallower perched water zones may occur. Hydraulic conductivity within HR1 is estimated at 2 to 171 ft/day (SNL, 1994). A general discussion of the hydrogeology at Kirtland AFB is presented in Section 2.5.

5.3.4 Nature and Extent of Contamination

The following section describes the nature and extent of contamination based on the analytical results for soil samples submitted for analysis from ST-203. Analytical results are summarized in Table 5-5, where only the reportable concentrations are listed. Full analytical results are presented in Appendix F and laboratory validation reports are presented in Appendix K.

Organic Compounds

Methylene chloride was the only VOC analyte detected in six of the seven soil samples submitted for analysis from ST-203. The detected concentrations ranged from 0.007 to 0.008 mg/kg. These concentrations do not exceed the HHRB action level of 85 mg/kg (Table 5-5).

There were no SVOC analytes detected in the soil samples submitted for analysis at ST-203.

Petroleum Hydrocarbons

Gasoline range hydrocarbons were detected in two out of the seven soil samples submitted for analysis from ST-203 at concentrations of 0.24 and 0.27 mg/kg. These concentrations do not exceed the 100 mg/kg NMED action level (Table 5-5).

Metals

Table 5-5 lists all metal concentrations reported at ST-203 and the respective UTL and HHRB action level concentrations. Arsenic was detected in all seven of the soil samples at concentrations above the HHRB action level of 0.37 mg/kg but below the UTL of 6.5 mg/kg. The seven soil samples had arsenic concentrations ranging from 2.2 to 5.3 mg/kg. Barium (933 mg/kg) was detected at a concentration above the 735 mg/kg UTL in the 1- to 6-ft replicate sample from borehole ST-203C-02. Beryllium (0.44 mg/kg) was detected in one of the seven samples; these concentrations appear to be naturally occurring at Kirtland AFB as discussed in Section 4.2.2.

Soil pH and Moisture

Soil pH value ranged from 8.0 to 8.4 in these samples. Soil moisture values ranged from 6.7 to 17.2 percent (Table 5-5).

Table 5-5. Summary of Reportable Concentrations for Soil Analyses at SWMU 10-7, Building 334, OWS Lines (ST-203)*[1]
(Concentrations mg/kg)

Chemical Class	Analyte	HHRB Action Level[2]	PQL UTL	Borehole Number and Sample Depth Interval (ft)						
				ST203C-01	*ST203C-02*		*ST203C-03*	*ST203C-04*	*ST203C-05*	*ST203C-06*
				1–6	1–6 FR	1–6	1–3	1–3	1–3	1–3
VOC	Methylene chloride	85.0	0.005	ND	0.007	0.007	0.008	0.008	0.008	0.007
TPH	Gasoline fraction	100	1.0	0.27	ND	0.24	ND	ND	ND	ND
METALS	Aluminum	78,000	14,700	6,260	5,680	9,600	5,580	5,040	5,170	5,720
	Arsenic	0.37	6.5	4.1	4.3	5.3	2.4	2.2	3.2	3.0
	Barium	5,500	735	289	933	248	81.4	133	209	297
	Beryllium	0.15	0.84	ND	ND	0.44	ND	ND	ND	ND
	Calcium	N/A	121,000	194,000	181,000	66,700	38,100	113,000	159,000	52,100
	Chromium, total	390	21.6	5.7	4.5	7.3	5.2	4.0	5.0	3.9
	Cobalt	4,700	15.4	3.4	4.5	4.6	2.7	2.5	4.3	3.6
	Copper	2,900	223	7.2	8.5	17.8	10.0	33.1	9.6	68.2
	Iron	N/A	23,800	4,960	6,600	9,240	7,020	5,200	6,470	6,810
	Lead	400	17.5	3.2	2.8	5.5	3.7	2.6	2.7	3.4
	Magnesium	N/A	10,400	5,700	6,550	4,610	2,160	2,390	4,890	2,740
	Manganese	390	549	47.7	99.1	177	96.1	61.3	84.7	85.6
	Nickel	1,600	188	3.0	3.6	6.7	5.5	3.7	3.2	3.9
	Potassium	N/A	3,590	691	553	1,580	1,170	867	652	836
	Sodium	N/A	787	268	229	402	134	114	199	152
	Vanadium	550	55.3	20.4	28.6	29.7	14.8	12.8	20.1	18.6
	Zinc	23,000	114	14.5	14.3	26.1	16.2	16.6	14.6	38.3
OTHER	pH			8.3	8.4	8.2	8.0	8.4	8.1	8.2
	Moisture (%)			17.2	13.0	10.0	7.6	11.4	13.5	6.7

FOOTNOTES

1	Complete laboratory analytical results and method detection limits are presented in Appendix K.
2	Action level of RCRA Proposed Rule Subpart S (55 FR 30814, 7/27/90).
*	TPH action level is 100 mg/kg adopted from NMED UST regulations (NMED, 1990). SW-8015 analyzes volatile and semivolatile petroleum hydrocarbon fractions separately. The total concentration of the two fractions analyzed under SW-8015 will be used to assess compliance with stipulated action levels for the purpose of this RFI.
#	Denotes TCLP analysis, results in mg/l.
--	No Data.
FR	Field Replicate.
HHRB	Human health risk based.
J	Estimated value.
N/A	Not Applicable.
NA	Not Analyzed.
ND	Not detected above the method detection limit.
pCi/g	picocuries per gram.
PQL	Practical quantitation limits (defines VOC, SVOC, and TPH).
R	Reject NDs due to interference.
RAD	Radionuclides.
RE	Resample.
SVOC	Semivolatile organic compounds.
TPH	Total petroleum hydrocarbons.
U	Accept data (positive results may be influenced by lab contamination).
UJ	Estimated nondetect.
UTL	Upper tolerance limits (defines metals).
VOC	Volatile organic compounds.

5.3.5 Conclusions and Recommendations

Conclusions

- One VOC was detected in the soil samples submitted from this site. All concentrations were below HHRB action levels. No SVOCs were detected in the soil samples submitted from this site.
- No gasoline or diesel range hydrocarbons were detected at concentrations above the NMED action levels.
- Arsenic and beryllium were the only metals detected at concentrations exceeding the HHRB action level; these concentrations appear to be naturally occurring throughout Kirtland AFB.
- The analytical results at the lines of ST-203 are not indicative of a release from this site.

Recommendations

- Based on the findings of the RFI, no further action is necessary; therefore, ST-203 does not require further investigation. A No Further Action proposal should be prepared.

5.4 SWMU 10-7, Building 334, OWS Lines (ST-204)

5.4.1 Site Background and Environmental Setting

ST-204 is approximately 120 ft east of the northeast corner of Building 334, which is associated with Building 333, a hangar that houses the Aero Club and base operations offices in the Kirtland AFB flightline area. According to engineering drawings, the inflow to ST-204 is from sediment trap ST-205, which catches surface flow from the flightline ramp. The outflow from ST-204 runs to a storm sewer lateral on the north side of Buildings 333 and 334. This lateral drains west into the main storm sewer system (ST-285). During a cross-connection survey conducted by the Kirtland AFB Compliance Branch, it was discovered that ST-204 is erroneously connected to the west storm sewer (ST-285). A project is scheduled for Fiscal Year 1996 to connect this site to sanitary sewer A.

The lines serving ST-204 are located in the urban/industrial zone. The nearest production wells are KAFB-14, 2,900 ft east-northeast; KAFB-13, 3,000 ft northwest; and KAFB-12, 3,700 ft north.

5.4.2 Study Area Investigation

5.4.2.1 Previous Investigations

During the Stage 2B RFI, subsurface soil samples were collected from the perimeter of OWS ST-204. Analytical results from the soil samples collected at ST-204 were not indicative of a release from this unit. These results are presented in the Stage 2B RFI Report (USAF, 1995).

5.4.2.2 Data Gaps

Prior to the Appendix III RFI, no data were available to determine if a release occurred from the ST-203 wastelines.

5.4.2.3 RFI Field Investigation

The inflow line to ST-204 is the 10-ft-long outflow line from sediment trap ST-205, which receives the surface flow from the flightline ramp east of Building 333. The outflow line runs 10 ft east before turning north to run about 15 ft to the sanitary sewer lateral that parallels the north side of Buildings 333 and 334. The samples collected from the sediment trap and the OWS during the Stage 2B RFI were used to characterize the soil adjacent to line lengths within 50 ft from the unit(s). In this instance, samples collected during the Stage 2B RFI should adequately characterize soil conditions surrounding the outflow line as the distance is less than 50 ft between the OWS and the sediment trap. Line location activities were performed as described in Section 3.0.

5.4.3 Conclusions and Recommendations

Conclusions

- The analytical results at the Stage 2B RFI are not indicative of a release from this site.

Recommendations

- On the basis of the Stage 2B analytical results, no further action is necessary; therefore, ST-204 does not require further investigation. A No Further Action proposal should be prepared.

5.5 SWMU 10-7, Building 333, Sediment Trap Lines (ST-205)

5.5.1 Site Background and Environmental Setting

ST-205 is near the northeast corner of Building 333, a hangar that houses the Aero Club and base operations offices in the Kirtland AFB flightline area. The inflow to ST-205 consists of the surface flow from the flightline ramp. ST-205 outflows to OWS ST-204 10 ft north. During a cross-connection survey conducted by the Kirtland AFB Compliance Branch, it was discovered that ST-205 is erroneously connected to the west storm sewer (ST-285). A project is scheduled for Fiscal Year 1996 to connect this site to sanitary sewer A.

The lines serving ST-205 are located in the urban/industrial zone as described in Section 2.0. The nearest production wells to this site are KAFB-14, 2,900 ft east-northeast; KAFB-13, 3,000 ft northwest; and KAFB-12, 3,700 ft north.

5.5.2 Study Area Investigation

5.5.2.1 Previous Investigations

During the Stage 2B RFI, subsurface soil samples were collected from the perimeter of sediment trap ST-205. Analytical results from soil samples collected at ST-205 were not indicative of a release from this unit. These results are presented in the Stage 2B RFI (USAF, 1995).

5.5.2.2 Data Gaps

Prior to the Appendix III RFI, no data were available to determine if a release occurred from the outflow line of ST-205.

5.5.2.3 RFI Field Investigation

The inflow source to ST-205 is the surface flow from the flightline ramp east of Building 333; the outflow destination is OWS ST-204, 10 ft north. The samples collected from the sediment trap and the OWS during the Stage 2B RFI were used to characterize the soil adjacent to lines within 50 ft of the unit. In this instance, samples collected during the Stage 2B RFI should adequately characterize soil conditions surrounding the outflow line as the distance is less than 50 ft between the OWS and the sediment trap. Line location activities were performed as described in Section 3.0.

5.5.3 Conclusions and Recommendations

Conclusions

- The analytical results from the Stage 2B RFI are not indicative of release from this unit.

Recommendations

- On the basis of the Stage 2B RFI analytical results, no further action is necessary; therefore, ST-205 does not require further investigation. A No Further Action Proposal should be prepared.

5.6 SWMU 10-7, Building 336, OWS Lines (ST-206)

5.6.1 Site Background and Environmental Setting

ST-206 is near the northwest corner of Building 336, which is the jet engine repair shop. The general location of the unit and its associated lines are shown on Figure 5-4. Based on engineering drawings, the inflow sources to ST-206 are the west side floor drains in Building 336 and the outflow destination is to the storm sewer that runs east along the north side of the building. The storm sewer runs close by, or possibly underneath, ST-208. The storm sewer line from ST-208 to the nearest manhole was investigated as the outflow line for ST-206. ST-206 and ST-207 will be replaced in 1995 by a single OWS with outflow to the sanitary sewer.

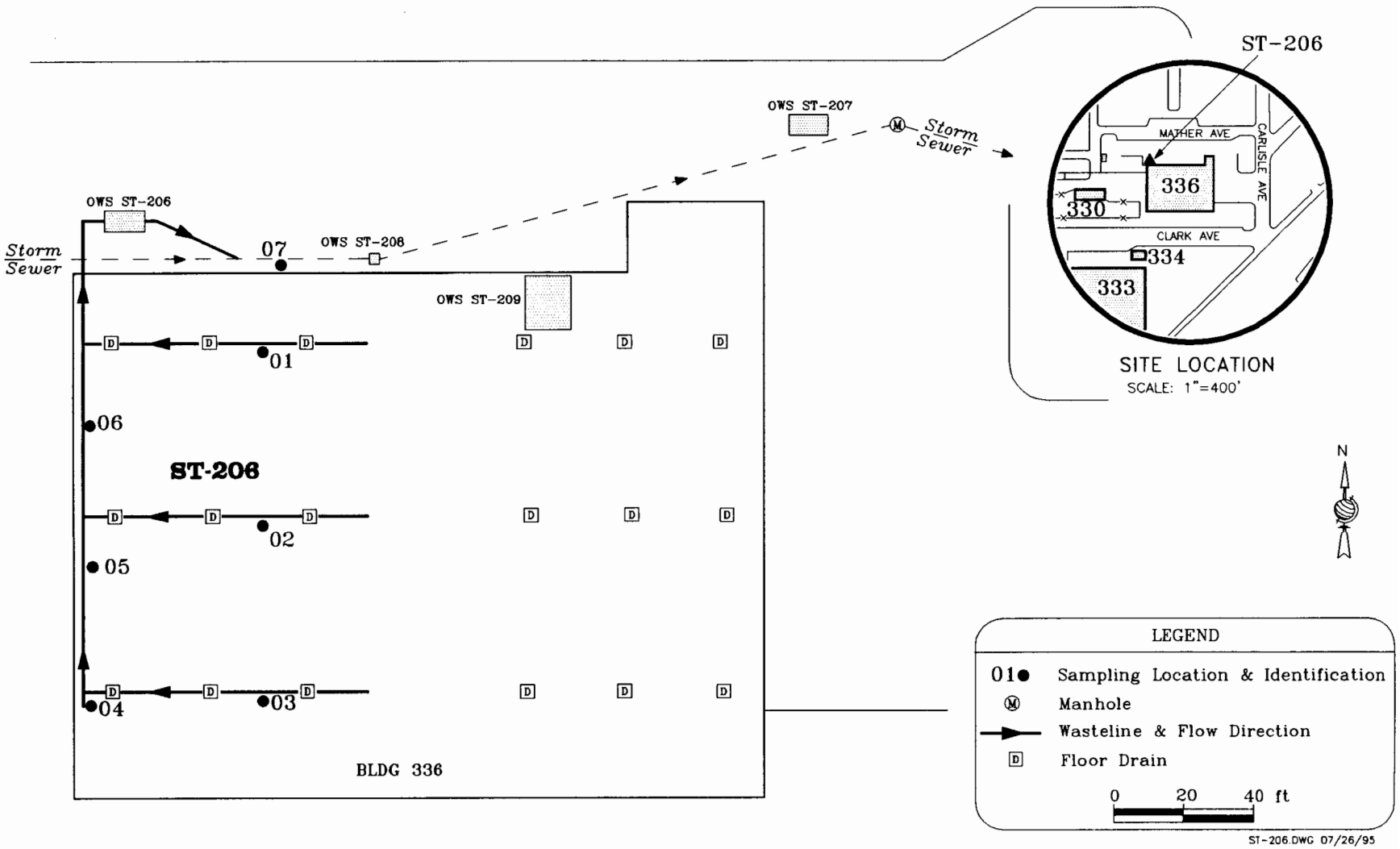


Figure 5-4. Soil Sampling Locations at SWMU 10-7, Building 336, OWS Lines (ST-206)

The lines serving ST-206 are in the urban/industrial zone. The nearest production wells to this site are KAFB-12, 2,800 ft north; KAFB-13, 2,800 ft west-northwest; and KAFB-14, 2,900 ft east-northeast.

5.6.2 Study Area Investigation

5.6.2.1 Previous Investigations

During the Stage 2B RFI, subsurface soil samples were collected from the perimeter of ST-206. Analytical results were not indicative of a release from this unit. These results are presented in the Stage 2B RFI Report (USAF, 1995).

5.6.2.2 Data Gaps

Prior to the Appendix III RFI, no data were available to determine if a release occurred from ST-206.

5.6.2.3 RFI Field Investigation

The objective of the investigation was to determine the presence or absence of contamination in the soil adjacent to the wastelines. Line location and sample borehole designation were completed prior to the soil sampling effort. The soil investigation was limited to the shallow subsurface. Analytical results from soil samples collected during the Stage 2B RFI were used to characterize the soil adjacent to the inflow and outflow lines within a 50-ft length of ST-206. Based on engineering drawings, the inflow lines to ST-206 consist of three parallel lines that collect flow from the floor drains on the west side of Building 336. These three lines run west for 80 ft, join a line running north for 140 ft, and then turn east into OWS ST-206. The outflow line exits on the west side and immediately angles southeast for 25 ft to join the storm sewer running east on the north side of the building. Subsurface line locations were confirmed using methods described in Section 3.0.

On December 16, 1994, seven boreholes were sampled using a Geoprobe. The sample interval at each borehole extended from the depth of the line to 5 ft below the line. From this interval, two samples were collected: one at a depth equal to the base of the line, the other from 3 ft below the base of the line (i.e., 1 to 3 and 4 to 6 ft below grade). Both samples were field-screened with a FID organic vapor meter and only the sample with the highest FID reading was submitted to the laboratory for analysis. If no FID readings were detected, the sample collected at the depth closest to the base of the line was submitted for analysis. Along the lines serving ST-206, eight soil samples, including one replicate sample, were collected and submitted for laboratory analysis during the Appendix III RFI.

Because of the close proximity of ST-206, ST-207, and ST-208, analytical results from sample ST-208-01, collected during the Stage 2B RFI, were used as background concentration data for samples collected at ST-206 during Appendix III RFI.

Sampling operations and sample handling procedures are described in Section 3.0. Sample depths, borehole locations, and replicate samples collected during the Appendix III RFI are listed in Table 5-6. Soil boring logs for the boreholes drilled and sampled at ST-206 are in Appendix C.

Table 5-6. Boreholes and Samples Analyzed from SWMU 10-7, Building 336, OWS Lines (ST-206)

Borehole	Borehole Location	Sample Depths (ft)	FID (ppm_v)
01	Inside, 54 ft E and approx. 25 ft S of NW corner of Building 336	3-8	0
02	51 ft S of borehole 01	2-7[a]	0-5
03	53 ft S of borehole 02	2-4	0
04	51 ft W and 4 ft S of borehole 03	3-5	0
05	47 ft N of borehole 04	3-5	0
06	41 ft N of borehole 05	4-6	0
07	Outside, 60 ft E and 1.5 ft N of NW corner of Building 336	6-8	0

FID readings are values above background and are the high readings of the sample interval.

a. Replicate sample also collected at this interval.

5.6.2.4 Laboratory Analysis

The soil samples were analyzed for VOCs, SVOCs, TPH, metals, mercury (the potential contaminants associated with normal operations at this site), soil pH, and soil moisture. The four brass tubes in each 2-ft sample interval were field-screened for possible contamination using a beta-gamma meter and a FID. All field-screening instrument readings remained at background levels throughout ST-206 drilling and sampling activities.

5.6.3 Site Characteristics

5.6.3.1 Geology

Building 336 is underlain by unconsolidated alluvial sediment that is predominantly silty sand to fine-grained sand and very fine-grained sand. Seven boreholes were drilled and a maximum depth of 11 ft below grade was attained at borehole ST-206C-07. No borehole penetrated into the Santa Fe Group sediments that presumably underlie this area. A discussion of the general geology at Kirtland AFB is presented in Section 2.4.

As a result of ST-206 line installation, it is probable that backfill material is present adjacent to a depth at least equal to the total depth of each line. Borehole logs for this area are presented in Appendix C.

5.6.3.2 Hydrogeology

Groundwater beneath ST-206 is found within the Upper Santa Fe sediments and is generally thought to be unconfined in the upper portion of the aquifer. This area is within the HR1 saturated zone setting as defined by SNL studies (Figure 2-9) (SNL, 1994). Hydrogeologic characterization in this portion of Kirtland AFB is complicated by the presence of numerous production wells (Figure 2-11). It is probable that uniform groundwater conditions do not exist in this region. Local cones of depression associated with groundwater withdrawal have altered the groundwater flow direction in the vicinity of the well fields (Figure 2-7).

The gradient is probably to the northeast at this site. Three production wells are located near ST-206: KAFB-12 is cross-gradient 2,800 ft north, KAFB-13 is cross-gradient 2,800 ft west-northwest, and KAFB-14 is downgradient 2,900 ft east-northeast (Figures 2-7 and 2-11). Depth to groundwater is estimated to be 350 ft below grade (Figure 2-10); however, shallower perched water zones may occur. Hydraulic conductivity within HR1 is estimated at 2 to 171 ft/day (SNL, 1994). A general discussion of the hydrogeology at Kirtland AFB is presented in Section 2.5.

5.6.4 Nature and Extent of Contamination

The following section describes the nature and extent of contamination based on soil sampling results for soil samples submitted for analysis from ST-206. Analytical results for soil samples at ST-206 are summarized in Table 5-7, where only the reportable concentrations are listed. Full analytical results are presented in Appendix F and laboratory validation reports are presented in Appendix K.

Organic Compounds

Two VOCs, acetone and methylene chloride, were detected in one or more of the soil samples collected at ST-206. Acetone was detected in two soil samples with concentrations of 0.063 and 0.062 mg/kg. Methylene chloride was detected in all eight of the soil samples with concentrations ranging from 0.008 to 0.009 mg/kg. Neither of these compounds exceeded HHRB action levels, 7,800 mg/kg and 85 mg/kg, respectively (Table 5-7).

The SVOC analytes that were detected in one or more of the soil samples collected at ST-206 include di-n-butylphthalate and phenol. Di-n-butylphthalate was detected in one soil sample with a concentration of 0.55 mg/kg. Phenol was detected in five of the eight soil samples with concentrations ranging from 0.38 to 0.98 mg/kg. Neither of these compounds exceeded HHRB action levels, 7,800 mg/kg and 47,000 mg/kg, respectively (Table 5-7).

Petroleum Hydrocarbons

Diesel range hydrocarbons were detected in one soil sample at a concentration of 14 mg/kg. The concentration did not exceed the 100 mg/kg NMED action level. The concentration in this one sample is similar to those measured in background samples collected during the Appendix III RFI.

Table 5-7. Summary of Reportable Concentrations for Soil Analyses at SWMU 10-7, Building 336, OWS Lines (ST-206)[1]
(Concentrations mg/kg)

Chemical Class	Analyte	HHRB Action Level[2]	PQL UTL	Borehole Number and Sample Depth Interval (ft)							
				ST206C-01	*ST206C-02*		*ST206C-03*	*ST206C-04*	*ST206C-05*	*ST206C-06*	*ST206C-07*
				3–8	2–7 FR	2–7	2–4	3–5	3–5	4–6	6–8
VOC	Acetone	7,800	0.10	0.063	ND	ND	ND	ND	0.062	ND	ND
	Methylene chloride	85.0	0.005	0.009	0.008	0.008	0.009	0.009	0.008	0.009	0.009
SVOC	Di-n-butylphthalate	7,800	0.70	0.55	ND	ND	ND	ND	ND	ND	ND
	Phenol	47,000	0.30	ND	0.38	ND	0.98	0.89	0.83	0.39	ND
TPH	Diesel fraction	100	10.0	ND	ND	ND	ND	ND	ND	ND	14.0
METALS	Aluminum	78,000	14,700	6,450	4,170	3,040	6,000	9,130	3,880	8,700	9,050
	Arsenic	0.37	6.5	2.6	1.7	1.9	3.0	3.6	2.0	3.4	3.6
	Barium	5,500	735	48.2	94.8	67.3	313	215	235	249	120
	Beryllium	0.15	0.84	0.43	ND	ND	ND	0.47	ND	0.46	0.47
	Cadmium	39.0	N/A	0.65	ND	ND	ND	ND	ND	ND	1.3
	Calcium	N/A	121,000	36,700	37,700	40,500	153,000	135,000	41,600	129,000	55,300
	Chromium, total	390	21.6	5.7	3.5	3.3	5.4	6.1	4.3	5.9	7.6
	Cobalt	4,700	15.4	3.8	2.6	2.7	3.6	4.1	1.5	3.2	5.7
	Copper	2,900	223	37.1	30.9	26.1	13.1	19.9	18.2	15.2	19.5
	Iron	N/A	23,800	8,320	5,170	4,120	5,250	7,340	4,900	7,840	13,000
	Lead	400	17.5	4.3	2.5	2.7	3.0	4.2	5.2	4.3	6.9
	Magnesium	N/A	10,400	3,920	2,270	1,550	5,040	6,320	2,260	5,680	4,800
	Manganese	390	549	105	61.5	59.4	69.1	75.4	78.7	84.1	211
	Nickel	1,600	188	6.3	2.9	2.8	5.2	6.7	3.4	6.7	7.2
	Potassium	N/A	3,590	1,040	648	545	690	1,200	713	1,390	1,720
	Sodium	N/A	787	292	152	54.9	246	177	156	151	83.9
	Thallium	N/A	N/A	0.11	ND	ND	ND	ND	ND	ND	ND
	Vanadium	550	55.3	24.7	13.6	11.1	19.4	24.8	11.8	22.2	35.2
	Zinc	23,000	114	29.1	20.9	18.8	16.4	22.0	16.7	21.2	32.1
OTHER	pH			8.5	8.3	8.6	8.6	8.6	8.4	8.4	8.4
	Moisture (%)			7.7	5.3	5.8	13.3	14.6	7.0	13.2	14.3

FOOTNOTES

1	Complete laboratory analytical results and method detection limits are presented in Appendix K.
2	Action level of RCRA Proposed Rule Subpart S (55 FR 30814, 7/27/90).
*	TPH action level is 100 mg/kg adopted from NMED UST regulations (NMED, 1990). SW-8015 analyzes volatile and semivolatile petroleum hydrocarbon fractions separately. The total concentration of the two fractions analyzed under SW-8015 will be used to assess compliance with stipulated action levels for the purpose of this RFI.
#	Denotes TCLP analysis, results in mg/l.
--	No Data.
FR	Field Replicate.
HHRB	Human health risk based.
J	Estimated value.
N/A	Not Applicable.
NA	Not Analyzed.
ND	Not detected above the method detection limit.
pCi/g	picocuries per gram.
PQL	Practical quantitation limits (defines VOC, SVOC, and TPH).
R	Reject NDs due to interference.
RAD	Radionuclides.
RE	Resample.
SVOC	Semivolatile organic compounds.
TPH	Total petroleum hydrocarbons.
U	Accept data (positive results may be influenced by lab contamination).
UJ	Estimated nondetect.
UTL	Upper tolerance limits (defines metals).
VOC	Volatile organic compounds.

Metals

Table 5-7 lists all reportable metal concentrations detected at ST-206 and the respective UTL and HHRB action level concentrations. Arsenic was detected in all eight of the soil samples at concentrations above the HHRB action level of 0.37 mg/kg, but below the UTL of 6.5 mg/kg. The eight soil samples had arsenic concentrations ranging from 1.7 to 3.6 mg/kg. Beryllium was detected in four of the eight samples with concentrations ranging from 0.43 to 0.47 mg/kg; these concentrations appear to be naturally occurring at Kirtland AFB as discussed in Section 4.2.2.

Soil pH and Moisture

Soil pH values ranged from 8.3 to 8.6 in these samples. Soil moisture values ranged from 5.3 to 14.6 percent (Table 5-7).

5.6.5 Conclusions and Recommendations

Conclusions

- Two VOCs and two SVOCs were detected in the soil samples collected from this site. All concentrations were below HHRB action levels.
- Diesel range hydrocarbons were detected in one sample collected from this site at concentrations below the NMED action levels. The one detection is within the range of background concentrations; without the presence of other release indicators (VOCs, SVOCs and metals), it is probable that a release has not occurred. No gasoline range hydrocarbons were detected in samples collected and submitted for analysis from this site.
- Arsenic and beryllium were the only metals detected at concentrations exceeding the HHRB action level; these concentrations appear to be naturally occurring throughout Kirtland AFB.
- The analytical results at the lines of ST-206 are not indicative of a release from this site.

Recommendations

- Based on the findings of the RFI, no further action is necessary; therefore, ST-206 does not require further investigation. A No Further Action proposal should be prepared.

5.7 SWMU 10-7, Building 336, OWS Lines (ST-207)

5.7.1 Site Background and Environmental Setting

ST-207 is northeast of the northeast corner of Building 336, a jet engine repair shop dating back to World War II, located in the western portion of Kirtland AFB. The general location of the unit and its associated lines are shown in Figure 5-5. Based on engineering drawings, the inflow sources

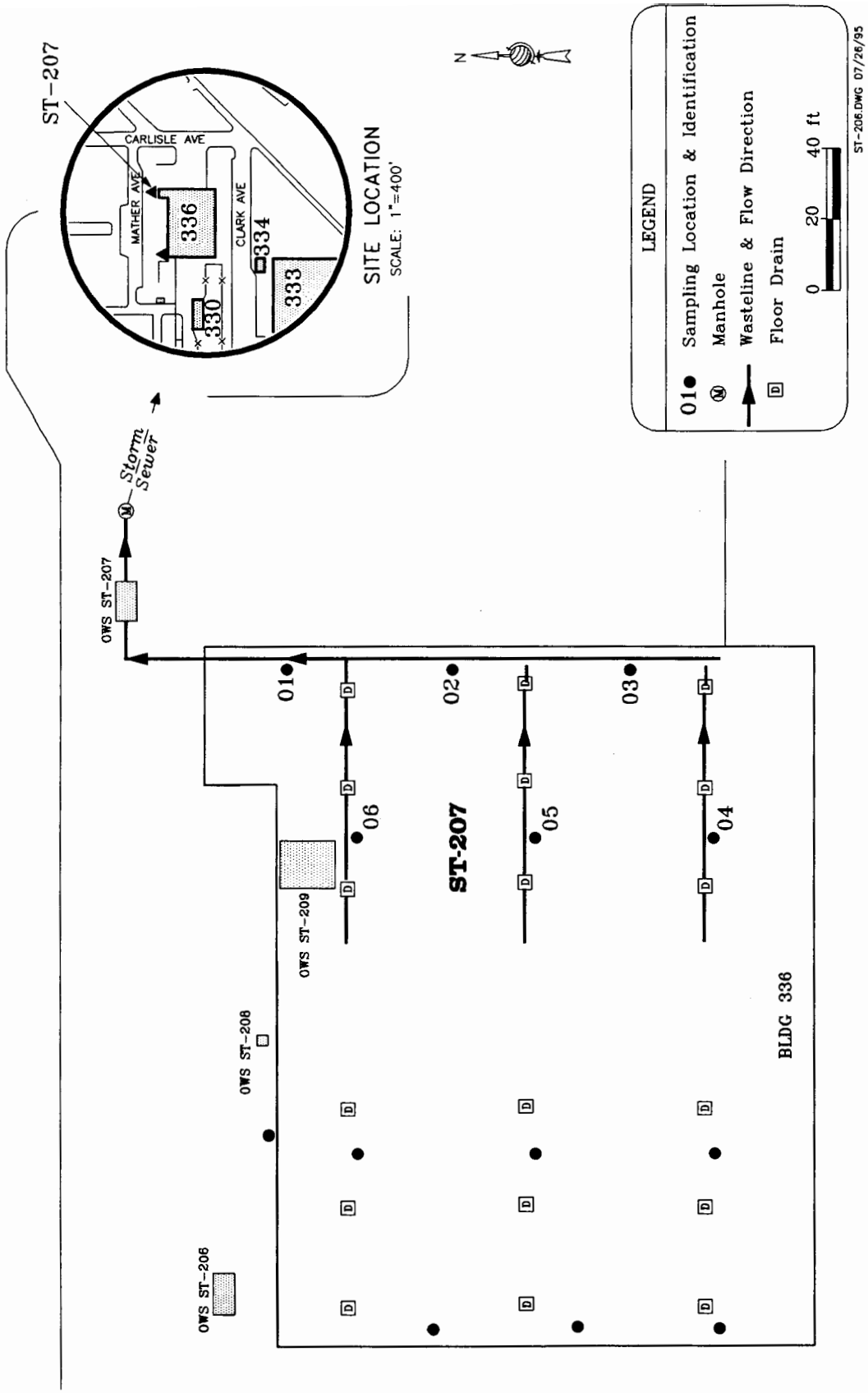


Figure 5-5. Soil Sampling Locations at SWMU 10-7, Building 336, OWS Lines (ST-207)

to ST-207 are the east side floor drains in the building; the outflow destination is to the storm sewer that runs east along the north side of Building 336. ST-207 and ST-206 will be replaced in 1995 by a single OWS with outflow to the sanitary sewer.

The lines serving ST-207 are located in the urban/industrial zone. The nearest production wells located near this site are KAFB-12, 2,800 ft north; KAFB-13, 2,800 ft west-northwest; and KAFB-14, 2,900 ft east-northeast.

5.7.2 Study Area Investigation

5.7.2.1 Previous Investigation

During the Stage 2B RFI, subsurface soil samples were collected from the perimeter of OWS ST-207. Analytical results were not indicative of a release from this unit. These results are presented in the Stage 2B RFI Report (USAF, 1995).

5.7.2.2 Data Gaps

Prior to the Appendix III RFI, no data were available to determine if a release occurred from ST-207 OWS lines.

5.7.2.3 RFI Field Investigation

The objective of the investigation was to determine the presence or absence of contamination in the soil adjacent to the wastelines. Line location and sample borehole designation were completed prior to the soil sampling effort. The soil investigation was limited to the shallow subsurface.

Analytical results from soil samples collected during Stage 2B RFI were used to characterize the soil adjacent to the inflow and outflow lines within a 50-ft length of ST-207. Based on engineering drawings, the inflow lines to ST-207 consist of three parallel lines that collect flow from the floor drains on the east side of Building 336. These three lines run east for 80 ft and then join a line north for 165 ft before turning east for 10 ft to run into OWS ST-207. The outflow line for ST-207 runs west to join the storm sewer running east on the north side of the building. Subsurface line locations were confirmed using methods described in Section 3.0.

On December 19, 1994, six boreholes were drilled and sampled using a Geoprobe. The sample interval at each borehole extended from the depth of the line to 5 ft below the line. From this interval, two samples were collected: one at a depth equal to the base of the line, the other from 3 ft below the base of the line (i.e., 1 to 3 and 4 to 6 ft below grade). Both samples were field-screened with a FID organic vapor meter and only the sample with the highest FID reading was submitted to the laboratory for analysis. If no FID readings were detected, the sample collected at the depth closest to the base of the line was submitted for analysis. Along the lines serving ST-207, seven soil samples, including one replicate sample, were collected and submitted for laboratory analysis during the Appendix III RFI.

Because of the close proximity of ST-206, ST-207, and ST-208, analytical results from sample ST-208-01, collected during the Stage 2B RFI, were used as background concentration data for samples collected at ST-207 during Appendix III RFI.

Sampling operations and sample handling procedures are described in Section 3.0. Sample depths, borehole locations, and replicate samples collected during the Appendix III RFI are listed in Table 5-8. Soil boring logs for the boreholes drilled and sampled at ST-207 are in Appendix C.

Table 5-8. Boreholes and Samples Analyzed from SWMU 10-7, Building 336, OWS Lines (ST-207)

Borehole	Borehole Location	Sample Depths (ft)
01	Inside, 3 ft W and approx. 2 ft S of NE corner of Building 336	4-6
02	48 ft S of borehole 01	3-5
03	50 ft S of borehole 02	7-9
04	25 ft N and 57 ft W of SE corner of Building 336	2-7[a]
05	48 ft N of borehole 04	3-5
06	52 ft N of borehole 05	3-5

a. Replicate sample also collected at this interval.

5.7.2.4 Laboratory Analysis

The soil samples were analyzed for VOCs, SVOCs, TPH, metals, mercury (the potential contaminants associated with normal operations at this site), soil pH, and soil moisture. The four brass tubes in each 2-ft sample interval were field-screened for possible contamination using a beta-gamma meter and a FID. All field-screening instrument readings remained at background levels throughout ST-207 drilling and sampling activities.

5.7.3 Site Characteristics

5.7.3.1 Geology

Building 336 is underlain by unconsolidated alluvial sediment that is predominantly silty sand to fine-grained sand and very fine-grained sand. Six boreholes were drilled and a maximum depth of 9 ft below grade was attained at borehole ST-207C-01. No borehole penetrated into the Santa Fe Group sediments that presumably underlie this area. A discussion of the general geology at Kirtland AFB is presented in Section 2.4.

As a result of ST-207 line installation, it is probable that backfill material is present adjacent to a depth at least equal to the total depth of each line. Borehole logs for this area are presented in Appendix C.

5.7.3.2 Hydrogeology

Groundwater beneath Building 336 is found within the Upper Santa Fe sediments and is generally thought to be unconfined in the upper portion of the aquifer. This area is within the HR1 saturated zone setting as defined by SNL studies (Figure 2-9) (SNL, 1994). Hydrogeologic characterization in this portion of Kirtland AFB is complicated by the presence of numerous production wells (Figure 2-11). It is probable that uniform groundwater conditions do not exist in this region. Local cones of depression associated with groundwater withdrawal have altered the groundwater flow direction in the vicinity of the well fields (Figure 2-7).

The gradient is probably to the northeast at this site. Three production wells are located near ST-207: KAFB-12 is cross-gradient 2,800 ft north, KAFB-13 is cross-gradient 2,800 ft west-northwest, and KAFB-14 is downgradient 2,900 ft east-northeast (Figures 2-7 and 2-11). Depth to groundwater is estimated to be 350 ft below grade (Figure 2-10); however, shallower perched water zones may occur. Hydraulic conductivity within HR1 is estimated at 2 to 171 ft/day (SNL, 1994). A general discussion of the hydrogeology at Kirtland AFB is presented in Section 2.5.

5.7.4 Nature and Extent of Contamination

The following section describes the nature and extent of contamination based on analytical results for soil samples submitted for analysis from ST-201. Analytical results are summarized in Table 5-9, where only the reportable concentrations are listed. Full analytical results are presented in Appendix F and laboratory validation reports are presented in Appendix K.

Organic Compounds

Methylene chloride was the only VOC analyte detected in all seven of the soil samples submitted for analysis at ST-207, with concentrations ranging from 0.008 to 0.009 mg/kg. The concentrations of this compound did not exceed the HHRB action level of 85 mg/kg (Table 5-9).

Di-n-butylphthalate was the only SVOC analyte detected in two of the seven soil samples with concentrations equal to 0.42 and 0.58 mg/kg. The detected concentrations of this compound do not exceed the HHRB action level of 7,800 mg/kg (Table 5-9).

Petroleum Hydrocarbons

No petroleum hydrocarbons were detected in any of the soil samples collected at ST-207.

Metals

Table 5-9 lists all metal concentrations reported at ST-207 and the respective UTL and HHRB action level concentrations. Arsenic was detected in all seven of the soil samples at concentrations above the HHRB action level of 0.37 mg/kg but below the UTL of 6.5 mg/kg. The seven soil samples had arsenic concentrations ranging from 2.4 to 5.5 mg/kg. Beryllium was detected in two of the eight samples with concentrations ranging from 0.45 to 0.95 mg/kg; these concentrations appear to be naturally occurring at Kirtland AFB as discussed in Section 4.2.2.

Table 5-9. Summary of Reportable Concentrations for Soil Analyses at SWMU 10-7, Building 336, OWS Lines (ST-207)[1]
(Concentrations mg/kg)

Chemical Class	Analyte	HHRB Action Level[2]	PQL UTL	Borehole Number and Sample Depth Interval (ft)						
				ST207C-01	*ST207C-02*	*ST207C-03*	*ST207C-04*		*ST207C-05*	*ST207C-06*
				4–6	3–5	3–5	2–7 FR	2–7	3–5	3–5
VOC	Methylene chloride	85.0	0.005	0.008	0.008	0.008	0.008	0.008	0.008	0.009
SVOC	Di-n-butylphthalate	7,800	0.70	0.42	ND	ND	ND	ND	0.58	ND
METALS	Aluminum	78,000	14,700	4,150	8,200	3,580	5,020	4,600	6,330	16,300
	Arsenic	0.37	6.5	2.4	3.6	2.5	3.1	4.0	3.6	5.5
	Barium	5,500	735	223	964	127	172	216	142	578
	Beryllium	0.15	0.84	ND	0.45	ND	ND	ND	ND	0.95
	Cadmium	39.0	N/A	ND	ND	ND	ND	ND	ND	0.71
	Calcium	N/A	121,000	34,500	67,400	81,700	77,200	108,000	153,000	76,000
	Chromium, total	390	21.6	5.1	6.4	3.1	2.9	2.6	4.6	12.6
	Cobalt	4,700	15.4	1.8	4.1	2.8	3.9	3.0	2.4	6.5
	Copper	2,900	223	13.5	7.9	7.7	10.9	9.1	58.1	11.8
	Iron	N/A	23,800	5,430	8,380	4,170	6,640	6,020	5,690	14,400
	Lead	400	17.5	3.3	5.4	2.5	2.5	2.2	3.6	9.1
	Magnesium	N/A	10,400	2,760	4,650	3,130	4,190	4,060	5,030	9,550
	Manganese	390	549	82.7	132	50.6	93.2	74.4	80.4	220
	Mercury	23.0	N/A	ND	ND	ND	ND	4.7	ND	ND
	Nickel	1,600	188	3.8	7.8	2.4	4.9	5.4	3.8	14.8
	Potassium	N/A	3,590	700	1,270	455	590	447	803	2,760
	Sodium	N/A	787	107	222	78.0	172	136	287	614
	Thallium	N/A	N/A	ND	ND	ND	ND	ND	ND	0.13
	Vanadium	550	55.3	15.6	25.4	15.0	22.8	18.6	19.8	42.1
	Zinc	23,000	114	16.5	19.2	9.6	15.9	11.6	31.6	35.9
OTHER	pH			8.5	8.4	8.4	8.4	8.4	8.1	8.1
	Moisture (%)			7.3	10.5	8.5	8.4	10.9	13.3	15.6

FOOTNOTES

1	Complete laboratory analytical results and method detection limits are presented in Appendix K.
2	Action level of RCRA Proposed Rule Subpart S (55 FR 30814, 7/27/90).
*	TPH action level is 100 mg/kg adopted from NMED UST regulations (NMED, 1990). SW-8015 analyzes volatile and semivolatile petroleum hydrocarbon fractions separately. The total concentration of the two fractions analyzed under SW-8015 will be used to assess compliance with stipulated action levels for the purpose of this RFI.
#	Denotes TCLP analysis, results in mg/l.
--	No Data.
FR	Field Replicate.
HHRB	Human health risk based.
J	Estimated value.
N/A	Not Applicable.
NA	Not Analyzed.
ND	Not detected above the method detection limit.
pCi/g	picocuries per gram.
PQL	Practical quantitation limits (defines VOC, SVOC, and TPH).
R	Reject NDs due to interference.
RAD	Radionuclides.
RE	Resample.
SVOC	Semivolatile organic compounds.
TPH	Total petroleum hydrocarbons.
U	Accept data (positive results may be influenced by lab contamination).
UJ	Estimated nondetect.
UTL	Upper tolerance limits (defines metals).
VOC	Volatile organic compounds.

Soil pH and Moisture

Soil pH value ranged from 8.1 to 8.5 in these samples. Soil moisture values ranged from 7.3 to 15.6 percent (Table 5-9).

5.7.5 Conclusions and Recommendations

Conclusions

- One VOC and one SVOC were detected in the soil samples collected from this site; all concentrations were below HHRB action levels.
- No gasoline or diesel range hydrocarbons were detected in the soil samples collected from this site.
- Arsenic and beryllium were the only metals detected at concentrations exceeding the HHRB action level; these concentrations appear to be naturally occurring throughout Kirtland AFB.
- The analytical results at the lines of ST-207 are not indicative of a release from this site.

Recommendations

- Based on the findings of the RFI, no further action is necessary; therefore, ST-207 does not require further investigation. A No Further Action proposal should be prepared.

5.8 SWMU 10-7, Building 336, OWS Lines (ST-208)

5.8.1 Site Background and Environmental Setting

Although designated as an OWS, ST-208 is not constructed as a separator; it functions only as a drop box on the storm sewer line and does not receive flow from Building 336. ST-208 is 1 ft north of Building 336 next to the entrance. Building 336 is a jet engine repair shop dating back to World War II, located in the western portion of Kirtland AFB. The general location of the unit and its associated lines are shown in Figure 5-6. Outflow is to the storm sewer that runs close by, or possibly underneath, the unit. The storm sewer line from ST-208 to the nearest manhole was investigated as the outflow line for ST-208.

Building 336 is located in the urban/industrial environmental zone. The nearest production wells to this site are KAFB-12, 2,800 ft north; KAFB-13, 2,800 ft west-northwest; and KAFB-14, 2,900 ft east-northeast.

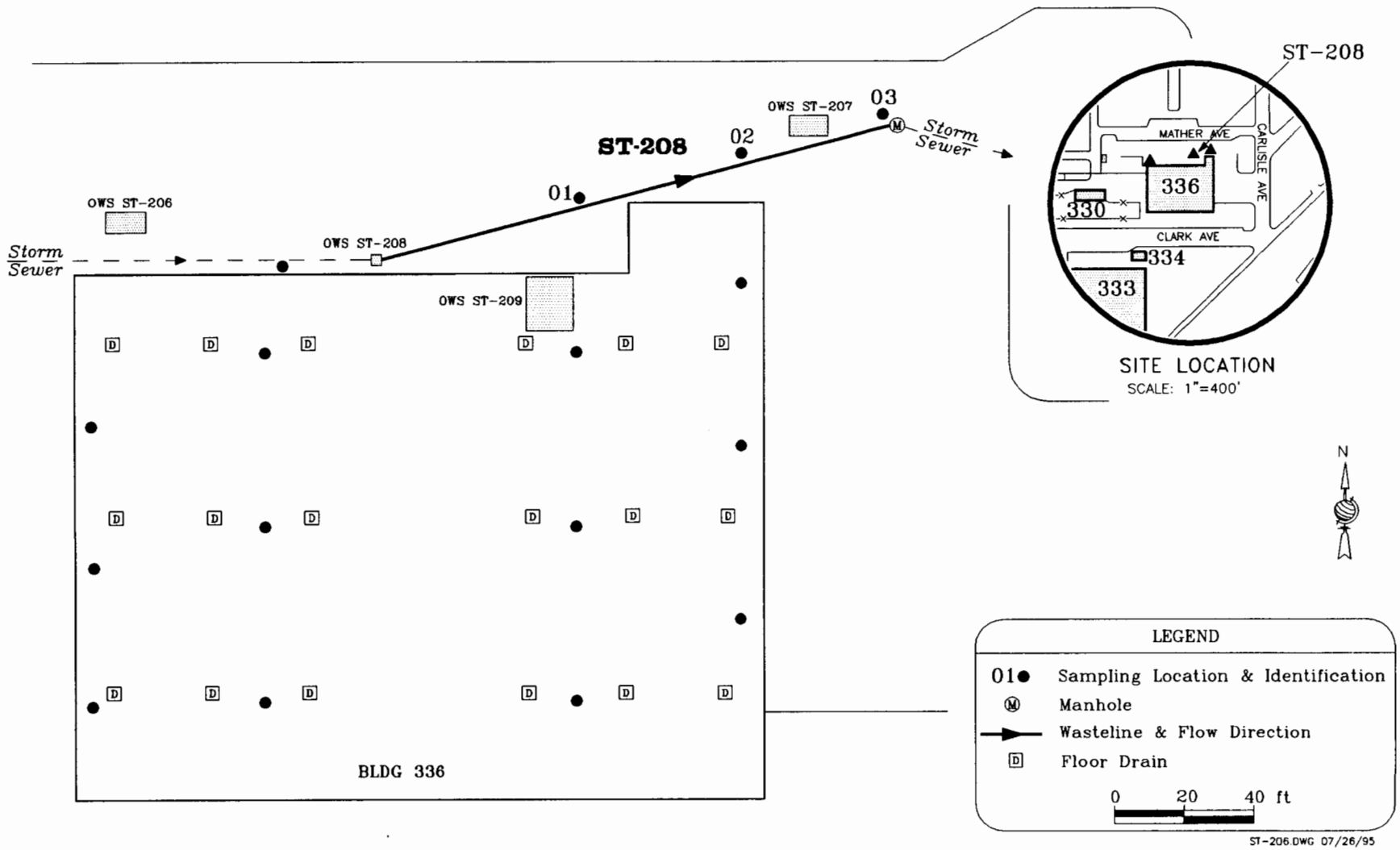


Figure 5-6. Soil Sampling Locations at SWMU 10-7, Building 336, OWS Lines (ST-208)

5.8.2 Study Area Investigation

5.8.2.1 Previous Investigations

During the Stage 2B RFI, subsurface soil samples were collected from the perimeter of ST-208. Analytical results were not indicative of a release from this unit. These results are presented in the Stage 2B RFI Report (USAF, 1995).

5.8.2.2 Data Gaps

Prior to the Appendix III RFI, no data were available to determine if a release occurred from the ST-208 OWS lines.

5.8.2.3 RFI Investigation

The objective of the investigation was to determine the presence or absence of contamination in the soil adjacent to the wastelines. Line location and sample borehole designation were completed prior to the soil sampling effort. The soil investigation was limited to the shallow subsurface.

Analytical results from soil samples collected during Stage 2B RFI were used to characterize the soil adjacent to the inflow and outflow lines within a 50-ft length of ST-208. Outflow is to the storm sewer line that runs close by, or possibly underneath, the unit. The storm sewer line runs 150 ft east-northeast from ST-208 to the nearest manhole. This line was investigated as the outflow line for ST-208. Subsurface line locations were confirmed using methods described in Section 3.0.

On December 19, 1994, three boreholes were sampled using a Geoprobe. The sample interval at each borehole extended from the depth of the line to 5 ft below the line. From this interval, two samples were collected: one at a depth equal to the base of the line, the other from 3 ft below the base of the line (i.e., 1 to 3 ft and 4 to 6 ft below grade). Both samples were field-screened with a FID organic vapor meter and only the sample with the highest FID reading was submitted to the laboratory for analysis. If no FID readings were detected, the sample collected at the depth closest to the base of the line was submitted for analysis. Along the lines serving ST-208, three soil samples were collected and submitted for laboratory analysis during the Appendix III RFI.

The analytical results from ST-208, collected during the Stage 2B RFI, were used as background concentration data for the samples collected at ST-208 during Appendix III RFI.

Sampling operations and sample handling procedures are described in Section 3.0. Sample depths, borehole locations, and replicate samples collected during the Appendix III RFI are listed in Table 5-10. Soil boring logs for the boreholes drilled and sampled at ST-208 are in Appendix C.

Table 5-10. Boreholes and Samples Analyzed from SWMU 10-7, Building 336, OWS Lines (ST-208)

Borehole	Borehole Location	Sample Depths (ft)
01	55 ft E-NE of ST-208	6-8
02	50 ft E-NE of borehole 01	10-12
03	50 ft E-NE of borehole 02	7-9

5.8.2.4 Laboratory Analysis

The soil samples were analyzed for VOCs, SVOCs, TPH, metals, mercury (the potential contaminants associated with normal operations at this site), soil pH, and soil moisture. The four brass tubes in each 2-ft sample interval were field-screened for possible contamination using a beta-gamma meter and a FID. All field-screening instrument readings remained at background levels throughout the ST-208 drilling and sampling activities.

ST-208-01, collected during Stage 2B RFI, was used as a background sample during the investigation of the inflow and outflow lines at ST-208. The background sample was analyzed for TPH, VOCs, SVOCs, metals, soil pH, and soil moisture.

5.8.3 Site Characteristics

5.8.3.1 Geology

Building 336 area is underlain by unconsolidated alluvial sediment that is predominantly silty sand to fine-grained sand and very fine-grained sand. Three boreholes were drilled and a maximum depth of 12 ft below grade was attained at boreholes ST-208C-02 and ST-208C-03. No borehole penetrated into the Santa Fe Group sediments that presumably underlie this area. A discussion of the general geology at Kirtland AFB is presented in Section 2.4.

As a result of ST-208 line installation, it is probable that backfill material is present adjacent to each line to a depth at least equal to the total depth of each line. Borehole logs for this area are presented in Appendix C.

5.8.3.2 Hydrogeology

Groundwater beneath Building 336 is found within the Upper Santa Fe sediments and is generally thought to be unconfined in the upper portion of the aquifer. This area is within the HR1 saturated zone setting as defined by SNL studies (Figure 2-9) (SNL, 1994). Hydrogeologic characterization in this portion of Kirtland AFB is complicated by the presence of numerous production wells (Figure 2-11). It is probable that uniform groundwater conditions do not exist in this region. Local cones of depression associated with groundwater withdrawal have altered the groundwater flow direction in the vicinity of the well fields (Figure 2-7).

The gradient is probably northeast at this site. Three production wells are located near ST-208: KAFB-12 is cross-gradient 2,800 ft north, KAFB-13 is cross-gradient 2,800 ft west-northwest, and KAFB-14 is downgradient 2,900 ft east-northeast (Figures 2-7 and 2-11). Depth to groundwater is estimated to be 350 ft below grade (Figure 2-10); however, shallower perched water zones may occur. Hydraulic conductivity within HR1 is estimated at 2 to 171 ft/day (SNL, 1994). A general discussion of the hydrogeology at Kirtland AFB is presented in Section 2.5.

5.8.4 Nature and Extent of Contamination

The following section describes the nature and extent of contamination based on soil sampling results for soil samples submitted for analysis from ST-208. Analytical results are summarized in Table 5-11, where only the reportable concentrations are listed. Full analytical results are presented in Appendix F and laboratory validation reports are presented in Appendix K.

Organic Compounds

Methylene chloride was the only VOC analyte detected in two of the three soil samples collected at ST-208, both with concentrations equal to 0.008 mg/kg. The concentration of this compound does not exceed the HHRB action level of 85 mg/kg (Table 5-11).

The SVOC analytes bis(2-ethylhexyl)phthalate and di-n-butylphthalate were detected in one or more of the three soil samples. Bis(2-ethylhexyl)phthalate was detected in one soil sample with a concentration of 2.2 mg/kg. Di-n-butylphthalate was detected in two soil samples with concentrations equal to 0.56 and 0.57 mg/kg. Neither of these compounds was detected at levels exceeding the HHRB action levels, 46 mg/kg and 7,800 mg/kg, respectively (Table 5-11).

Petroleum Hydrocarbons

There were no petroleum hydrocarbons detected in any of the soil samples submitted for analysis at ST-208.

Metals

Table 5-11 lists all metal concentrations reported at ST-208 and the respective UTL and HHRB action level concentrations. Arsenic was detected in all three of the soil samples at concentrations above the HHRB action level of 0.37 mg/kg but below the UTL of 6.5 mg/kg. The three soil samples had arsenic concentrations ranging from 2.5 to 4.0 mg/kg. Beryllium was detected in all three soil samples with concentrations ranging from 0.33 to 0.7 mg/kg; these concentrations appear to be naturally occurring at Kirtland AFB as discussed in Section 4.2.2.

5.8.4.4 Soil pH and Moisture

Soil pH value ranged from 8.2 to 8.5 in these samples. Soil moisture values ranged from 9.7 to 11.7 percent (Table 5-11).

Table 5-11. Summary of Reportable Concentrations for Soil Analyses at SWMU 10-7, Building 336, OWS Lines (ST-208)[1]
(Concentrations mg/kg)

Chemical Class	Analyte	HHRB Action Level[2]	PQL UTL	Borehole Number and Sample Depth Interval (ft)		
				ST208C-01 6–8	*ST208C-02* 10–12	*ST208C-03* 7–9
VOC	Methylene chloride	85.0	0.005	0.008	0.008	ND
SVOC	Bis(2-ethylhexyl)phthalate	46.0	0.70	ND	2.2	ND
	Di-n-butylphthalate	7,800	0.70	0.57	ND	0.56
METALS	Aluminum	78,000	14,700	6,360	12,100	5,640
	Arsenic	0.37	6.5	4.0	3.7	2.5
	Barium	5,500	735	122	84.7	225
	Beryllium	0.15	0.84	0.45	0.70	0.33
	Calcium	N/A	121,000	20,600	16,600	41,400
	Chromium, total	390	21.6	6.5	13.4	5.8
	Cobalt	4,700	15.4	4.0	7.5	3.7
	Copper	2,900	223	17.4	24.9	26.7
	Iron	N/A	23,800	7,960	17,000	7,260
	Lead	400	17.5	5.7	10.9	4.0
	Magnesium	N/A	10,400	3,490	6,260	3,120
	Manganese	390	549	129	333	104
	Nickel	1,600	188	5.9	10.3	4.4
	Potassium	N/A	3,590	1,190	2,100	1,020
	Sodium	N/A	787	68.0	110	99.1
	Thallium	N/A	N/A	ND	0.15	ND
	Vanadium	550	55.3	24.2	40.4	18.3
	Zinc	23,000	114	22.9	45.2	26.2
OTHER	pH			8.4	8.2	8.5
	Moisture (%)			11.7	13.9	9.7

FOOTNOTES

1	Complete laboratory analytical results and method detection limits are presented in Appendix K.
2	Action level of RCRA Proposed Rule Subpart S (55 FR 30814, 7/27/90).
*	TPH action level is 100 mg/kg adopted from NMED UST regulations (NMED, 1990). SW-8015 analyzes volatile and semivolatile petroleum hydrocarbon fractions separately. The total concentration of the two fractions analyzed under SW-8015 will be used to assess compliance with stipulated action levels for the purpose of this RFI.
#	Denotes TCLP analysis, results in mg/l.
--	No Data.
FR	Field Replicate.
HHRB	Human health risk based.
J	Estimated value.
N/A	Not Applicable.
NA	Not Analyzed.
ND	Not detected above the method detection limit.
pCi/g	picocuries per gram.
PQL	Practical quantitation limits (defines VOC, SVOC, and TPH).
R	Reject NDs due to interference.
RAD	Radionuclides.
RE	Resample.
SVOC	Semivolatile organic compounds.
TPH	Total petroleum hydrocarbons.
U	Accept data (positive results may be influenced by lab contamination).
UJ	Estimated nondetect.
UTL	Upper tolerance limits (defines metals).
VOC	Volatile organic compounds.

5.9.2.2 Data Gaps

No data were available to determine if a release occurred from ST-210 OWS lines.

5.9.2.3 RFI Field Investigation

The objective of the investigation was to determine the presence or absence of contamination in soil adjacent to the wastelines. Line location and sample borehole designation were completed prior to the soil sampling effort. The soil investigation was limited to the shallow subsurface.

Analytical results from soil samples collected during the Stage 2B RFI were used to characterize the soil adjacent to the OWS inflow and outflow lines within a 50-ft length of ST-210. The inflow lines to ST-210 run approximately 155 ft northeast from the floor drains in Building 378 and 40 ft northwest from the area drains inside Building 377. The oil-phase outflow is to a holding tank 10 ft south of the unit. Water-phase outflow runs 105 ft northeast to a storm drain that connects to the storm sewer that runs south on the east side of Building 377. Subsurface line locations were confirmed using methods described in Section 3.0.

On December 28, 1994, five boreholes were sampled using a Geoprobe. The sample interval at each borehole extended from the depth of the line to 5 ft below the line. From this interval, two samples were collected: one at a depth equal to the base of the line, the other from 3 ft below the base of the line (i.e., 1 to 3 ft and 4 to 6 ft below grade). Both samples were field-screened with a FID organic vapor meter; only the sample with the highest FID reading was submitted to the laboratory for analysis. If no FID readings were detected, the sample collected at the depth closest to the base of the line was submitted for analysis. Along the lines serving ST-210, six soil samples, including one replicate sample, were collected and submitted for laboratory analysis during the Appendix III RFI.

The analytical results from ST-210-01, collected during the Stage 2B RFI, were used as background concentration data for the samples collected at ST-210 during Appendix III RFI.

Sampling operations and sample handling procedures are described in Section 3.0. Sample depths, borehole locations, and replicate samples collected during the Appendix III RFI are listed in Table 5-12. Soil boring logs for the boreholes drilled and sampled at ST-210 are in Appendix C.

Table 5-12. Boreholes and Samples Analyzed from SWMU 10-7, Building 377, OWS Lines (ST-210)

Borehole	Borehole Location	Sample Depths (ft)	FID (ppm_v)
01	9 ft NW and 139 ft NE of the N corner of Building 378	4-9	46
02	9 ft NW and 186 ft NE of the N corner of Building 378	4-9[a]	0
03	9 ft NW and 88 ft NE of the N corner of Building 378	3-5	0
04	9 ft NW and 37 ft NE of the N corner of Building 378	3-5	0
05	9 ft NW and 18 ft SW of the N corner of Building 378	2-4	0

FID readings are values above background and are the high readings of the sample interval.

a. Replicate sample also collected at this interval.

5.9.2.4 Laboratory Analysis

The soil samples were analyzed for TPH, VOCs, SVOCs, metals (the potential contaminants associated with normal operations at this facility), soil pH, and soil moisture. The four brass tubes in each 2-ft sample interval were field-screened for possible contamination using a beta-gamma meter and a FID. The sample with the highest FID reading was to be submitted for VOC analysis. Only one soil sample collected at ST-210 (ST-210C-01-0409), exhibited FID readings above background levels. The elevated FID readings are listed in Table 5-12.

5.9.3 Site Characteristics

5.9.3.1 Geology

Building 377 area is underlain by unconsolidated alluvial sediment that is predominantly silty sand to very fine-grained sand at depths of up to 9 ft below grade; small amounts of coarse to very coarse sand to fine gravel are in several boreholes. Five holes were drilled and a maximum depth of 9 ft below grade was attained at boreholes ST-210C-01 and ST-210C-02. A discussion of the general geology at Kirtland AFB is presented in Section 2.4.

As a result of ST-210 line installation, it is probable that backfill material is present adjacent to each line to a depth at least equal to the total depth of each line. Borehole logs for this area are presented in Appendix C.

5.9.3.2 Hydrogeology

Groundwater beneath ST-210 is found within the Upper Santa Fe sediments and is generally thought to be unconfined in the upper portion of the aquifer. This area is within the HR1 saturated zone setting as defined by SNL studies (Figure 2-9) (SNL, 1994). Hydrogeologic characterization in this portion of Kirtland AFB is complicated by the presence of numerous production wells (Figure 2-11). It is unlikely that uniform groundwater conditions exist in this region. Local cones of depression associated with groundwater withdrawal have altered the groundwater flow direction in the vicinity of the well fields (Figure 2-7).

The gradient is probably to the northeast at this site. Three production wells are located near this site: KAFB-14 is upgradient 1,700 ft east, KAFB-12 is cross-gradient 2,800 ft north-northwest, and KAFB-13 is upgradient 3,300 ft west-northwest (Figures 2-7 and 2-11). Depth to groundwater is estimated to be 350 ft below grade; however, shallower perched water zones may occur (Figure 2-10). Hydraulic conductivity within HR1 is estimated at 2 to 171 ft/day (SNL, 1994). A general discussion of the hydrogeology at Kirtland AFB is presented in Section 2.5.

5.9.4 Nature and Extent of Contamination

The following section describes the nature and extent of contamination based on the analytical results for soil samples submitted for analysis from ST-210. Analytical results are summarized in Table 5-13, where only the reportable concentrations are listed. Full analytical results are presented in Appendix F and laboratory validation reports are presented in Appendix K.

Organic Compounds

Methylene chloride was the only VOC analyte detected in all six of the soil samples submitted for analysis at ST-210. The detected concentrations of this compound ranged from 0.006 to 0.01 mg/kg and did not exceed the HHRB action level of 85 mg/kg (Table 5-13).

The SVOC analyte di-n-butylphthalate was detected in all six soil samples submitted for analysis at ST-210. The concentrations of the compound ranged from 0.66 to 0.86 mg/kg. These concentrations are far below the HHRB action level of 7,800 mg/kg (Table 5-13).

Petroleum Hydrocarbons

No gasoline range hydrocarbons were indicated in the soil samples submitted for analysis from ST-210. Diesel range hydrocarbons (6.2 to 13 mg/kg) were detected in four of the six soil samples submitted for analysis from ST-210. The concentrations do not exceed the NMED action level of 100 mg/kg (Table 5-13).

Table 5-13. Summary of Reportable Concentrations for Soil Analyses at SWMU 10-7, Building 377, OWS Lines (ST-210)[1]
(Concentrations mg/kg)

Chemical Class	Analyte	HHRB Action Level[2]	PQL UTL	Borehole Number and Sample Depth Interval (ft)					
				ST210C-01		*ST210C-02*	*ST210C-03*	*ST210C-04*	*ST210C-05*
				4–9 FR	4–9	4–9	3–5	3–5	2–4
VOC	Methylene chloride	85.0	0.005	0.006	0.007	0.01	0.006	0.006	0.006
SVOC	Di-n-butylphthalate	7,800	0.70	0.78	0.82	0.66	0.74	0.86	0.83
TPH	Diesel fraction	100	10.0	13.0	11.0	ND	10.0	6.2	ND
METALS	Aluminum	78,000	14,700	12,800	10,300	8,930	5,960	5,250	5,480
	Arsenic	0.37	6.5	3.9	3.8	2.8	1.6	2.1	1.9
	Barium	5,500	735	85.2	143	410	108	69.0	77.1
	Beryllium	0.15	0.84	0.57	0.44	0.35	0.32	ND	ND
	Calcium	N/A	121,000	63,100	57,700	118,000	26,600	48,200	20,900
	Chromium, total	390	21.6	8.0	7.3	6.3	5.0	5.5	6.5
	Cobalt	4,700	15.4	7.2	5.8	3.5	3.6	3.4	3.4
	Copper	2,900	223	21.5	10.4	16.3	17.4	9.5	21.5
	Iron	N/A	23,800	14,000	12,900	7,590	8,220	6,870	8,310
	Lead	400	17.5	5.5	4.7	2.7	2.9	2.3	15.9
	Magnesium	N/A	10,400	5,970	4,860	5,060	2,610	2,290	2,290
	Manganese	390	549	287	180	126	105	82.0	112
	Mercury	23.0	N/A	ND	ND	0.14	ND	ND	ND
	Nickel	1,600	188	11.0	5.5	6.1	3.9	3.8	5.8
	Potassium	N/A	3,590	1,980	1,760	1,300	1,010	1,010	917
	Sodium	N/A	787	150	ND	154	109	88.1	62.8
	Vanadium	550	55.3	45.8	37.9	21.9	19.7	16.3	21.8
	Zinc	23,000	114	36.3	28.5	20.0	20.2	15.1	28.3
OTHER	pH			8.8	8.5	8.8	8.8	8.8	8.7
	Moisture (%)			12.9	9.8	15.1	7.6	8.1	8.0

FOOTNOTES

1	Complete laboratory analytical results and method detection limits are presented in Appendix K.
2	Action level of RCRA Proposed Rule Subpart S (55 FR 30814, 7/27/90).
*	TPH action level is 100 mg/kg adopted from NMED UST regulations (NMED, 1990). SW-8015 analyzes volatile and semivolatile petroleum hydrocarbon fractions separately. The total concentration of the two fractions analyzed under SW-8015 will be used to assess compliance with stipulated action levels for the purpose of this RFI.
#	Denotes TCLP analysis, results in mg/l.
--	No Data.
FR	Field Replicate.
HHRB	Human health risk based.
J	Estimated value.
N/A	Not Applicable.
NA	Not Analyzed.
ND	Not detected above the method detection limit.
pCi/g	picocuries per gram.
PQL	Practical quantitation limits (defines VOC, SVOC, and TPH).
R	Reject NDs due to interference.
RAD	Radionuclides.
RE	Resample.
SVOC	Semivolatile organic compounds.
TPH	Total petroleum hydrocarbons.
U	Accept data (positive results may be influenced by lab contamination).
UJ	Estimated nondetect.
UTL	Upper tolerance limits (defines metals).
VOC	Volatile organic compounds.

Metals

Table 5-13 lists all metal concentrations reported at ST-210 and the respective UTL and HHRB action level concentrations. Arsenic was detected in all of the soil samples at concentrations above the HHRB action level of 0.37 mg/kg but below the UTL of 6.5 mg/kg. The six soil samples had arsenic concentrations ranging from 1.6 to 3.9 mg/kg. Beryllium was detected in four of the six soil samples with concentrations ranging from 0.32 to 0.57 mg/kg; these concentrations appear to be naturally occurring at Kirtland AFB as discussed in Section 4.2.2.

Soil pH and Moisture

Soil pH values ranged from 8.5 to 8.8 in these samples. Soil moisture values ranged from 7.6 to 15.1 percent (Table 5-13).

5.9.5 Conclusions and Recommendations

Conclusions

- One VOC and one SVOC were detected in the soil samples submitted from this site; all concentrations were below HHRB action levels.
- No gasoline range hydrocarbons were detected in the subsurface soil samples collected from the site. Diesel range hydrocarbons (6.2 to 13 mg/kg) were detected in subsurface soil samples submitted for analysis at concentrations below the NMED action level. The diesel hydrocarbon concentrations are similar to those detected in background samples analyzed during the Appendix III RFI, and are not conclusive evidence that a release occurred. Without the presence of other release indicators (significant concentrations of VOCs, SVOCs and metals), it is probable that the diesel range hydrocarbon concentrations are not the result of a release.
- Arsenic and beryllium were the only metals detected at concentrations exceeding the HHRB action level; these concentrations appear to be naturally occurring throughout Kirtland AFB.
- The analytical results at the lines of ST-210 are not indicative of a release from this site.

Recommendations

- Based on the findings of the RFI, no further action is necessary; therefore, the lines at ST-210 do not require further investigation. A No Further Action proposal should be prepared. A CMS is being conducted at OWS ST-210 in accordance with Stage 2B RFI recommendations.

5.10 SWMU 10-7, Building 381, OWS Lines (ST-211)

5.10.1 Site Background and Environmental Setting

ST-211 is near the east side of Building 381; area drain ST-213 is between the east side of the building and ST-211. Building 381 is the Aerospace Ground Equipment (AGE) shop, used for the maintenance of flightline support equipment, and is located in western portion of Kirtland AFB. The general location of the unit is shown on Figure 5-8. According to engineering drawings, the inflow to ST-211 comes from wash rack area drain, ST-213. Discharge is to the sanitary sewer southeast of the building.

In accordance with the Kirtland AFB RCRA Part B Permit (as an interim measure), OWS ST-211 was removed and replaced with a new unit in late 1994. The new unit, a double-walled steel tank with a fiberglass coating, is equipped with an interstitial monitoring system. A 6-in. sanitary sewer line was installed to connect the new OWS to the existing sanitary sewer. Area drain ST-213, which formerly discharged into OWS ST-211, has been redirected to discharge into an existing 6-in. storm sewer line.

The lines serving ST-211 are in the urban/industrial zone. The nearest production wells to this site are KAFB-14, 2,200 ft east, and KAFB-12, 2,800 ft north.

5.10.2 Study Area Investigation

5.10.2.1 Previous Investigations

During the Stage 2B RFI, subsurface soil samples were collected from the perimeter of OWS ST-211 and from the perimeter of area drain ST-213. Analytical results from the soil samples collected at ST-211 indicated that a small release had occurred at the unit. These results are presented in the Stage 2B RFI Report (USAF, 1995).

5.10.2.2 Data Gaps

Prior to the Appendix III RFI, no data were available to determine if a release occurred from the inflow or outflow waste lines of either ST-211 or ST-213. A discussion of the ST-213 investigation is in Section 6.3.

5.10.2.3 RFI Field Investigation

The objective of the ST-211 and ST-213 OWS lines investigation was to determine the presence or absence of contamination in the soil adjacent to the wastelines. The soil investigation was limited to the shallow subsurface.

Analytical results from soil samples collected during Stage 2B RFI were used to characterize the soil adjacent to the inflow and outflow lines within a 50-ft length of ST-211. Based on engineering drawings, the inflow lines to ST-211 run south for 125 ft along the east side of Building 381 collecting flow from the building's east side floor drains. The line turns east for 40 ft to enter ST-211, collecting flow from area drain ST-213 along the way. Subsurface line locations were confirmed using methods described in Section 3.0.

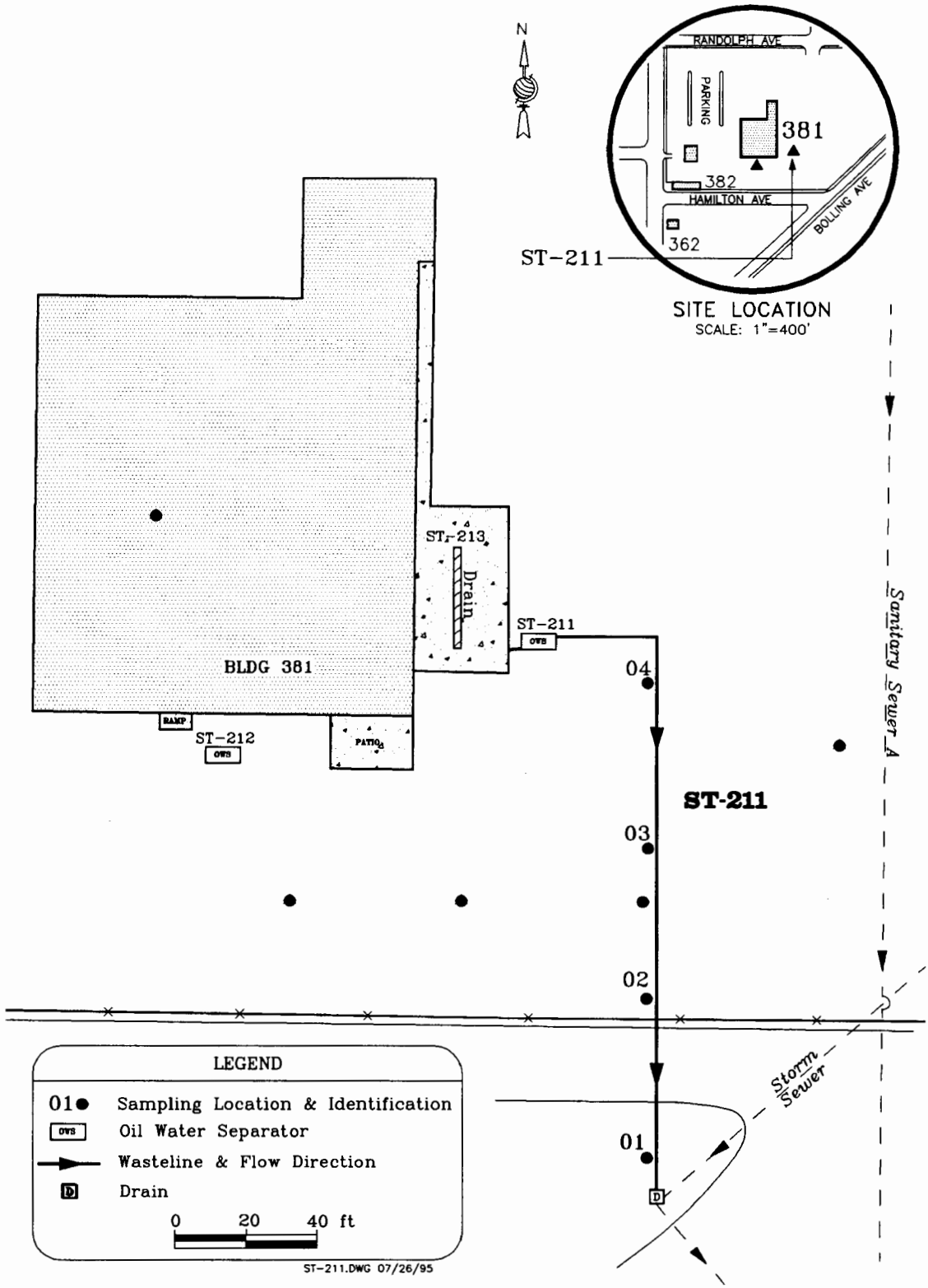


Figure 5-8. Soil Sampling Locations at SWMU 10-7, Building 381, OWS Lines (ST-211)

On January 12, 1995, four boreholes were sampled using a Geoprobe. The sample interval at each borehole extended from the depth of the line to 5 ft below the line. From this interval, two samples were collected: one at a depth equal to the base of the line, the other from 3 ft below the base of the line (i.e., 1 to 3 ft and 4 to 6 ft below grade). Both samples were field-screened with a FID organic vapor meter and only the sample with the highest FID reading was submitted to the laboratory for analysis. If no elevated FID readings were detected, the sample collected at the depth closest to the base of the line was submitted for analysis. Along the lines serving ST-211, four soil samples were collected and submitted for laboratory analysis during the Appendix III RFI.

The analytical results from ST-211-01, collected during the Stage 2B RFI, were used as background concentration data for the samples collected at ST-211 during Appendix III RFI.

Sampling operations and sample handling procedures are described in Section 3.0. Sample depths, borehole locations, and replicate samples collected during the Appendix III RFI are listed in Table 5-14. Soil boring logs for the boreholes drilled and sampled at ST-211 are in Appendix C.

Table 5-14. Boreholes and Samples Analyzed from SWMU 10-7, Building 381, OWS Lines (ST-211)

Borehole	Borehole Location	Sample Depths (ft)
01	50 ft S of borehole 02	4-6
02	50 ft S of borehole 03	4-6
03	50 ft S of borehole 04	4-6
04	30 ft E and 10 ft S of ST-211	4-6

5.10.2.4 Laboratory Analysis

The soil samples were analyzed for VOCs, SVOCs, TPH, metals, mercury (the potential contaminants associated with normal operations at this site), soil pH, and soil moisture. The four brass tubes in each 2-ft sample interval were field-screened for possible contamination using a beta-gamma meter and a FID. All field-screening instrument readings remained at background levels throughout the ST-211 drilling and sampling activities.

5.10.3 Site Characteristics

5.10.3.1 Geology

Building 381 is underlain by unconsolidated alluvial sediment that is predominantly fine-grained sand and very fine-grained to fine-grained silty sand. Four boreholes were drilled and a maximum depth of 9 ft below grade was attained. No boreholes penetrated into the Santa Fe Group sediments that presumably underlie this area. A discussion of the general geology at Kirtland AFB is presented in Section 2.4.

As a result of ST-211 line installation, it is probable that backfill material is present adjacent to each line to a depth at least equal to the total depth of each line. Borehole logs for this area are presented in Appendix C.

5.10.3.2 Hydrogeology

Groundwater beneath Building 381 is found within the Upper Santa Fe sediments and is generally thought to be unconfined in the upper portion of the aquifer. This area is within the HR1 saturated zone setting as defined by SNL studies (Figure 2-9) (SNL, 1994). Hydrogeologic characterization in this portion of Kirtland AFB is complicated by the presence of numerous production wells (Figure 2-11). It is probable that uniform groundwater conditions do not exist in this region. Local cones of depression associated with groundwater withdrawal have altered the groundwater flow direction in the vicinity of the well fields (Figure 2-7).

The gradient is probably to the northeast at this site. Two production wells are located near the OWS and area drain: KAFB-14 is downgradient 2,200 ft east and KAFB-12 is cross-gradient 2,800 ft north (Figures 2-7 and 2-11). Depth to groundwater is estimated to be approximately 350 ft below grade (Figure 2-10); however, shallower perched water zones may occur. Hydraulic conductivity within HR1 is estimated at 2 to 171 ft/day (SNL, 1994). A general discussion of the hydrogeology at Kirtland AFB is presented in Section 2.5.

5.10.4 Nature and Extent of Contamination

This section describes the nature and extent of contamination based on the analytical results. Analytical results for ST-211 are summarized in Table 5-15, where only the reportable concentrations are listed. Full analytical results are presented in Appendix F and laboratory validation reports are presented in Appendix K.

Organic Compounds

Methylene chloride was the only VOC analyte detected in one of the four soil samples submitted for analysis. The detected concentrations of this compound were equal to 0.008 mg/kg. This concentration does not exceed the HHRB action level of 85 mg/kg (Table 5-15).

There were no SVOC analytes detected in the soil sample collected at ST-211.

Petroleum Hydrocarbons

Diesel range hydrocarbons were detected in one of the soil samples collected at ST-211 at a concentration of 7.2 mg/kg. This concentration does not exceed the 100 mg/kg NMED action level (Table 5-15).

Metals

Table 5-15 lists all metal concentrations reported at ST-211 and the respective UTL and HHRB action level concentrations. Arsenic (3.5 to 5.2 mg/kg) was detected in all four of the soil samples at concentrations above the HHRB action level of 0.37 mg/kg, but below the UTL of 6.5 mg/kg. Beryllium (0.34 to 0.57 mg/kg) was detected in the four soil samples at concentrations above the HHRB action level of 0.15 mg/kg, but below the 0.84 mg/kg UTL. These concentrations of arsenic and beryllium appear to be naturally occurring at Kirtland AFB as discussed in Section 4.2.2.

Table 5-15. Summary of Reportable Concentrations for Soil Analyses at SWMU 10-7, Building 381, OWS Lines (ST-211)[1] (Concentrations mg/kg)

Chemical Class	Analyte	HHRB Action Level[2]	PQL UTL	Borehole Number and Sample Depth Interval (ft)			
				ST211C-01 4–6	*ST211C-02* 4–6	*ST211C-03* 4–6	*ST211C-04* 4–6
VOC	Methylene chloride	85.0	0.005	ND	ND	ND	0.008
TPH	Diesel fraction	100	10.0	7.2	ND	ND	ND
METALS	Aluminum	78,000	14,700	7,320	8,530	8,600	5,880
	Arsenic	0.37	6.5	4.0	5.2	4.5	3.5
	Barium	5,500	735	172	1,230	2,500	121
	Beryllium	0.15	0.84	0.35	0.57	0.44	0.34
	Calcium	N/A	121,000	162,000	86,500	48,600	89,600
	Chromium, total	390	21.6	4.8	5.6	6.0	4.9
	Cobalt	4,700	15.4	3.4	4.5	6.4	3.9
	Copper	2,900	223	6.9	34.2	29.7	32.3
	Iron	N/A	23,800	6,410	8,080	11,100	6,140
	Lead	400	17.5	3.7	4.4	5.3	3.0
	Magnesium	N/A	10,400	4,750	4,390	4,300	3,540
	Manganese	390	549	110	109	263	133
	Nickel	1,600	188	6.2	5.4	9.4	4.0
	Potassium	N/A	3,590	1,020	1,380	1,480	865
	Sodium	N/A	787	125	85.0	154	90.2
	Vanadium	550	55.3	21.0	29.3	33.6	17.5
	Zinc	23,000	114	15.0	26.3	30.2	21.1
OTHER	pH			8.5	8.6	8.9	8.6
	Moisture (%)			15.1	12.7	9.8	12.2

FOOTNOTES

1	Complete laboratory analytical results and method detection limits are presented in Appendix K.
2	Action level of RCRA Proposed Rule Subpart S (55 FR 30814, 7/27/90).
*	TPH action level is 100 mg/kg adopted from NMED UST regulations (NMED, 1990). SW-8015 analyzes volatile and semivolatile petroleum hydrocarbon fractions separately. The total concentration of the two fractions analyzed under SW-8015 will be used to assess compliance with stipulated action levels for the purpose of this RFI.
#	Denotes TCLP analysis, results in mg/l.
--	No Data.
FR	Field Replicate.
HHRB	Human health risk based.
J	Estimated value.
N/A	Not Applicable.
NA	Not Analyzed.
ND	Not detected above the method detection limit.
pCi/g	picocuries per gram.
PQL	Practical quantitation limits (defines VOC, SVOC, and TPH).
R	Reject NDs due to interference.
RAD	Radionuclides.
RE	Resample.
SVOC	Semivolatile organic compounds.
TPH	Total petroleum hydrocarbons.
U	Accept data (positive results may be influenced by lab contamination).
UJ	Estimated nondetect.
UTL	Upper tolerance limits (defines metals).
VOC	Volatile organic compounds.

Soil pH and Moisture

Soil pH value ranged from 8.5 to 8.9 in these samples. Soil moisture values ranged from 9.8 to 15.1 percent (Table 5-15).

5.10.5 Conclusions and Recommendations

Conclusions

- One VOC and no SVOCs were detected in the soil samples submitted from this site; all concentrations were below HHRB action levels.
- No gasoline range hydrocarbons were detected in samples from ST-212. Diesel range hydrocarbons were detected in one sample at a concentration below the NMED action level. This diesel range hydrocarbon concentration was similar to those measured in background samples collected during the Appendix III RFI.
- Arsenic and beryllium were the only metals detected at concentrations exceeding the HHRB action level; these concentrations appear to be naturally occurring throughout Kirtland AFB.
- The analytical results at ST-211 are not indicative of a release from this site.

Recommendations

- Based on the findings of the RFI, no further action is necessary; therefore, ST-211 does not require further investigation. A No Further Action proposal should be prepared.

5.11 SWMU 10-7, Building 381, OWS Lines (ST-212)

5.11.1 Site Background and Environmental Setting

ST-212 is outside near the south side of Building 381, the AGE shop, in the western portion of Kirtland AFB. The general location of the unit and the associated inflow lines are shown on Figure 5-9. ST-212 receives inflow runs from the central floor drain in the building and discharges south and east to the sanitary sewer line east of the building. The length of the wasteline system is approximately 300 ft.

ST-212 is located in the urban/industrial zone. The nearest production wells to this site are KAFB-14, 2,200 ft east, and KAFB-12, 2, 800 ft north.

5.11.2 Study Area Investigation

5.11.2.1 Previous Investigations

During the Stage 2B RFI, subsurface soil samples were collected from the perimeter of ST-212. Analytical results were not indicative of a release from this unit. These results are presented in the Stage 2B RFI Report (USAF, 1995).

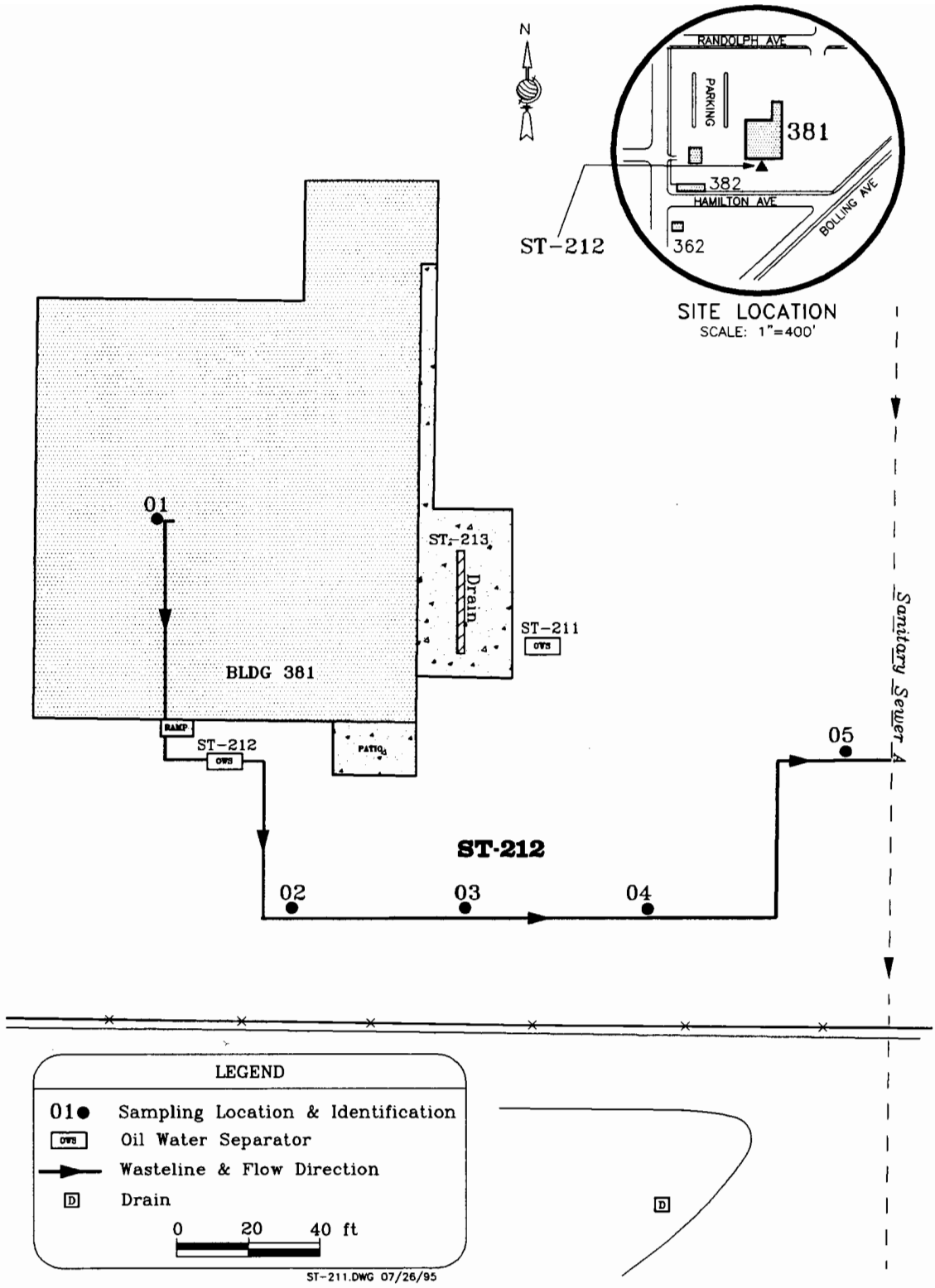


Figure 5-9. Soil Sampling Locations at SWMU 10-7, Building 381, OWS Lines (ST-212)

5.11.2.2 Data Gaps

Prior to the Appendix III RFI, no data were available to determine if a release occurred from ST-212 OWS wastelines.

5.11.2.3 RFI Field Investigation

The objective of the investigation was to determine the presence or absence of contamination in soil adjacent to the wastelines. Line location and sample borehole designations were completed prior to the soil sampling effort. The soil investigation was limited to the shallow subsurface.

Analytical results from soil samples collected during the Stage 2B RFI were used to characterize the soil adjacent to the OWS inflow and outflow lines within a 50-ft length of ST-212. Based on engineering drawings, the inflow line to ST-212 runs south for 60 ft from the middle of the 120-ft-long floor drain in the center of the building, then turns east for about 12 ft to enter the unit. The outflow line exits the unit to the east, turns south for 45 ft, runs east for 145 ft, turns north for 45 ft and then turns back east and runs 30 ft to the sanitary sewer (Figure 5-9). Subsurface line locations were determined using methods described in Sections 3.0.

On December 21, 1994, five boreholes were drilled and sampled using a Geoprobe. The sample interval at each borehole extended from the depth of the line to 5 ft below the line. From this interval, two samples were collected: one at a depth equal to the base of the line, the other from 3 ft below the base of the line (i.e., 2 to 4 ft and 6 to 8 ft below grade). Both samples were field-screened with a FID organic vapor meter and only the sample with the highest FID reading was submitted for laboratory analysis. If no elevated FID readings were detected, the sample collected at the depth closest to the base of the line was submitted for analysis. Six soil samples, including one replicate sample, were collected along the ST-212 wasteline and submitted for laboratory analysis during the Appendix III RFI.

Because of the proximity of ST-212 to ST-211, analytical results from borehole ST-211-01, collected during the Stage 2B RFI, were used as background concentration data for samples collected at ST-212 during the Appendix III RFI.

Sampling operations and sample handling procedures are described in Section 3.0. Sample depths, borehole locations, and replicate samples submitted for analysis collected during the Appendix III RFI are listed in Table 5-16. Soil boring logs for the boreholes drilled and sampled at ST-212 are in Appendix C.

Table 5-16. Boreholes and Samples Analyzed from SWMU 10-7, Building 381, OWS Lines (ST-212)

Borehole	Borehole Location	Sample Depths (ft)
01	Near center of main floor drain inside Building 381	2-4
02	50 ft SE of ST-212, along outflow line	5-7
03	50 ft E of borehole 02	6-11[a]
04	50 ft E and borehole 03	7-9
05	60 ft E and 40 ft N of borehole 04	8-10

a. Replicate sample also collected at this interval.

5.11.2.4 Laboratory Analysis

Soil samples were analyzed for VOCs, SVOCs, TPH, metals, mercury (the potential contaminants associated with normal operations at this site), soil pH, and soil moisture. The four brass tubes in each 2-ft sample interval were field-screened for possible contamination using a beta-gamma meter and a FID. All field-screening instrument readings remained at background levels throughout the ST-212 drilling and sampling activities.

5.11.3 Site Characteristics

5.11.3.1 Geology

Building 381 is underlain by unconsolidated alluvial sediment that is predominantly fine-grained sand and very fine-grained to fine-grained silty sand. Five boreholes were drilled and a maximum depth of 13 ft below grade was attained in borehole ST-212C-05. No boreholes penetrated into the Santa Fe Group sediments that presumably underlie this area. A discussion of the general geology at Kirtland AFB is presented in Section 2.4.

As a result of ST-212 line installation, it is probable that backfill material is present adjacent to each line to a depth at least equal to the total depth of each line. Borehole logs for this site are presented in Appendix C.

5.11.3.2 Hydrogeology

Groundwater beneath Building 381 is found within the Upper Santa Fe sediments and is generally thought to be unconfined in the upper portion of the aquifer. This area is within the HR1 saturated zone setting as defined by SNL studies (Figure 2-9) (SNL, 1994). Hydrogeologic characterization in this portion of Kirtland AFB is complicated by the presence of numerous production wells (Figure 2-11). It is probable that uniform groundwater conditions do not exist in this region. Local cones of depression associated with groundwater withdrawal have altered the groundwater flow direction in the vicinity of the well fields (Figure 2-7).

The gradient is probably northeast at this site. Two production wells are near OWS ST-212: KAFB-14 is downgradient 2,200 ft east, and KAFB-12 is cross-gradient 2,800 ft north (Figures 2-7 and 2-11). Depth to groundwater is estimated at 350 ft below grade (Figure 2-10); however, shallower perched water zones may occur. Hydraulic conductivity within HR1 is estimated at 2 to 171 ft/day (SNL, 1994). A general discussion of the hydrogeology at Kirtland AFB is presented in Section 2.5.

5.11.4 Nature and Extent of Contamination

The following section describes the nature and extent of contamination based on the analytical results for soil samples submitted for analysis from ST-212. Analytical results are summarized in Table 5-17, where only the reportable concentrations are listed. Full analytical results are presented in Appendix F and laboratory validation reports are presented in Appendix K.

Table 5-17. Summary of Reportable Concentrations for Soil Analyses at SWMU 10-7, Building 381, OWS Lines (ST-212)[1]
(Concentrations mg/kg)

Chemical Class	Analyte	HHRB Action Level[2]	PQL UTL	Borehole Number and Sample Depth Interval (ft)					
				ST212C-01	*ST212C-02*	*ST212C-03*		*ST212C-04*	*ST212C-05*
				2–4	5–7	6–11 FR	6–11	7–9	8–10
VOC	Methylene chloride	85.0	0.005	0.009	0.008	0.008	0.008	0.007	0.007
SVOC	Di-n-butylphthalate	7,800	0.70	ND	ND	0.57	ND	ND	ND
	Phenol	47,000	0.30	0.52	0.65	0.98	0.71	0.57	0.94
TPH	Diesel fraction	100	10.0	7.8	5.8	6.6	8.2	ND	ND
METALS	Aluminum	78,000	14,700	3,950	7,130	9,110	11,700	5,370	11,600
	Arsenic	0.37	6.5	1.5	2.8	3.9	5.1	1.6	4.8
	Barium	5,500	735	69.2	121	174	154	94.7	1,000
	Beryllium	0.15	0.84	0.31	0.34	0.46	0.57	0.32	0.56
	Calcium	N/A	121,000	12,600	51,500	145,000	57,900	28,800	34,000
	Chromium, total	390	21.6	5.3	7.4	8.7	11.0	6.8	10.4
	Cobalt	4,700	15.4	2.6	3.6	3.7	5.7	2.3	8.0
	Copper	2,900	223	22.1	13.8	13.1	37.8	12.0	12.1
	Iron	N/A	23,800	7,040	9,790	9,660	13,300	7,240	16,200
	Lead	400	17.5	3.5	4.2	3.8	4.3	3.2	6.3
	Magnesium	N/A	10,400	1,670	3,460	5,250	5,530	2,670	6,100
	Manganese	390	549	107	151	125	266	102	301
	Nickel	1,600	188	3.4	7.5	6.1	9.2	5.8	9.8
	Potassium	N/A	3,590	813	1,330	1,530	1,880	1,030	1,900
	Sodium	N/A	787	105	101	107	106	73.1	325
	Thallium	N/A	N/A	ND	ND	ND	0.17	ND	0.12
	Vanadium	550	55.3	14.3	24.3	28.4	39.6	16.1	45.1
	Zinc	23,000	114	22.1	22.8	24.2	36.4	21.2	33.3
OTHER	pH			8.6	8.9	8.5	8.6	8.6	9.0
	Moisture (%)			4.2	12.3	12.7	11.7	7.2	10.8

FOOTNOTES

1	Complete laboratory analytical results and method detection limits are presented in Appendix K.
2	Action level of RCRA Proposed Rule Subpart S (55 FR 30814, 7/27/90).
*	TPH action level is 100 mg/kg adopted from NMED UST regulations (NMED, 1990). SW-8015 analyzes volatile and semivolatile petroleum hydrocarbon fractions separately. The total concentration of the two fractions analyzed under SW-8015 will be used to assess compliance with stipulated action levels for the purpose of this RFI.
#	Denotes TCLP analysis, results in mg/l.
--	No Data.
FR	Field Replicate.
HHRB	Human health risk based.
J	Estimated value.
N/A	Not Applicable.
NA	Not Analyzed.
ND	Not detected above the method detection limit.
pCi/g	picocuries per gram.
PQL	Practical quantitation limits (defines VOC, SVOC, and TPH).
R	Reject NDs due to interference.
RAD	Radionuclides.
RE	Resample.
SVOC	Semivolatile organic compounds.
TPH	Total petroleum hydrocarbons.
U	Accept data (positive results may be influenced by lab contamination).
UJ	Estimated nondetect.
UTL	Upper tolerance limits (defines metals).
VOC	Volatile organic compounds.

Organic Compounds

Methylene chloride was the only VOC analyte detected in soil samples submitted for analysis at ST-212. It was detected in all six samples. The detected concentrations ranged from 0.007 to 0.009 mg/kg and do not exceed the HHRB action level of 85 mg/kg (Table 5-16). Methylene chloride was also detected in associated QC samples and is believed to be the result of laboratory contamination as discussed in Section 3.5.1.

The SVOC analytes di-n-butylphthalate and phenol were detected in one or more of the soil samples submitted for analysis at ST-212. Di-n-butylphthalate was detected in one soil sample at a concentration of 0.57 mg/kg. Phenol was detected in all six soil samples at concentrations ranging from 0.52 to 0.98 mg/kg. Neither of these compounds was detected at concentrations exceeding the HHRB action levels, 7,800 and 47,000 mg/kg, respectively (Table 5-17).

Petroleum Hydrocarbons

Diesel range hydrocarbons were detected in four of the six soil samples submitted for analysis at ST-212. Concentrations ranged from 5.8 to 8.2 mg/kg. These concentrations do not exceed the NMED action level of 100 mg/kg (Table 5-17).

Metals

Table 5-17 lists all metal concentrations reported at ST-212 and the respective UTL and HHRB action level concentrations. Arsenic (1.5 to 5.1 mg/kg) was detected in all six samples at concentrations above the HHRB action level of 0.37 mg/kg, but below the UTL of 6.5 mg/kg. Beryllium (0.31 to 0.57 mg/kg) was detected in all six soil samples at concentrations above the 0.15 mg/kg HHRB action level, but below the 0.84 mg/kg UTL concentration. These concentrations appear to be naturally occurring at Kirtland AFB as discussed in Section 4.2.2.

Soil pH and Moisture

Soil pH values ranged from 8.5 to 9.0 in these samples. Soil moisture values ranged from 4.2 to 12.7 percent (Table 5-17).

5.11.5 Conclusions and Recommendations

Conclusions

- One VOC and two SVOCs were detected in the soil samples submitted from this site. All concentrations were below HHRB action levels.

- No gasoline range hydrocarbons were detected in samples from ST-212. Diesel range hydrocarbons were detected in four samples at concentrations below the NMED action level. The diesel range hydrocarbon concentrations detected in the samples at this site were similar to those measured in background samples collected during the Appendix III RFI. The TPH detections alone are not conclusive evidence of a release from this unit. Because no other release components (such as VOCs, SVOCs, or metals) are present, it is probable that a release has not occurred.

- Arsenic and beryllium was the only metal detected at a concentration exceeding the HHRB action level; these concentrations appear to be naturally occurring throughout Kirtland AFB.

- The analytical results at ST-212 are not indicative of a release from this site.

Recommendations

- Based on the findings of the RFI, no further action is necessary; therefore, ST-212 does not require further investigation. A No Further Action proposal should be prepared.

5.12 SWMU 10-7, Building 471, Former AAFES Service Station, OWS Line (ST-215)

5.12.1 Site Background and Environmental Setting

ST-215 was located in the center service bay of Building 471, the former west side service station (Figure 5-10). It had two compartments, one on each side of the hydraulic lift in this service bay. Inflow was through the metal grate covering the north compartment of the unit. Inflow fluids were those commonly associated with vehicle servicing and service bay washdown activities. This unit's discharge line ran about 55 ft southwest to a sanitary sewer lateral. The south compartment bottom, which was broken out, allowed fluids to drain into the underlying soil. OWS ST-215 was removed in September 1994 during renovations to convert the service bays of Building 471 into retail sales space. The area around ST-215 was excavated to a total depth of 4 ft in an attempt to remove visibly contaminated soil. After the unit was removed, ancillary piping was plugged and capped.

Site ST-215 is in the urban/industrial zone. The nearest production wells to this site are KAFB-12, 1,700 ft northwest; KAFB-14, 1,950 ft southeast; and KAFB-13, 4,000 ft southwest.

5.12.2 Study Area Investigation

5.12.2.1 Previous Investigations

During the Stage 2B RFI, subsurface soil samples were collected from the perimeter of OWS ST-215. Analytical results for these soil samples indicated that releases had occurred at the unit. Diesel and gasoline range hydrocarbons were present at concentrations exceeding the 100 mg/kg NMED action level to a depth of about 15 ft. The vertical extent of contamination was estimated to extend to a depth of about 26 to 30 ft. Complete analytical results are presented in the Stage 2B RFI Report (USAF, 1995).

5.12.2.2 Data Gaps

Prior to the Appendix III RFI, no data were available to confirm the presence or absence of contaminants in the subsurface soil surrounding this unit.

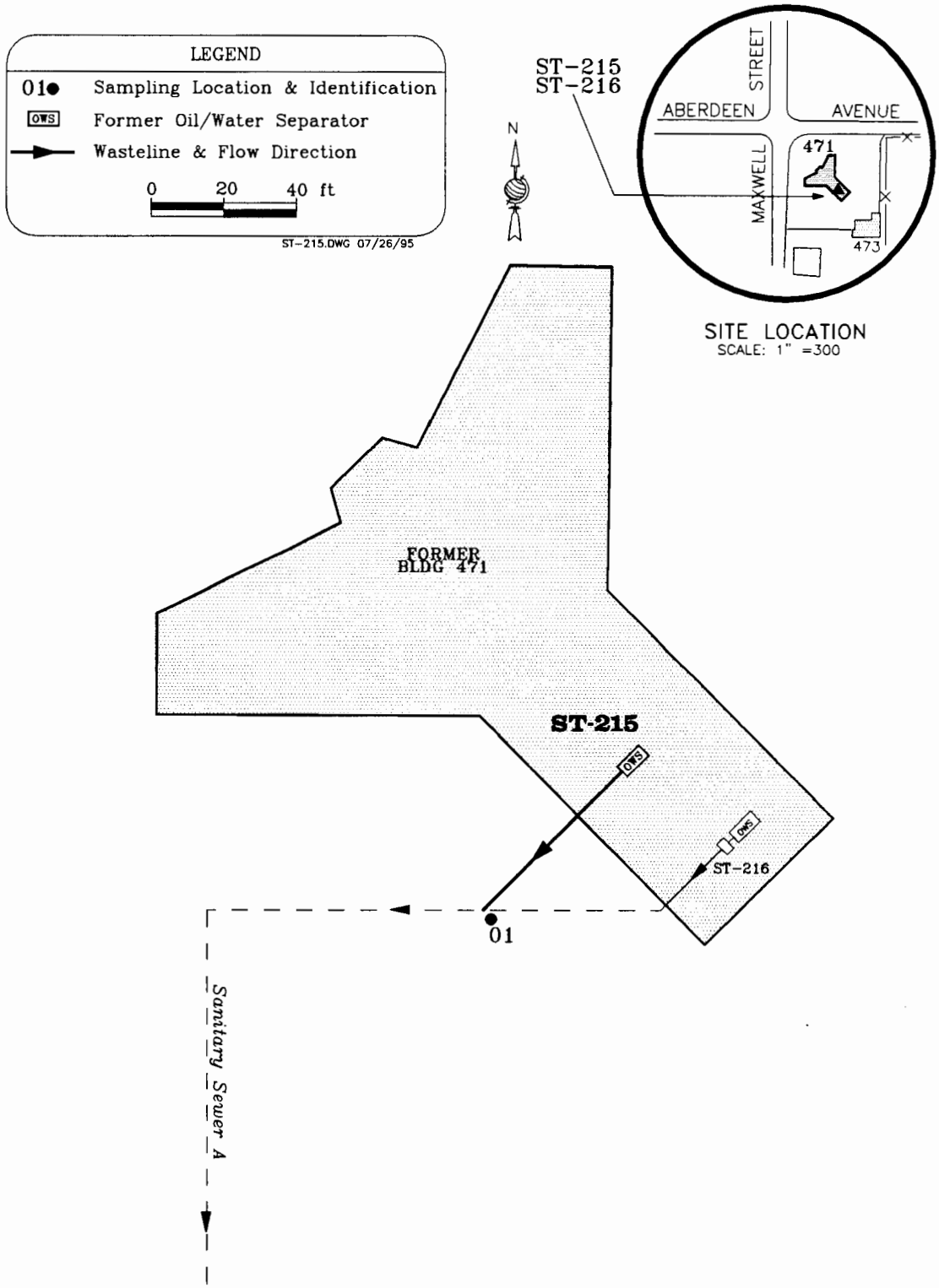


Figure 5-10. Soil Sampling Locations at SWMU 10-7, Building 471, Former AAFES Service Station, OWS Line (ST-215)

5.12.2.3 RFI Field Investigation

The objective of the investigation was to determine the presence or absence of contamination in soil adjacent to the discharge line. Line location and sample borehole designation were completed prior to the soil sampling effort. The soil investigation was limited to the shallow subsurface.

Analytical results from soil samples collected during the Stage 2B RFI were used to characterize the soil adjacent to the outflow line within a 50-ft length of ST-215. Based on engineering drawings and field observations, inflow to ST-215 was restricted to surface drainage from the service bays. The capped and abandoned outflow line runs southwest for 55 ft from the former unit location to a sanitary sewer lateral west of the units (Figure 5-10). Subsurface line locations were confirmed using methods described in Section 3.0.

On May 10, 1995, one borehole was sampled using the Geoprobe. The sample interval at each borehole extended from the depth of the line to 5 ft below the line. From this interval, two samples were collected: one at a depth equal to the base of the line, the other from 3 ft below the base of the line (i.e., 4 to 6 ft and 7 to 9 ft below). Both samples were field-screened with a FID organic vapor meter and only the sample with the highest FID reading was submitted to the laboratory for analysis. If no elevated FID readings were detected, the sample collected at the depth closest to the base of the line was submitted for analysis. No elevated FID readings were observed, therefore, the 4- to 6-ft sample was submitted for laboratory analysis.

Because of the close proximity of three sites at Building 471 (ST-214, ST-215, and ST-216), analytical results from borehole ST-214-01, collected during the Stage 2B RFI, were used for background concentration data for the sample collected at ST-215 during the Appendix III RFI.

Sampling operations and sample handling procedures are described in Section 3.0. The soil boring log for the borehole drilled and sampled at ST-215 are in Appendix C.

5.12.2.4 Laboratory Analysis

The soil sample was analyzed for VOCs, SVOCs, TPH, metals, mercury (the potential contaminants associated with normal operations at this site), soil pH, and soil moisture. The four brass tubes in the 2-ft sample interval were field-screened for possible contamination using a beta-gamma meter and a FID. All field-screening instrument readings remained at background levels throughout drilling and sampling activities at ST-215.

5.12.3 Site Characteristics

5.12.3.1 Geology

Building 471 area is underlain by unconsolidated alluvial sediment that is predominantly very fine- to fine-grained sand and silty sand; finer-grained materials were rarely encountered. Borehole ST-215C-01 was drilled to a depth of 9 ft and did not penetrate into the Santa Fe Group sediments that presumably underlie this area. A discussion of the general geology at Kirtland AFB is presented in Section 2.4.

As a result of ST-215 line installation, it is probable that backfill material is present adjacent to this line to a depth at least equal to the total depth of the line. The borehole log for this site is presented in Appendix C.

5.12.3.2 Hydrogeology

Groundwater beneath Building 471 is found within the Upper Santa Fe sediments and is generally thought to be unconfined in the upper portion of the aquifer. This area is within the HR1 saturated zone setting as defined by SNL studies (Figure 2-9) (SNL, 1994). Hydrogeologic characterization in this portion of Kirtland AFB is complicated by the presence of numerous production wells (Figure 2-11). It is probable that uniform groundwater conditions do not exist in this region. Local cones of depression associated with groundwater withdrawal have altered the groundwater flow direction in the vicinity of the well fields (Figure 2-7).

The gradient is probably east at this site. Three production wells are located in this area of Kirtland AFB: KAFB-12 is downgradient 1,700 ft northwest, KAFB-14 is upgradient 1,950 ft southeast, and KAFB-13 is cross-gradient 4,000 ft southwest (Figures 2-7 and 2-11). Depth to groundwater is estimated at 350 ft below grade; however, shallower perched water zones may occur (Figure 2-10). Hydraulic conductivity within HR1 is estimated at 2 to 171 ft/day (SNL, 1994). A general discussion of the hydrogeology at Kirtland AFB is presented in Section 2.6.

5.12.4 Nature and Extent of Contamination

The following section describes the nature and extent of contamination based on the analytical results. Analytical results are summarized in Table 5-18, where only the reportable concentrations are listed. Full analytical results are presented in Appendix F and laboratory validation reports are presented in Appendix K.

Organic Compounds

Methylene chloride was the only VOC analyte detected in the soil sample collected at ST-215. The 0.032 mg/kg concentration did not exceed the HHRB action level of 85 mg/kg (Table 5-18).

No SVOCs were detected in the soil sample collected at ST-215.

Petroleum Hydrocarbons

Diesel range hydrocarbons were detected in the soil sample collected at ST-215 at a concentration of 12 mg/kg; the concentration did not exceed the NMED action level of 100 mg/kg (Table 5-18).

Metals

Table 5-18 lists all metal concentrations reported at ST-217 and the respective UTL and HHRB action level concentrations. Arsenic (6.9 mg/kg) and beryllium (0.46 mg/kg) were detected at concentrations above the HHRB action levels of 0.37 and 0.15 mg/kg, respectively. The arsenic concentration was also above the 6.5 mg/kg UTL concentration. These concentrations appear to be naturally occurring at Kirtland AFB as discussed in Section 4.2.2.

Soil pH and Moisture

The soil pH was equal to 7.8 in this sample. The soil moisture value was 12.6 percent (Table 5-18).

Table 5-18. Summary of Reportable Concentrations for Soil Analyses at SWMU 10-7, Building 471, Former AAFES Service Station, OWS Line (ST-215)[1] (Concentrations mg/kg)

Chemical Class	Analyte	HHRB Action Level[2]	PQL UTL	Borehole Number and Sample Depth Interval (ft) ST215C-01 4–6
VOC	Methylene chloride	85.0	0.005	0.032
TPH	Diesel fraction	100	10.0	12.0
METALS	Aluminum	78,000	14,700	12,500
	Arsenic	0.37	6.5	6.9
	Barium	5,500	735	936
	Beryllium	0.15	0.84	0.46
	Calcium	N/A	121,000	79,000
	Chromium, total	390	21.6	8.3
	Cobalt	4,700	15.4	6.4
	Copper	2,900	223	25.1
	Iron	N/A	23,800	14,100
	Lead	400	17.5	7.0
	Magnesium	N/A	10,400	6,630
	Manganese	390	549	193
	Nickel	1,600	188	10.1
	Potassium	N/A	3,590	1,760
	Sodium	N/A	787	129
	Vanadium	550	55.3	49.8
	Zinc	23,000	114	36.8
OTHER	pH			7.8
	Moisture (%)			12.6

FOOTNOTES

1	Complete laboratory analytical results and method detection limits are presented in Appendix K.
2	Action level of RCRA Proposed Rule Subpart S (55 FR 30814, 7/27/90).
*	TPH action level is 100 mg/kg adopted from NMED UST regulations (NMED, 1990). SW-8015 analyzes volatile and semivolatile petroleum hydrocarbon fractions separately. The total concentration of the two fractions analyzed under SW-8015 will be used to assess compliance with stipulated action levels for the purpose of this RFI.
#	Denotes TCLP analysis, results in mg/l.
--	No Data.
FR	Field Replicate.
HHRB	Human health risk based.
J	Estimated value.
N/A	Not Applicable.
NA	Not Analyzed.
ND	Not detected above the method detection limit.
pCi/g	picocuries per gram.
PQL	Practical quantitation limits (defines VOC, SVOC, and TPH).
R	Reject NDs due to interference.
RAD	Radionuclides.
RE	Resample.
SVOC	Semivolatile organic compounds.
TPH	Total petroleum hydrocarbons.
U	Accept data (positive results may be influenced by lab contamination).
UJ	Estimated nondetect.
UTL	Upper tolerance limits (defines metals).
VOC	Volatile organic compounds.

5.12.5 Conclusions and Recommendations

Conclusions

- One VOC was detected in the soil sample collected from this site. The concentration was below the HHRB action level. No SVOCs were detected in this sample.
- No gasoline range hydrocarbons were detected. Diesel range hydrocarbons were not detected at concentrations above the NMED action level; the concentrations detected in the samples at this site were similar to those measured in background samples collected during the Appendix III RFI. The TPH detections alone are not conclusive evidence of a release from this unit. Because no other release components (such as VOCs, SVOCs, or metals) are present, it is probable that a release has not occurred.
- Arsenic and beryllium were the only metals detected at concentrations exceeding the HHRB action level; these concentrations appear to be naturally occurring throughout Kirtland AFB.
- The analytical results at ST-215 are not indicative of a release from this site.

Recommendations

- Based on the findings of the RFI, no further action is necessary; therefore, ST-215 does not require further investigation. A No Further Action proposal should be prepared. A CMS is being conducted at ST-215 in accordance with Stage 2B RFI recommendations.

5.13 SWMU 10-7, Building 471, OWS Lines (ST-216)

5.13.1 Site Description and Environmental Setting

ST-216 was removed in September 1994 during renovations to convert the service bays of Building 471 into retail sale space. ST-216 was located in the east service bay of Building 471, the former west side service station. The northern portion of the OWS was covered by a metal grate and received fluids commonly associated with vehicle servicing and service bay washwater. The unit's discharge line ran about 25 ft southwest to join a sanitary sewer lateral. After the unit was removed, ancillary piping was plugged and capped.

Site ST-216 is in the urban/industrial zone. The nearest production wells to this site are KAFB-12, 1,700 ft northwest; KAFB-14, 1,950 ft southeast; and KAFB-13, 4,000 ft southwest.

5.13.2 Study Area Investigation

5.13.2.1 Previous Investigations

During the Stage 2B RFI, subsurface soil samples were collected from the perimeter of ST-216. Analytical results were not indicative of a release from this unit. These results are presented in the Stage 2B RFI Report (USAF, 1995).

5.13.2.2 Data Gaps

Prior to the Appendix III RFI, no data were available to confirm the presence or absence of contaminants in the subsurface soil surrounding this unit.

5.13.2.3 RFI Field Investigation

The inflow to ST-216 consisted of surface drainage from vehicle servicing and wash-down activities in the service bays. The outflow line from ST-216 ran 25 ft southwest to the sanitary sewer west of the unit. Because the discharge line length was less than 50 ft, no soil samples were collected at this site during this investigation. The soil samples collected during the Stage 2B RFI at ST-216 and the wasteline sample collected at adjacent OWS ST-215 during the Appendix III RFI (Section 5.12) were used to characterize this site.

5.13.3 Conclusions and Recommendations

Conclusions

- The analytical results from the Stage 2B RFI do not indicate a release from ST-216.
- The analytical results from Appendix III RFI sampling at the adjacent ST-215 wasteline are not indicative of a release from this site.

Recommendations

- Based on the findings of the RFI, no further action is necessary; therefore, ST-216 does not require further investigation. A No Further Action proposal should be prepared.

5.14 SWMU 10-7, Building 481, OWS Lines (ST-217)

5.14.1 Site Background and Environmental Setting

ST-217 is at Building 481, the Ross Aviation aircraft hangar and maintenance facility, in the western portion of Kirtland AFB (Figure 5-11). The original OWS location was in an alcove on the north side of the building. In 1993, this OWS was replaced with a new unit located about 20 ft northwest of the original location and the inflow system was rerouted to the new unit. ST-217 receives inflow from a system of floor and gutter drains inside the building (Figure 5-11). The inflow line system is approximately 700 ft long. The original unit discharged north to sanitary sewer system A (ST-278). The original outflow line length was about 15 ft, the mapped distance from the former OWS location to the sanitary sewer. The new OWS is tied directly into the sewer system.

ST-217 is located in the urban/industrial zone. The nearest production wells to this site are KAFB-14, 1,600 ft southeast, and KAFB-12, 2,100 ft northwest.

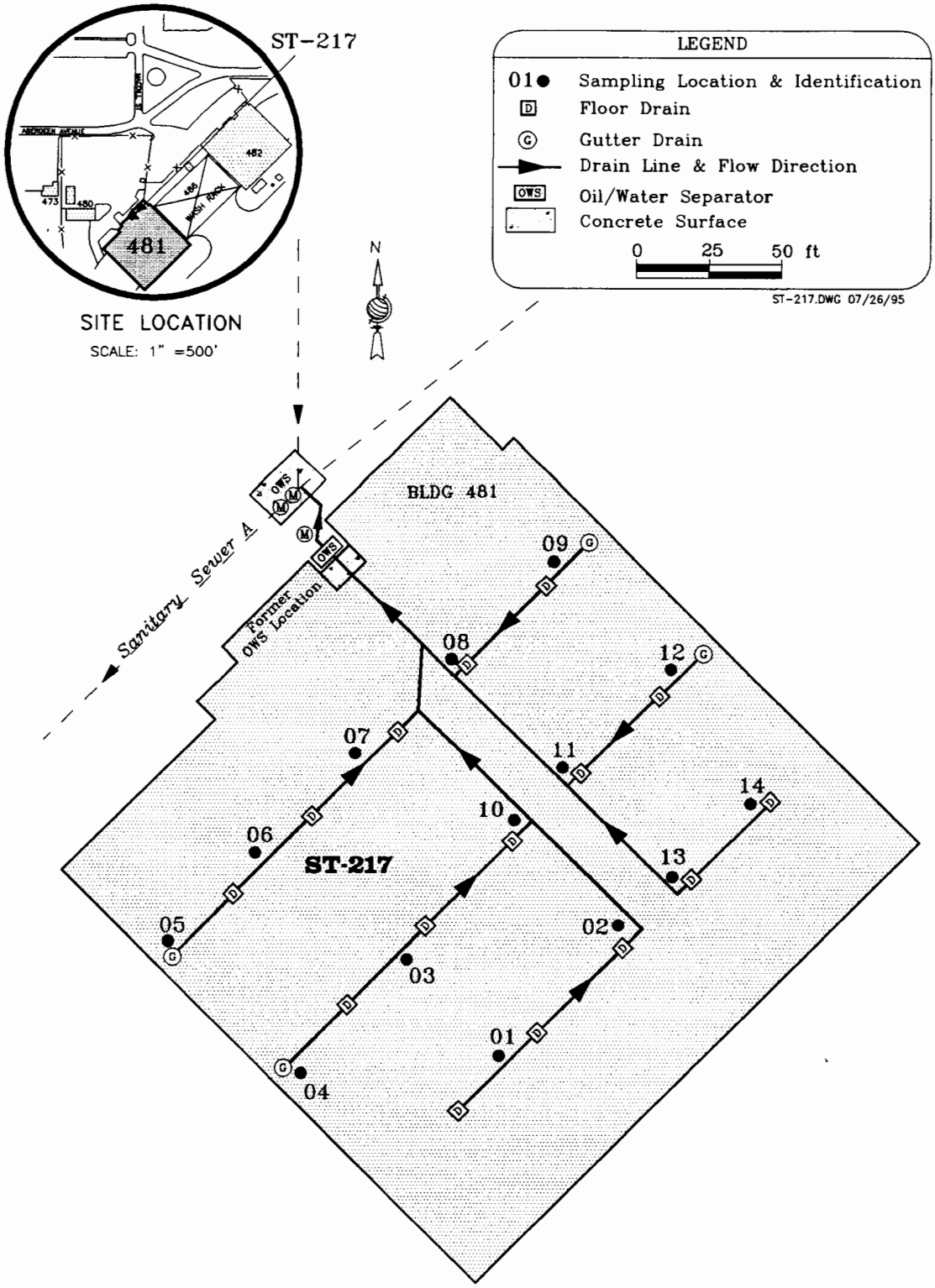


Figure 5-11. Soil Sampling Locations at SWMU 10-7, Building 481, OWS Lines (ST-217)

5.14.2 Study Area Investigation

5.14.2.1 Previous Investigations

During the Stage 2B RFI, subsurface soil samples were collected near the inflow and outflow points of the former OWS. Analytical results for the soil samples collected at the former OWS were not indicative of a release from this unit. These results are presented in the Stage 2B RFI Report (USAF, 1995).

5.14.2.2 Data Gaps

Prior to the Appendix III RFI, no data were available to determine if a release occurred from the ST-217 OWS wastelines.

5.14.2.3 RFI Field Investigation

The objective of the investigation was to determine the presence or absence of contamination in the soil adjacent to the OWS inflow and outflow lines. Line location and sample borehole designation were completed prior to the soil sampling effort. The soil investigation was limited to the shallow subsurface.

Analytical results from soil samples collected at the former OWS location during the Stage 2B RFI were used to characterize the soil adjacent to the inflow and outflow lines for lengths of 50 ft from each unit. Based on engineering drawings, the inflow lines run from the floor and gutter drains inside the hanger. The former outflow line ran northwest from 15 ft to the sanitary sewer on the northwest side of the hanger. The outflow line from the new OWS ties directly into the sewer system. Subsurface line locations were confirmed using methods described in Section 3.0.

On January 12, 1995, 14 boreholes drilled and sampled using a Geoprobe. The sample interval at each borehole extended from the depth of the line to 5 ft below the line. From this interval, two samples were collected: one at a depth equal to the base of the line, the other from 3 ft below the base of the line (i.e., 1 to 3 ft and 4 to 6 ft below grade). Both samples were field-screened with a FID organic vapor meter and only the sample with the highest FID reading was submitted to the laboratory for analysis. If no FID readings were detected, the sample collected at the depth closest to the base of the line was submitted for analysis. Along the inflow lines to ST-217, sixteen soil samples, including two replicate samples, were collected for laboratory analysis during the Appendix III RFI.

The analytical results from borehole ST-217-01, collected during the Stage 2B RFI were used for background concentration data for the samples collected at ST-217 during Appendix III RFI.

Sampling operations and sample handling procedures are described in Section 3.0. Sample depths, sample locations, and replicate samples, collected during the Appendix III RFI are listed in Table 5-19. Soil boring logs for the boreholes drilled and sampled at ST-217 are in Appendix C.

Table 5-19. Boreholes and Samples Analyzed from SWMU 10-7, Building 481, OWS Lines (ST-217)

Borehole	Borehole Location	Sample Depths (ft)	FID (ppm_v)
01	Inside, 80 ft north of south corner of Building 481	1-3	0
02	60 ft NE of borehole 01	2-7[a]	0
03	45 ft NW of borehole 01	2-4	0
04	67 ft West of borehole 01	1-3	0
05	65 ft NW of borehole 04	2-4	0
06	38 ft NE of borehole 05	3-5	0
07	49 ft NE of borehole 06	4-6	0
08	49 ft NE of borehole 07	4-6	0
09	51 ft NE of borehole 08	3-5	0
10	67 ft NE of borehole 03	3-5	0
11	25 ft NE of borehole 10	3-5	0
12	50 ft NE of borehole 11	2-7	0
13	37 ft SW of borehole 14	2-7[a]	0
14	54 ft SE of borehole 12	4-6	66

FID readings are values above background and are the high readings of the sample interval.

a. Replicate sample also collected at this interval.

5.14.2.4 Laboratory Analysis

The soil samples were analyzed for VOCs, SVOCs, TPH, metals, mercury (the potential contaminants associated with normal operations at this facility), soil pH, and soil moisture. The four brass tubes in each 2-ft sample interval were field-screened for possible contamination using a beta-gamma meter and a FID. With the exception of the 4- to 6-ft sample from borehole ST-217C-14 (66 ppm with the FID), no readings above background values were measured with these instruments.

5.14.3 Site Characteristics

5.14.3.1 Geology

Building 481 is underlain by unconsolidated alluvial sediment that is predominantly sandy silt with very fine-grained to fine-grained sand. Fourteen boreholes were drilled and a maximum depth of 7 ft below grade was reached. No borehole penetrated into the Santa Fe Group sediments that presumably underlie this area. A discussion of the general geology at Kirtland AFB is presented in Section 2.4.

As a result of ST-217 line installation, it is probable that backfill material is present adjacent to each line to a depth at least equal to the total depth of each line. Borehole logs for this area are presented in Appendix C.

5.14.3.2 Hydrogeology

Groundwater beneath Building 481 is found within the Upper Santa Fe sediments and is generally thought to be unconfined in the upper portion of the aquifer. This area is within the HR1 saturated zone setting as defined by SNL studies (Figure 2-9) (SNL, 1994). Hydrogeologic characterization in this portion of Kirtland AFB is complicated by the presence of numerous production wells (Figure 2-11). It is probable that uniform groundwater conditions do not exist in this region. Local cones of depression associated with groundwater withdrawal have altered the groundwater flow direction within the well fields (Figure 2-7).

The gradient is probably northeast at this site. Two production wells are located near ST-217: KAFB-14 is cross-gradient 1,600 ft southeast, and KAFB-12 is cross-gradient 2,100 ft northwest (Figures 2-7 and 2-11). Depth to groundwater is estimated to be 350 ft below grade (Figure 2-10); however, shallower perched water zones may occur. Hydraulic conductivity within HR1 is estimated at 2 to 171 ft/day (SNL, 1994). A general discussion of the hydrogeology at Kirtland AFB is presented in Section 2.5.

5.14.4 Nature and Extent of Contamination

The following section describes the nature and extent of contamination based on analytical results for soil samples submitted for analysis from ST-217. Analytical results are summarized in Table 5-20, where only the reportable concentrations are listed. Full analytical results are presented in Appendix F and laboratory validation reports are presented in Appendix K.

Organic Compounds

Methylene chloride (0.007 to 0.011 mg/kg) was the only VOC analyte detected in soil samples submitted for analysis at ST-217. These concentrations do not exceed the HHRB action level of 85 mg/kg (Table 5-20). Methylene chloride was also detected in associated QC samples and is believed to be the result of laboratory contamination as discussed in Section 3.5.1.

No SVOC analytes were detected in any of the soil samples submitted for analysis at ST-217.

Table 5-20. Summary of Reportable Concentrations for Soil Analyses at SWMU 10-7, Building 481, OWS Lines (ST-217)[1]
(Concentrations mg/kg)

Chemical Class	Analyte	HHRB Action Level[2]	PQL UTL	Borehole Number and Sample Depth Interval (ft)					
				ST217C-01	*ST217C-02*		*ST217C-03*	*ST217C-04*	*ST217C-05*
				1–3	2–7 FR	2–7	2–4	1–3	2–4
VOC	Methylene chloride	85.0	0.005	0.011	0.011	0.01	0.007	0.012	0.009
TPH	Diesel fraction	100	10.0	ND	ND	ND	ND	ND	ND
METALS	Aluminum	78,000	14,700	6,910	7,970	5,510	4,440	9,720	6,540
	Antimony	31.0	N/A	ND	ND	ND	ND	ND	ND
	Arsenic	0.37	6.5	4.2	7.3	4.4	3.3	3.0	3.5
	Barium	5,500	735	156	438	179	195	91.8	120
	Beryllium	0.15	0.84	0.35	0.36	ND	ND	0.42	0.33
	Cadmium	39.0	N/A	ND	ND	ND	ND	ND	ND
	Calcium	N/A	121,000	174,000	163,000	176,000	99,000	12,900	63,700
	Chromium, total	390	21.6	5.4	5.8	5.2	4.5	8.8	5.3
	Cobalt	4,700	15.4	5.4	3.2	3.6	2.2	3.9	3.5
	Copper	2,900	223	39.3	21.3	18.9	14.3	53.8	20.8
	Iron	N/A	23,800	6,080	6,530	4,990	4,490	10,100	7,800
	Lead	400	17.5	3.3	3.2	2.6	2.6	4.7	3.7
	Magnesium	N/A	10,400	4,390	6,330	3,790	2,890	2,660	2,350
	Manganese	390	549	49.9	62.0	44.7	45.1	133	80.2
	Nickel	1,600	188	3.5	3.8	3.4	3.9	5.5	4.0
	Potassium	N/A	3,590	887	1,040	749	661	2,010	1,170
	Sodium	N/A	787	333	371	242	229	72.6	104
	Thallium	N/A	N/A	ND	ND	ND	ND	0.11	ND
	Vanadium	550	55.3	17.5	28.6	15.8	13.9	19.0	20.4
	Zinc	23,000	114	26.9	22.3	17.1	13.6	34.5	19.7
OTHER	pH			8.2	8.4	8.3	8.3	8.1	8.1
	Moisture (%)			14.5	15.8	13.7	10.2	4.9	8.2

Table 5-20. Summary of Reportable Concentrations for Soil Analyses at SWMU 10-7, Building 481, OWS Lines (ST-217)[1]
(Concentrations mg/kg) (Continued)

Chemical Class	Analyte	HHRB Action Level[2]	PQL UTL	Borehole Number and Sample Depth Interval (ft)					
				ST217C-06	*ST217C-07*	*ST-217C-08*	*ST-217C-09*	*ST-217C-10*	*ST-217C-11*
				3–5	4–6	4–6	3–5	3–5	3–5
VOC	Methylene chloride	85.0	0.005	0.007	0.007	0.007	0.007	0.008	0.008
TPH	Diesel fraction	100	10.0	ND	4.6	0.005	ND	0.005	0.007
METALS	Aluminum	78,000	14,700	6,380	4,760	10,100	6,070	7,520	7,040
	Antimony	31.0	N/A	ND	ND	ND	ND	ND	0.82
	Arsenic	0.37	6.5	3.8	3.5	7.4	4.2	5.0	6.8
	Barium	5,500	735	141	558	473	245	380	404
	Beryllium	0.15	0.84	0.32	ND	0.35	ND	0.33	0.36
	Cadmium	39.0	N/A	ND	ND	0.58	ND	ND	ND
	Calcium	N/A	121,000	164,000	75,500	138,000	73,400	74,300	170,000
	Chromium, total	390	21.6	5.0	6.2	7.6	5.2	7.7	6.4
	Cobalt	4,700	15.4	4.1	2.7	4.7	3.6	2.6	3.6
	Copper	2,900	223	37.8	52.7	42.1	14.7	42.2	17.5
	Iron	N/A	23,800	5,650	5,850	8,680	6,610	6,860	5,450
	Lead	400	17.5	2.8	3.0	3.8	3.3	8.3	6.4
	Magnesium	N/A	10,400	4,820	2,940	6,960	3,150	4,080	5,580
	Manganese	390	549	51.1	64.7	78.7	77.1	71.4	45.9
	Nickel	1,600	188	3.2	3.3	5.7	4.3	5.7	6.0
	Potassium	N/A	3,590	789	777	1,640	959	1,150	1,030
	Sodium	N/A	787	335	109	478	250	265	188
	Thallium	N/A	N/A	ND	ND	ND	ND	ND	ND
	Vanadium	550	55.3	18.9	18.1	32.8	20.1	25.9	23.3
	Zinc	23,000	114	21.3	27.1	28.6	15.6	26.0	16.1
OTHER	pH			8.5	8.2	8.4	8.5	8.6	8.2
	Moisture (%)			7.2	7.1	13.3	9.0	8.2	17.0

Table 5-20. Summary of Reportable Concentrations for Soil Analyses at SWMU 10-7, Building 481, OWS Lines (ST-217)[1] (Concentrations mg/kg) (Concluded)

Chemical Class	Analyte	HHRB Action Level[2]	PQL UTL	ST-217C-12	ST-217C-13		ST-217C-14
				2–7	2–7 FR	2–7	4–6
VOC	Methylene chloride	85.0	0.005	0.007	0.007	0.007	0.007
TPH	Diesel fraction	100	10.0	ND	ND	ND	ND
METALS	Aluminum	78,000	14,700	9,890	6,280	7,190	13,500
	Antimony	31.0	N/A	ND	ND	ND	ND
	Arsenic	0.37	6.5	4.7	3.6	3.5	5.9
	Barium	5,500	735	422	410	122	186
	Beryllium	0.15	0.84	0.33	0.33	0.32	0.56
	Cadmium	39.0	N/A	ND	ND	0.53	ND
	Calcium	N/A	121,000	71,500	93,200	66,000	70,900
	Chromium, total	390	21.6	8.0	6.2	6.5	12.6
	Cobalt	4,700	15.4	4.0	3.8	3.0	6.5
	Copper	2,900	223	19.9	11.1	55.6	15.5
	Iron	N/A	23,800	9,310	6,270	7,540	13,700
	Lead	400	17.5	4.4	3.9	4.1	8.8
	Magnesium	N/A	10,400	3,820	3,810	2,460	5,430
	Manganese	390	549	99.7	74.4	74.9	187
	Nickel	1,600	188	6.1	4.4	4.7	7.7
	Potassium	N/A	3,590	1,540	841	1,240	2,540
	Sodium	N/A	787	358	308	110	574
	Thallium	N/A	N/A	ND	ND	ND	0.14
	Vanadium	550	55.3	29.0	21.8	19.8	39.1
	Zinc	23,000	114	21.8	14.6	29.1	34.1
OTHER	pH			8.0	8.4	8.0	8.1
	Moisture (%)			9.7	7.8	6.5	10.3

FOOTNOTES

1	Complete laboratory analytical results and method detection limits are presented in Appendix K.
2	Action level of RCRA Proposed Rule Subpart S (55 FR 30814, 7/27/90).
*	TPH action level is 100 mg/kg adopted from NMED UST regulations (NMED, 1990). SW-8015 analyzes volatile and semivolatile petroleum hydrocarbon fractions separately. The total concentration of the two fractions analyzed under SW-8015 will be used to assess compliance with stipulated action levels for the purpose of this RFI.
#	Denotes TCLP analysis, results in mg/l.
--	No Data.
FR	Field Replicate.
HHRB	Human health risk based.
J	Estimated value.
N/A	Not Applicable.
NA	Not Analyzed.
ND	Not detected above the method detection limit.
pCi/g	picocuries per gram.
PQL	Practical quantitation limits (defines VOC, SVOC, and TPH).
R	Reject NDs due to interference.
RAD	Radionuclides.
RE	Resample.
SVOC	Semivolatile organic compounds.
TPH	Total petroleum hydrocarbons.
U	Accept data (positive results may be influenced by lab contamination).
UJ	Estimated nondetect.
UTL	Upper tolerance limits (defines metals).
VOC	Volatile organic compounds.

Petroleum Hydrocarbons

Diesel range hydrocarbons (0.005 to 4.6 mg/kg) were detected in 4 of the 16 soil samples submitted for analysis at ST-217. The concentrations do not exceed the NMED action level of 100 mg/kg (Table 5-20).

Metals

Table 5-20 lists all metal concentrations reported at ST-217 and the respective UTL and HHRB action level concentrations. Arsenic (3.0 to 7.4 mg/kg) was detected in all 16 soil samples at concentrations above the 0.4 mg/kg HHRB action level. In two samples, the arsenic concentration exceeded the 6.5 mg/kg UTL concentration. Beryllium (0.32 to 0.56 mg/kg) was detected in 12 of the 16 samples at concentrations above the 0.15 mg/kg HHRB action level, but below the 0.84 mg/kg UTL concentration. The arsenic and beryllium concentrations appear to be naturally occurring at Kirtland AFB as discussed in Section 4.2.2.

Soil pH and Moisture

Soil pH values ranged from 8.0 to 8.6 in these samples. Soil moisture values ranged from 4.9 to 17.0 percent (Table 5-20).

5.14.5 Conclusions and Recommendations

Conclusions

- Only one VOC was detected in the soil samples submitted from this site; all concentrations were below HHRB action levels. No SVOCs were detected.
- No gasoline range hydrocarbons were detected in samples from ST-217. Diesel range hydrocarbons were detected in four samples at concentrations below the NMED action level. The diesel range hydrocarbon concentrations detected in the samples at this site were similar to those measured in background samples collected during the Appendix III RFI. The TPH detections alone are not conclusive evidence of a release from this unit. Because no other release components (such as VOCs, SVOCs, or metals) are present, it is probable that a release has not occurred.
- Arsenic and beryllium were the only metals detected at concentrations exceeding HHRB action levels; these concentrations appear to be naturally occurring throughout Kirtland AFB.
- The analytical results at ST-217 are not indicative of a release from this site.

Recommendations

- Based on the findings of the RFI, no further action is necessary; therefore, ST-217 does not require further investigation. A No Further Action proposal should be prepared.

5.15 SWMU 10-7, Building 482, OWS Lines (ST-218)

5.15.1 Site Background and Environmental Setting

ST-218 is in an alcove on the north side of Building 482, an aircraft corrosion control hangar and maintenance facility in the western portion of Kirtland AFB. It receives inflow from a system of floor and gutter drains inside the building (Figure 5-12). The unit discharges north to sanitary sewer system A (ST-278). The inflow line system is approximately 700 ft long and the outflow line length is estimated at 25 ft, the mapped distance from the OWS to the sewer.

Site ST-218 is in the urban/industrial zone. The nearest production wells to this site are KAFB-14, 1,700 ft south-southeast, and KAFB-12, 2,100 ft northwest.

5.15.2 Study Area Investigation

5.15.2.1 Previous Investigations

During the Stage 2B RFI, subsurface soil samples were collected from the perimeter of OWS ST-218. Analytical results were not indicative of a release from this unit.

5.15.2.2 Data Gaps

Prior to the Appendix III RFI, no data were available to determine if a release occurred from the ST-218 OWS wastelines.

5.15.2.3 RFI Field Investigation

The objective of the investigation was to determine the presence or absence of contamination in soil adjacent to the wastelines. Line location and sample borehole designation were completed prior to the soil sampling effort. The soil investigation was limited to the shallow subsurface.

Analytical results from soil samples collected during the Stage 2B RFI were used to characterize the soil adjacent to the OWS inflow and outflow lines within a 50-ft length of ST-218. Based on engineering drawings, the inflow lines run from the floor and gutter drains inside Building 482, and the outflow line runs 25 ft to the sanitary sewer along the northeast side of the building. Subsurface line locations were confirmed using methods described in Section 3.0.

From January 3 through 5, 1995, 14 boreholes were drilled and sampled using a Geoprobe. The sample interval at each borehole extended from the depth of the line to 5 ft below the line. From this interval, two samples were collected: one at a depth equal to the base of the line, the other from 3 ft below the base of the line (i.e., 1 to 3 ft and 4 to 6 ft below grade). Both samples were field-screened with a FID organic vapor meter and only the sample with the highest FID reading was submitted to the laboratory for analysis. If no FID readings were detected, the sample collected at the depth closest to the base of the line was submitted for analysis. Along the inflow lines serving ST-218, 15 soil samples, including one replicate sample, were collected and submitted for laboratory analysis during the Appendix III RFI.

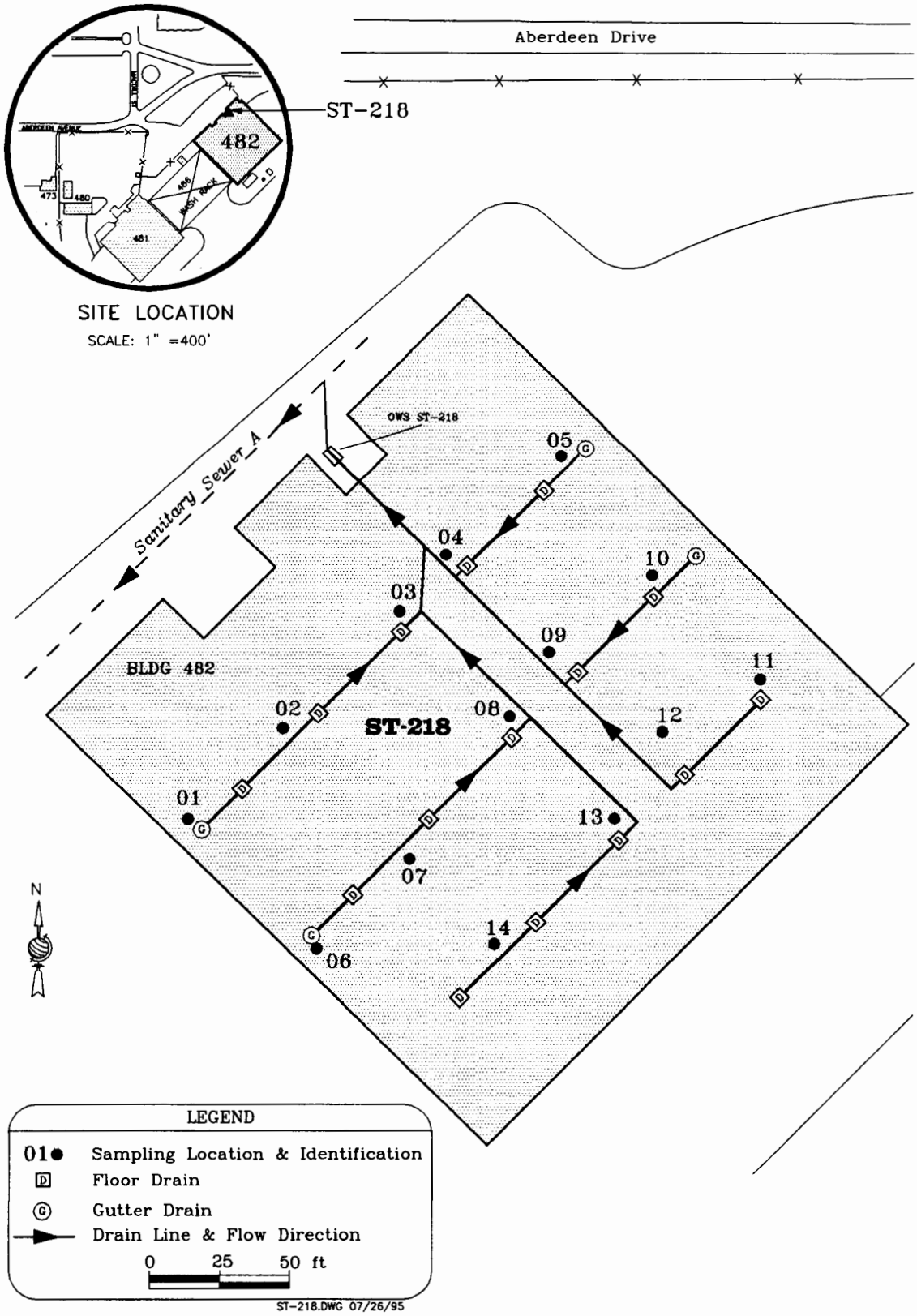


Figure 5-12. Soil Sampling Locations at SWMU 10-7, Building 482, OWS Lines (ST-218)

The analytical results from background sample ST-218-01, collected during the Stage 2B RFI were used as background concentration data for the samples collected at ST-218 during Appendix III RFI.

Sampling operations and sample handling procedures are described in Section 3.0. Sample depths, sample locations, and replicate samples, submitted during the Appendix III RFI are listed in Table 5-21. Soil boring logs for the boreholes drilled and sampled at ST-218C are in Appendix C.

Table 5-21. Boreholes and Samples Analyzed from SWMU 10-7, Building 482, OWS Lines (ST-218)

Borehole	Borehole Location	Sample Depths (ft)	FID (ppm_v)
01	NW corner of hangar	5-7	0
02	45 ft NE of borehole 01	3-5	0
03	60 ft NE of borehole 02	4-6	0
04	25 ft NE of borehole 03	4-6	0
05	55 ft NE of borehole 04	3-5	0
06	65 ft SE of borehole 01	1-6	0
07	45 ft NE of borehole 06	2-7[a]	0
08	60 ft NE of borehole 07	6-8	10
09	25 ft NE of borehole 08	3-5	0
10	45 ft NE of borehole 09	2-4	0
11	55 ft SE of borehole 10	1-3	0
12	40 ft SW of borehole 11	2-4	0
13	35 ft SW of borehole 12	2-4	0
14	60 ft SW of borehole 13	1-3	0

FID readings are values above background and are the high readings of the sample interval.

a. Replicate sample also collected at this interval.

5.15.2.4 Laboratory Analysis

The soil samples were analyzed for VOCs, SVOCs, TPH, metals, mercury (the potential contaminants associated with normal operations at this site), soil pH, and soil moisture. The four brass tubes in each 2-ft sample interval were field-screened for possible contamination using a beta-gamma meter and a FID. With the exception of samples collected from borehole ST-218C-08 (10 ppm_v with the FID in the 6- to 8-ft sample), all field-screening instrument readings remained at background levels throughout drilling and sampling activities at ST-218.

5.15.3 Site Characteristics

5.15.3.1 Geology

Building 482 is underlain by unconsolidated alluvial sediment that is predominantly silty sand to sandy silt with very-fine-grained to fine-grained sand. Fourteen boreholes were drilled and sampled at Building 482 during the Appendix III RFI. A maximum depth of 9 ft below grade was reached. No boreholes penetrated into the Santa Fe Group sediments that presumably underlie this area. A discussion of the general geology at Kirtland AFB is presented in Section 2.4.

As a result of ST-218 line installation, it is probable that backfill material is present adjacent to each line to a depth at least equal to the total depth of each line. Borehole logs for this area are presented in Appendix C.

5.15.3.2 Hydrogeology

Groundwater beneath ST-218 is found within the Upper Santa Fe sediments and is generally thought to be unconfined in the upper portion of the aquifer. This area is within the HR1 saturated zone setting as defined by SNL studies (Figure 2-9) (SNL, 1994). Hydrogeologic characterization in this portion of Kirtland AFB is complicated by the presence of numerous production wells (Figure 2-11). It is probable that uniform groundwater conditions do not exist in this region. Local cones of depression associated with groundwater withdrawal have altered the groundwater flow direction in the vicinity of the well fields (Figure 2-7).

The gradient is probably northeast at this site. Two production wells are located near ST-218: KAFB-14 is 1,700 ft south-southeast and KAFB-12 is 2,100 ft northwest. Both wells are cross-gradient of ST-218 (Figures 2-7 and 2-11). Depth to groundwater is estimated to be approximately 350 ft below grade (Figure 2-10); however, shallower perched water zones may occur. Hydraulic conductivity within HR1 is estimated at 2 to 171 ft/day (SNL, 1994). A general discussion of the hydrogeology at Kirtland AFB is presented in Section 2.5.

5.15.4 Nature and Extent of Contamination

The following section describes the nature and extent of contamination based on analytical results for soil samples submitted for analysis from ST-218. Analytical results are summarized in Table 5-22, where only the reportable concentrations are listed. Full analytical results are presented in Appendix F and laboratory validation reports are presented in Appendix K.

Organic Compounds

The VOC analyte methylene chloride (0.006 mg/kg) was detected in 13 of the 15 soil samples collected at ST-218. These concentrations do not exceed the HHRB action level of 85 mg/kg (Table 5-22). Methylene chloride was also detected in associated QC samples and is believed to be the result of laboratory contamination as discussed in Section 3.5.1.

Table 5-22. Summary of Reportable Concentrations for Soil Analyses at SWMU 10-7, Building 482, OWS Lines (ST-218)[1]
(Concentrations mg/kg)

Chemical Class	Analyte	HHRB Action Level[2]	PQL UTL	Borehole Number and Sample Depth Interval (ft)					
				ST218C-01 5–7	*ST218C-02* 3–5	*ST218C-03* 4–6	*ST218C-04* 4–6	*ST218C-05* 3–5	*ST218C-06* 1–6
VOC	Methylene chloride	85.0	0.005	0.006	0.006	0.006	0.006	0.005	0.006
SVOC	Bis(2-ethylhexyl)phthalate	46.0	0.70	ND	ND	ND	ND	ND	ND
	Di-n-butylphthalate	7,800	0.70	0.51	0.48	0.78	0.69	0.70	0.81
	2-Methylnaphthalene	N/A	0.70	ND	ND	ND	ND	ND	ND
	Naphthalene	3,100	0.70	ND	ND	ND	ND	ND	ND
TPH	Diesel fraction	100	10.0	ND	ND	ND	ND	ND	ND
METALS	Aluminum	78,000	14,700	12,400	11,500	7,840	7,060	8,120	9.48
	Arsenic	0.37	6.5	4.6	2.8	4.5	2.7	2.4	2.8
	Barium	5,500	735	157	104	483	87.8	59.5	228
	Beryllium	0.15	0.84	0.36	0.33	ND	ND	0.32	0.43
	Cadmium	39.0	N/A	ND	ND	ND	ND	ND	ND
	Calcium	N/A	121,000	144,000	40,900	134,000	65,700	21,200	56,300
	Chromium, total	390	21.6	5.6	5.5	5.0	3.2	4.0	6.5
	Cobalt	4,700	15.4	3.0	4.5	3.7	3.0	3.2	8.5
	Copper	2,900	223	5.8	42.1	11.7	28.1	10.0	18.3
	Iron	N/A	23,800	6,780	10,000	5,550	6,870	9,030	11,900
	Lead	400	17.5	4.0	3.9	2.9	2.7	3.5	3.9
	Magnesium	N/A	10,400	5,260	2,870	4,120	2,230	2,400	3,230
	Manganese	390	549	60.5	121	55.6	72.5	107	145
	Mercury	23.0	N/A	ND	ND	ND	ND	ND	ND
	Nickel	1,600	188	5.0	4.7	2.7	3.9	4.1	6.4
	Potassium	N/A	3,590	1,110	1,500	907	1,030	1,020	1,620
	Sodium	N/A	787	114	110	98.3	92.8	144	113
	Vanadium	550	55.3	25.1	21.7	19.1	17.5	20.8	29.9
	Zinc	23,000	114	14.3	30.4	14.3	22.4	18.2	26.9
OTHER	pH			8.1	7.9	8.2	8.4	8.2	8.2
	Moisture (%)			7.2	9.2	7.2	8.1	5.3	6.8

Table 5-22. Summary of Reportable Concentrations for Soil Analyses at SWMU 10-7, Building 482, OWS Lines (ST-218)[1]
(Concentrations mg/kg) (Continued)

Chemical Class	Analyte	HHRB Action Level[2]	PQL UTL	Borehole Number and Sample Depth Interval (ft)					
				ST218C-07		*ST-218C-08*	*ST-128C-09*	*ST-218C-10*	*ST-218C-11*
				2–7 FR	2–7	6–8	3–5	2–4	1–3
VOC	Methylene chloride	85.0	0.005	ND	0.006	ND	0.006	0.006	0.006
SVOC	Bis(2-ethylhexyl)phthalate	46.0	0.70	ND	ND	1.2	ND	ND	ND
	Di-n-butylphthalate	7,800	0.70	0.80	0.71	0.39	0.44	0.73	0.40
	2-Methylnaphthalene	N/A	0.70	ND	ND	5.1	ND	ND	ND
	Naphthalene	3,100	0.70	ND	ND	3.8	ND	ND	ND
TPH	Diesel fraction	100	10.0	ND	ND	96.0	ND	12.0	ND
METALS	Aluminum	78,000	14,700	10,500	10,000	6,520	13,100	10,700	16,800
	Arsenic	0.37	6.5	5.3	2.6	1.3	2.8	2.6	1.9
	Barium	5,500	735	1,460	57.2	50.6	94.4	105	73.5
	Beryllium	0.15	0.84	0.46	0.33	ND	0.43	0.34	0.44
	Cadmium	39.0	N/A	ND	ND	1.2	ND	ND	ND
	Calcium	N/A	121,000	103,000	16,200	9,320	13,800	43,400	2,060
	Chromium, total	390	21.6	6.6	5.3	6.2	7.0	7.6	8.4
	Cobalt	4,700	15.4	4.6	3.0	3.4	4.8	3.7	5.4
	Copper	2,900	223	16.1	9.8	52.1	17.6	28.2	31.5
	Iron	N/A	23,800	9,120	8,130	7,720	11,200	8,120	11,800
	Lead	400	17.5	4.5	5.4	8.6	4.9	6.7	5.7
	Magnesium	N/A	10,400	5,670	1,920	1,350	2,640	2,200	2,440
	Manganese	390	549	92.2	122	107	139	130	247
	Mercury	23.0	N/A	ND	ND	ND	ND	0.18	ND
	Nickel	1,600	188	4.7	3.9	6.9	6.0	3.8	6.7
	Potassium	N/A	3,590	1,590	1,310	1,020	1,600	1,350	2,400
	Sodium	N/A	787	139	70.8	73.3	105	85.7	83.5
	Vanadium	550	55.3	36.7	16.3	15.8	22.6	17.4	18.6
	Zinc	23,000	114	22.1	20.5	30.7	25.2	24.8	32.6
OTHER	pH			8.4	8.0	8.2	8.0	8.3	8.1
	Moisture (%)			13.0	10.3	5.1	6.9	11.6	9.2

Table 5-22. Summary of Reportable Concentrations for Soil Analyses at SWMU 10-7, Building 482, OWS Lines (ST-218)[1] (Concentrations mg/kg) (Concluded)

Chemical Class	Analyte	HHRB Action Level[2]	PQL UTL	*ST-218C-12* 2–4	*ST-218C-13* 2–4	*ST-218C-14* 1–3
VOC	Methylene chloride	85.0	0.005	0.006	0.006	0.006
SVOC	Bis(2-ethylhexyl)phthalate	46.0	0.70	ND	ND	ND
	Di-n-butylphthalate	7,800	0.70	0.63	ND	ND
	2-Methylnaphthalene	N/A	0.70	ND	ND	ND
	Naphthalene	3,100	0.70	ND	ND	ND
TPH	Diesel fraction	100	10.0	ND	ND	ND
METALS	Aluminum	78,000	78,000	7,930	7,730	8,970
	Arsenic	0.37	0.37	2.8	2.4	2.3
	Barium	5,500	5,500	101	242	90.8
	Beryllium	0.15	0.15	0.32	0.33	0.33
	Cadmium	39.0	39.0	ND	ND	ND
	Calcium	N/A	N/A	49,000	69,500	43,500
	Chromium, total	390	390	5.5	5.1	4.7
	Cobalt	4,700	4,700	3.1	3.0	3.6
	Copper	2,900	2,900	38.1	20.4	17.9
	Iron	N/A	N/A	8,090	7,070	7,200
	Lead	400	400	3.5	3.0	7.1
	Magnesium	N/A	N/A	2,410	2,540	2,150
	Manganese	390	390	98.8	78.9	106
	Mercury	23.0	23.0	ND	ND	ND
	Nickel	1,600	1,600	4.3	4.4	3.8
	Potassium	N/A	N/A	1,220	1,160	1,330
	Sodium	N/A	N/A	91.3	75.3	86.4
	Vanadium	550	550	19.4	17.3	14.1
	Zinc	23,000	23,000	25.2	20.2	20.8
OTHER	pH			8.2	8.3	8.0
	Moisture (%)			6.8	9.3	8.3

FOOTNOTES

1	Complete laboratory analytical results and method detection limits are presented in Appendix K.
2	Action level of RCRA Proposed Rule Subpart S (55 FR 30814, 7/27/90).
*	TPH action level is 100 mg/kg adopted from NMED UST regulations (NMED, 1990). SW-8015 analyzes volatile and semivolatile petroleum hydrocarbon fractions separately. The total concentration of the two fractions analyzed under SW-8015 will be used to assess compliance with stipulated action levels for the purpose of this RFI.
#	Denotes TCLP analysis, results in mg/l.
--	No Data.
FR	Field Replicate.
HHRB	Human health risk based.
J	Estimated value.
N/A	Not Applicable.
NA	Not Analyzed.
ND	Not detected above the method detection limit.
pCi/g	picocuries per gram.
PQL	Practical quantitation limits (defines VOC, SVOC, and TPH).
R	Reject NDs due to interference.
RAD	Radionuclides.
RE	Resample.
SVOC	Semivolatile organic compounds.
TPH	Total petroleum hydrocarbons.
U	Accept data (positive results may be influenced by lab contamination).
UJ	Estimated nondetect.
UTL	Upper tolerance limits (defines metals).
VOC	Volatile organic compounds.

The SVOC analytes bis(2-ethylhexyl)phthalate, di-n-butylphthalate, 2-methylnaphthalene, and naphthalene were detected in one or more of the soil samples collected at ST-218. Bis(2-ethylhexyl) phthalate was detected in one soil sample at a concentration of 1.2 mg/kg below the HHRB action level of 45 mg/kg. Di-n-butylphthalate was detected in 13 of the 15 soil samples at concentrations ranging from 0.39 to 0.81 mg/kg, below the HHRB action level of 7,800 mg/kg. The analyte 2-methylnaphthalene was detected in one soil sample at a concentration of 5.1 mg/kg; this constituent does not have an HHRB action level. Naphthalene was detected in one soil sample at a concentration of 3.8 mg/kg, below the HHRB action level of 3,100 mg/kg (Table 5-21). Bis(2-ethylhexyl)phthalate, 2-methylnaphthalene, and naphthalene were detected in the 6- to 8-ft sample from borehole ST-218C-08.

Petroleum Hydrocarbons

Diesel range hydrocarbons were only detected in two samples collected at ST-217 (Table 5-22). The 12 mg/kg concentration measured in the 2- to 4-ft sample from borehole ST-217C-10 is accompanied only by the SVOC di-n-butylphthalate and is probably not indicative of a release at this sampling location. The 96 mg/kg concentration measured in the 6- to 8-ft sample from borehole ST-217C-08 is accompanied by detections of the SVOCs 2-methylnaphthalene and naphthalene, indicating a possible release near this sampling location. Both diesel range hydrocarbon concentrations are below the NMED action level of 100 mg/kg.

Metals

Table 5-22 lists all reportable metal concentrations detected at ST-218 and the respective UTL and HHRB action level concentrations. Arsenic (1.3 to 5.3 mg/kg) was detected in all 15 soil samples at concentrations above the HHRB action level of 0.4 mg/kg but below the UTL of 6.5 mg/kg. Beryllium was detected in 12 of the 15 soil samples with concentrations ranging from 0.32 to 0.46 mg/kg. These concentrations are above the 0.15 mg/kg HHRB action level, but below the 0.84 mg/kg UTL concentrations. These arsenic and beryllium concentrations appear to be naturally occurring at Kirtland AFB as discussed in Section 4.2.2.

Soil pH and Moisture

Soil pH ranged from 7.9 to 8.4 in these samples. Soil moisture values ranged from 5.1 to 13.0 percent (Table 5-22)

5.15.5 Conclusions and Recommendations

Conclusions

- One VOC and four SVOCs were detected in the soil samples collected from this site. All concentrations were below HHRB action levels.

- Diesel range hydrocarbons were detected at two borehole locations inside Building 482. The 12 mg/kg concentration measured in the sample from borehole ST-218C-10 is not accompanied by other constituents, such as SVOCs, and is not indicative of a release. The 96 mg/kg concentration and the presence of four SVOCs in the sample from borehole ST-218C-08 indicate a release may have occurred near this location. Although this concentration is less than the 100 mg/kg NMED action level, higher concentrations may be present in subsurface soil at this borehole location.

- Arsenic and beryllium were the only metals detected at concentrations exceeding HHRB action levels; these concentrations appear to be naturally occurring throughout Kirtland AFB.

- The analytical results at ST-218 indicate that a release may have occurred in the vicinity of borehole ST-218C-08.

Recommendations

- Based on the findings of the RFI, a release may have occurred at ST-218. Further characterization should be performed near borehole ST-218C-08 to determine the vertical and horizontal extent of potential soil contamination.

5.16 SWMU 10-7, Buildings 481/482, OWS Lines (ST-219)

5.16.1 Site Description and Environmental Setting

ST-219 was removed by Kirtland AFB in October 1994. The excavated area was backfilled and covered with asphalt pavement. The two drains that discharged to the former OWS remain in place and now tie directly into sanitary sewer line A, located approximately 120 ft to the northeast. The general location of former OWS ST-219, the two drains, and sanitary sewer line A are shown on Figure 5-13.

The ST-219 area is in the urban/industrial zone. The nearest production wells to this site are KAFB-14, 1,600 ft southeast, and KAFB-12, 2,100 ft northwest.

5.16.2 Study Area Investigation

5.16.2.1 Previous Investigations

During the Stage 2B RFI, subsurface soil samples were collected from the perimeter of OWS ST-219. Analytical results from the Stage 2B RFI indicated contaminants had been released to the subsurface.

5.16.2.2 Data Gaps

Prior to the Appendix III RFI, no data were available that indicated a release occurred from ST-219 wastelines.

5.16.2.3 RFI Field Investigation

The objective of the investigation was to determine the presence or absence of contamination in the soil adjacent to the wastelines. Line location and sample borehole designation were completed prior to the soil sampling effort. The soil investigation was limited to the shallow subsurface.

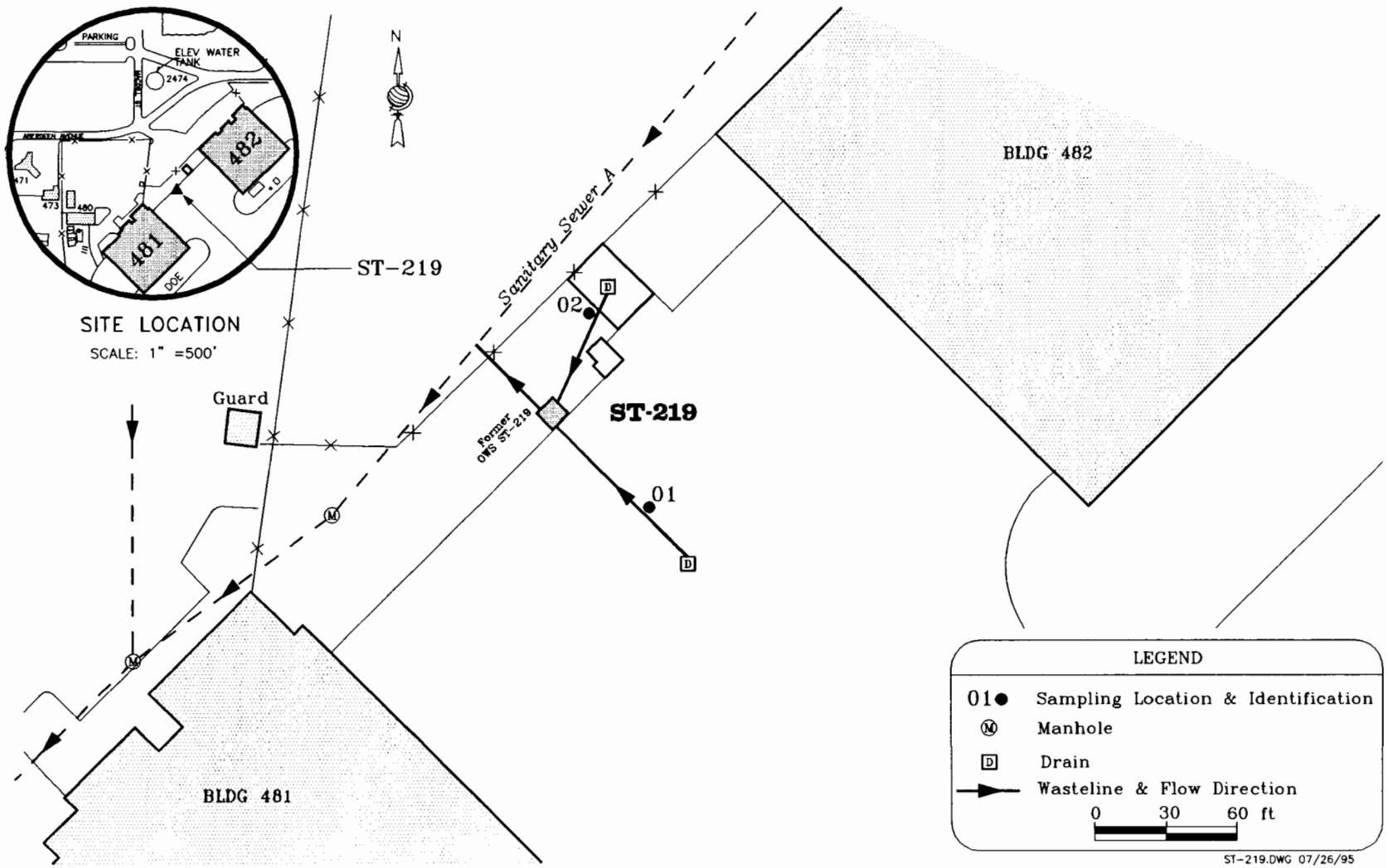


Figure 5-13. Soil Sampling Locations at SWMU 10-7, Buildings 481/482, OWS Lines (ST-219)

Analytical results from samples collected during the Stage 2B RFI were used to characterize the soil adjacent to the inflow and outflow lines for 50-ft lengths from the former OWS. Based on engineering drawings, one inflow line serving the former OWS ST-219 conveyed flow from an area drain 75 ft southeast. A second inflow line runs about 50 ft south-southwest from a floor drain in a nearby hazardous materials storage unit at the northwest edge of the flightline area between Buildings 481 and 482. Although the storage unit is still operational, site personnel have indicated the floor drain has been plugged. Subsurface line locations will be confirmed using methods described in Section 3.0.

On January 12, 1995, two boreholes were sampled using a Geoprobe. The sample interval at each borehole location was driven from the depth of the line to 5 ft below the line. From this interval, two samples were collected from each borehole: one at a depth equal to the base of the line, the other from 3 ft below the base of the line. Both samples were field-screened with a FID organic vapor meter. The sample with the highest FID reading was submitted to the laboratory for analysis. If no FID readings were detected, the sample collected at the depth closest to the line was submitted to the laboratory for analysis. Along the lines serving the former OWS ST-219, two soil samples were collected and submitted for laboratory analysis during the Appendix III RFI. Figure 5-13 shows Appendix III RFI borehole locations.

The analytical results from ST-219-01, collected during the Stage 2B RFI, were used as background concentration data for the samples collected at ST-219 during the Appendix III RFI.

Sampling operations and sample handling procedures are described in Section 3.0. Sample depths, sample locations, and replicate samples, collected during the Appendix III RFI are listed in Table 5-23. The corresponding soil boring logs for the boreholes drilled and sampled at ST-219C are in Appendix C.

Table 5-23. Boreholes and Samples Analyzed from SWMU 10-7, Buildings 481/482, OWS Lines (ST-219)

Borehole	Borehole Location	Sample Depths (ft)	FID (ppm_v)
01	27 ft NW and 2 ft NE of the west corner of the area drain between Buildings 481 and 482	4-6	12-460
02	71 ft NW and 48 ft NE of borehole 01	3-6	0

FID readings are values above background and are the high readings of the sample interval.

5.16.2.4 Laboratory Analysis

The soil samples were analyzed for VOCs, SVOCs, TPH, metals, mercury (the potential contaminants associated with normal operations at this facility), soil pH, and soil moisture. The four brass tubes in each 2-ft sample interval were field-screened for possible contamination using a beta-gamma meter and a FID. Only the sample collected from borehole ST-219C-01 (12-460 ppm_v with the FID) had a reading above background values as measured with these instruments.

ST-219-01, collected during Stage 2B RFI, was used as a background sample during the Appendix III RFI. The soil sampling and analysis at the background hole included analyses for TPH, VOCs, SVOCs, metals, soil pH, and soil moisture.

5.16.3 Site Characteristics

5.16.3.1 Geology

The ST-219 area is underlain by unconsolidated alluvial sediment that ranges from clay to gravel. The uppermost 25 ft are predominantly very fine-grained to fine-grained sand and silty sand with occasional 2-ft to 3-ft-thick gravel and clay layers. During the Appendix III RFI, the deepest borehole drilled and sampled had a total depth of 6 ft below grade. No borehole penetrated into the Santa Fe Group sediments that presumably underlie this area. A discussion of the general geology at Kirtland AFB is presented in Section 2-4.

As a result of ST-219 line installation, it is probable that backfill material is present adjacent to each line to a depth at least equal to the total depth of each line. Borehole logs for this area are presented in Appendix C.

5.16.3.2 Hydrogeology

Groundwater beneath this area is found within the Upper Santa Fe sediments and is generally thought to be approximately in the upper portion of the aquifer. This area is within the HR1 saturated zone setting as defined by SNL studies (Figure 2-9) (SNL, 1994). Hydrogeologic characterization in this portion of Kirtland AFB is complicated by the presence of numerous production wells (Figure 2-11). It is probable that uniform groundwater conditions do not exist in this region. Local cones of depression associated with groundwater withdrawal have altered the groundwater flow direction in the vicinity of the well fields (Figure 2-7).

The gradient is probably northeast at this site. Two production wells are located in this area of Kirtland AFB: KAFB-14 is cross-gradient 1,600 ft southeast and KAFB-12 is cross-gradient 2,100 ft northwest (Figures 2-7 and 2-11). Depth to groundwater is estimated to be about 350 ft below grade; however, shallower perched water zones may occur (Figure 2-10). Hydraulic conductivity within HR1 is estimated at 2 to 171 ft/day (SNL, 1994). A general discussion of the hydrogeology at Kirtland AFB is presented in Section 2.5.

5.16.4 Nature and Extent of Contamination

The following sections describes the nature and extent of contamination based on the analytical results. Analytical results for ST-219 are summarized in Table 5-24, where only the reportable concentrations are listed. Full analytical results are presented in Appendix F and laboratory validation reports are presented in Appendix K.

Organic Compounds

The following VOC analytes were detected in one or the other of the samples collected at ST-219: methylene chloride, tetrachloroethylene, m,p-xylene, and o-xylene. The detected concentration of methylene chloride (0.007 mg/kg) does not exceed the HHRB action level of 85.0 mg/kg (Table 5-24). The detected concentration of tetrachloroethylene (0.029 mg/kg) is below the HHRB action level of 12 mg/kg. The concentrations of m,p-xylene and o-xylene detected were 0.13 and 0.061 mg/kg, respectively. These concentrations did not exceed the HHRB action level of 160,000 mg/kg for xylenes.

Table 5-24. Summary of Reportable Concentrations for Soil Analyses at SWMU 10-7, Buildings 481/482, OWS Lines (ST-219)[1]
(Concentrations mg/kg)

Chemical Class	Analyte	HHRB Action Level[2]	PQL UTL	Borehole Number and Sample Depth Interval (ft)	
				ST219C-01	*ST219C-02*
				4–6	3–6
VOC	Methylene chloride	85.0	0.005	ND	0.007
	Tetrachloroethylene	12.0	0.005	ND	0.029
	M,p-xylene (sum of isomers)	160,000	N/A	0.13	ND
	O-xylene	160,000	N/A	0.061	ND
SVOC	Di-n-butylphthalate	7,800	0.70	ND	0.44
	Naphthalene	3,100	0.70	3.8	ND
TPH	Diesel fraction	100	10.0	1,300	ND
	Gasoline fraction	100	1.0	14.0	ND
METALS	Aluminum	78,000	14,700	11,600	8,510
	Arsenic	0.37	6.5	6.8	4.7
	Barium	5,500	735	434	227
	Beryllium	0.15	0.84	0.46	ND
	Calcium	N/A	121,000	98,700	175,000
	Chromium, total	390	21.6	8.2	6.1
	Cobalt	4,700	15.4	5.0	3.7
	Copper	2,900	223	21.8	20.1
	Iron	N/A	23,800	11,300	6,410
	Lead	400	17.5	5.3	3.0
	Magnesium	N/A	10,400	5,410	5,670
	Manganese	390	549	157	69.0
	Nickel	1,600	188	8.0	4.2
	Potassium	N/A	3,590	2,000	1,420
	Sodium	N/A	787	163	95.1
	Vanadium	550	55.3	37.5	25.0
	Zinc	23,000	114	30.0	19.9
OTHER	pH			8.2	8.2
	Moisture (%)			12.7	19.6

FOOTNOTES

1	Complete laboratory analytical results and method detection limits are presented in Appendix K.
2	Action level of RCRA Proposed Rule Subpart S (55 FR 30814, 7/27/90).
*	TPH action level is 100 mg/kg adopted from NMED UST regulations (NMED, 1990). SW-8015 analyzes volatile and semivolatile petroleum hydrocarbon fractions separately. The total concentration of the two fractions analyzed under SW-8015 will be used to assess compliance with stipulated action levels for the purpose of this RFI.
#	Denotes TCLP analysis, results in mg/l.
--	No Data.
FR	Field Replicate.
HHRB	Human health risk based.
J	Estimated value.
N/A	Not Applicable.
NA	Not Analyzed.
ND	Not detected above the method detection limit.
pCi/g	picocuries per gram.
PQL	Practical quantitation limits (defines VOC, SVOC, and TPH).
R	Reject NDs due to interference.
RAD	Radionuclides.
RE	Resample.
SVOC	Semivolatile organic compounds.
TPH	Total petroleum hydrocarbons.
U	Accept data (positive results may be influenced by lab contamination).
UJ	Estimated nondetect.
UTL	Upper tolerance limits (defines metals).
VOC	Volatile organic compounds.

The SVOC analytes di-n-butylphthalate and naphthalene were each detected in one of the samples collected at ST-219. The detected concentrations of these compounds, 0.44 and 3.8 mg/kg, respectively, were below the HHRB action levels of 7,800 and 3,100 mg/kg.

Petroleum Hydrocarbons

Diesel range hydrocarbons were detected in one of the two soil samples collected at ST-219 at a concentration of 1,300 mg/kg. This concentration exceeds the NMED action level of 100 mg/kg (Table 5-24). Gasoline range hydrocarbons were detected in only one sample at a concentration of 14 mg/kg, below the NMED action level of 100 mg/kg.

Metals

Table 5-24 lists all reportable metal concentrations detected at ST-219 and the respective UTL and HHRB action level concentrations. Arsenic was detected in both of the soil samples at concentrations above the HHRB action level of 0.37 mg/kg and above the UTL of 0.5 mg/kg. The two soil samples had arsenic concentrations equal to 6.8 and 4.7 mg/kg. Beryllium was detected above the HHRB action level of 0.15 mg/kg in one of the two soil samples with a concentration equal to 0.46 mg/kg; this concentration may be naturally occurring at Kirtland AFB.

Soil pH and Moisture

Soil pH values were 8.2 in these samples. Soil moisture values were 12.7 and 19.6 percent (Table 5-24).

5.16.5 Conclusions and Recommendations

Conclusions

- Four VOCs and two SVOCs were detected in the soil samples collected from this site; all concentrations were below HHRB action levels.
- Diesel range petroleum hydrocarbons and gasoline range hydrocarbons were detected in borehole ST-219C-01. Only the diesel range hydrocarbon detection is at a concentration above the NMED action level.
- Arsenic and beryllium were the only metals detected at concentrations exceeding the HHRB action level; these concentrations appear to be naturally occurring throughout Kirtland AFB.

Recommendations

- Based on the findings of the RFI, it is possible that a release has occurred along the wasteline near borehole ST-219C-01.
- Subsurface contamination in the ST-219 area will be further addressed in a separate investigation as a second phase of the Stage 2B RFI.

5.17 SWMU 8-13, Buildings 1001/1002, OWS Lines (ST-221)

5.17.1 Site Background and Environmental Setting

SWMU 8-13 is between hangars 1001 and 1002 on the flightline in the northwest portion of Kirtland AFB. The general location of the unit and the associated lines are shown on Figure 5-14. The inflow lines serving SWMU 8-13 carry flow from two drains south of the unit that serve the flightline area between the buildings. The area drained by SWMU 8-13 is used as an aircraft wash rack; the outflow lines discharge east to the sanitary sewer.

In the 1950s and 1960s, this site was used for washing aircraft that were involved in post-nuclear detonation measurements over the Nevada Test Site. On October 26, 1992, a radiological survey of the site was conducted by Kirtland AFB Bioenvironmental Division. Results of the survey indicated that no radiological activity was present above background levels (USAF, 1992).

The inflow and outflow lines serving SWMU 8-13 are in the urban/industrial zone. Three production wells are near this site: KAFB-14, 900 ft northwest; KAFB-2, 3,700 ft southeast; and KAFB-12, 4,500 ft northwest.

5.17.2 Study Area Investigation

5.17.2.1 Previous Investigations

During the Stage 2B RFI, subsurface soil samples were collected from the perimeter of SWMU 8-13. Analytical results indicated that releases of contaminants had occurred at the site.

5.17.2.2 Data Gaps

Prior to the Appendix III RFI, no data were available that indicated a release having occurred from SWMU 8-13 wastelines.

5.17.2.3 RFI Field Investigation

The objective of the investigation was to determine the presence or absence of contamination in the soil adjacent to the wastelines. Line location and sample borehole designation were completed prior to the soil sampling effort. The soil investigation was limited to the shallow subsurface.

During the Stage 2B RFI, analytical results from samples were used to characterize the soil adjacent to the inflow and outflow lines within a 50-ft radius of each unit investigated. Based on engineering drawings, two 125-ft east-west drain lines, parallel and 125 ft apart, tie into and are intersected by a single 185-ft inflow line that flows north and empties into SWMU 8-13. The outflow runs about 30 ft east, turns, and then runs 60 ft north to a catch basin. Subsurface line locations were confirmed using methods described in Section 3.0.

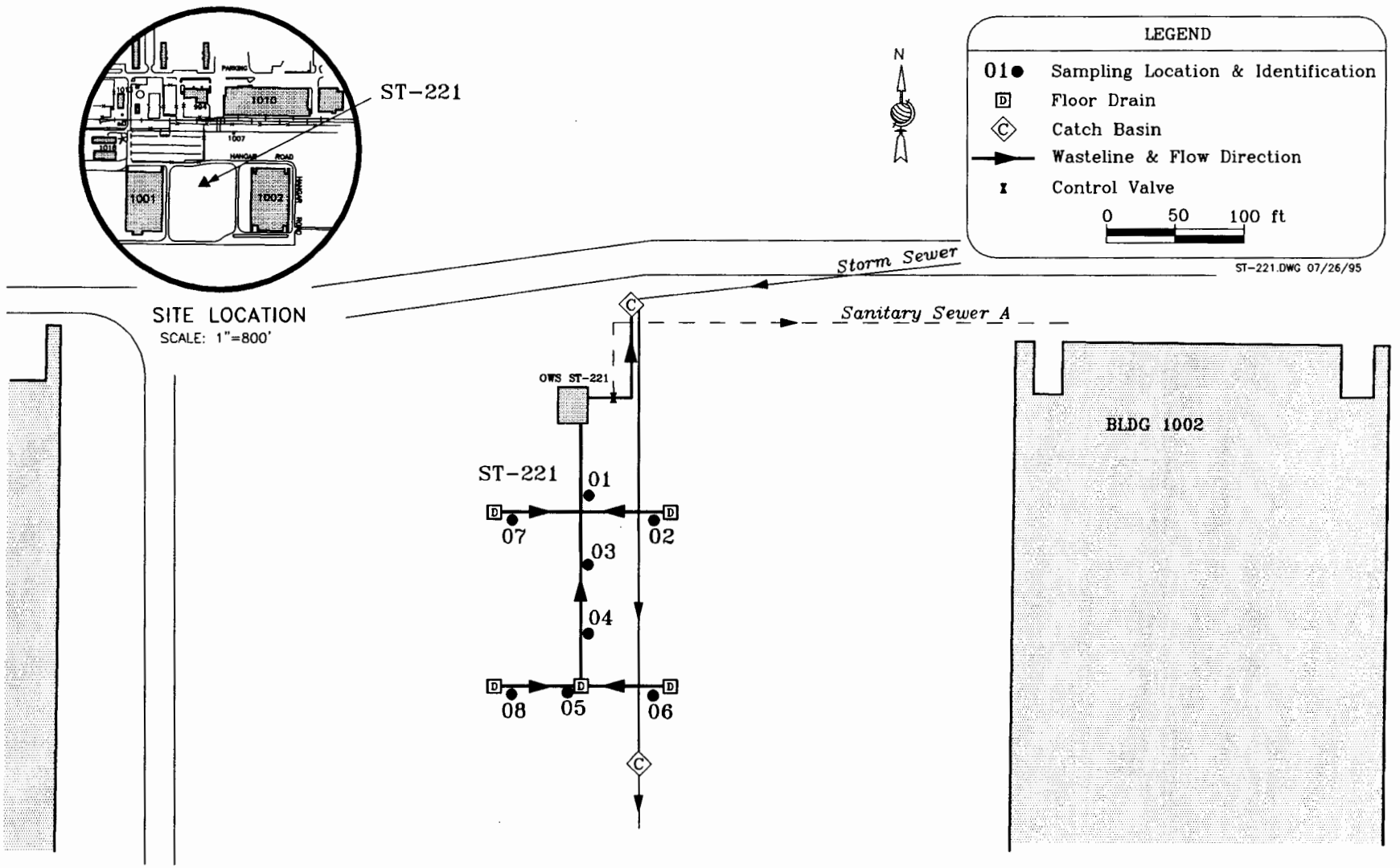


Figure 5-14. Soil Sampling Locations at SWMU 8-13, Buildings 1001/1002, OWS Lines (ST-221)

On January 9 and 10, 1995, eight boreholes were drilled and sampled using a Geoprobe. The sample interval at each borehole location was driven from the depth of the line to 5 ft below the line. From this interval, two samples were collected from each borehole: one at a depth equal to the base of the line, the other from 3 ft below the base of the line. Both samples were field-screened with a FID organic vapor meter and only the sample with the highest FID reading was submitted to the laboratory for analysis. If no FID readings were detected, the sample collected at the depth closest to the base of the line was submitted for analysis. Along the lines serving SWMU 8-13, nine soil samples, including one replicate, were collected and submitted for laboratory analysis during the Appendix III RFI.

The analytical results from ST-221-01, collected during the Stage 2B RFI, were used as background concentration data for samples collected at SWMU 8-13; the results are in Appendix F.

Sampling operations and sample handling procedures are described in Section 3.0. Sample depths, sample locations, and replicate samples collected during the Appendix III RFI are listed in Table 5-25. Soil boring logs for the boreholes drilled and sampled at SWMU 8-13 are in Appendix C.

Table 5-25. Boreholes and Samples Analyzed from SWMU 8-13, Buildings 1001/1002, OWS Lines (ST-221)

Borehole	Borehole Location	Sample Depths (ft)	FID (ppm_v)
01	51 ft S of SE corner of ST-221	3-8[a]	82
02	125 ft N of borehole 06	3-5	0
03	48 ft S of borehole 01	3-5	0
04	48 ft S of borehole 03	2-4	0
05	45 ft E of borehole 04	2-4	0
06	50 ft E of borehole 05	1-3	0
07	125 ft N of borehole 08	6-8	300
08	50 ft W of borehole 05	1-6	9

FID readings are values above background and are the high readings of the sample interval.

a. Replicate sample also collected at this interval.

5.17.2.4 Laboratory Analysis

The soil samples were analyzed for VOCs, SVOCs, TPH, metals, mercury (the potential contaminants associated with normal operations at this site), soil pH, and soil moisture. The four brass tubes in each 2-ft sample interval were field-screened for possible contamination using a beta-gamma meter and a FID. With the exception of the samples collected from boreholes ST-221C-01 and ST-221C-07 (82 ppm_v and 300 ppm_v, respectively, with the FID), all field-screening instrument readings remained at background levels throughout drilling and sampling activities at SWMU 8-13.

ST-221-01, collected during Stage 2B RFI, was used as a background sample during the investigation of the inflow and outflow lines at SWMU 8-13. The soil sampling and analysis at the background hole included analyses for TPH, VOCs, SVOCs, metals, soil pH, and soil moisture.

5.17.3 Site Characteristics

5.17.3.1 Geology

The area surrounding SWMU 8-13 is underlain by unconsolidated alluvial sediment that is predominantly fine-grained sand and very fine-grained to fine-grained silty sand. Eight boreholes were drilled and sampled, and a maximum depth of 8 ft below grade was attained. No borehole penetrated into the Santa Fe Group sediments that presumably underlie this area. A discussion of the general geology at Kirtland AFB is presented in Section 2.4.

As a result of SWMU 8-13 line installation, it is probable that backfill material is present adjacent to each line to a depth at least equal to the total depth of each line. Borehole logs for this area are presented in Appendix C.

5.17.3.2 Hydrogeology

Groundwater beneath SWMU 8-13 is found within the Upper Santa Fe sediments and is generally thought to be unconfined in the upper portion of the aquifer. This area is within the HR1 saturated zone setting as defined by SNL studies (Figure 2-9) (SNL, 1994). Hydrogeologic characterization in this portion of Kirtland AFB is complicated by the presence of numerous production wells (Figure 2-11). It is probable that uniform groundwater conditions do not exist in this region. Local cones of depression associated with groundwater withdrawal have altered the groundwater flow direction in the vicinity of the well fields (Figure 2-7).

The gradient is probably north-northeast at this site. Three production wells are near this site: KAFB-14 is 900 ft northwest and KAFB-12 is 4,500 ft northwest; the wells are downgradient or cross-gradient depending on the local influence of groundwater pumping (Figures 2-7 and 2-11). KAFB-2, 3,700 ft southeast, is upgradient. Depth to groundwater is estimated to be approximately 350 ft below grade (Figure 2-20); however, shallower perched water zones may occur. Hydraulic conductivity within HR1 is estimated at 2 to 171 ft/day (SNL, 1994). A general discussion of the hydrogeology at Kirtland AFB is presented in Section 2.5.

5.17.4 Nature and Extent of Contamination

The following sections describe the nature and extent of contamination based on the analytical results. Analytical results for SWMU 8-13 are summarized in Table 5-26, where only the reportable concentrations are listed. Full analytical results are presented in Appendix F and laboratory validation reports are presented in Appendix K.

Organic Compounds

The VOC analyte methylene chloride was detected in six of the nine soil samples collected at SWMU 8-13. The detected concentrations of this compound ranged from 0.006 to 0.016 mg/kg. These concentrations do not exceed the HHRB action level of 85.0 mg/kg (Table 5-26).

Table 5-26. Summary of Reportable Concentrations for Soil Analyses at SWMU 8-13, Buildings 1001/1002, OWS Lines (ST-221)[1]
(Concentrations mg/kg)

Chemical Class	Analyte	HHRB Action Level[2]	PQL UTL	Borehole Number and Sample Depth Interval (ft)				
				ST221C-01		*ST221C-02*	*ST221C-04*	*ST221C-05*
				3–8 FR	3–8	3–5	2–4	2–4
VOC	Methylene chloride	85.0	0.005	ND	0.006	0.016	0.006	0.006
SVOC	Di-n-butylphthalate	7,800	0.70	ND	ND	1.4	ND	0.98
TPH	Diesel fraction	100	10.0	16.0	140	ND	ND	ND
	Gasoline fraction	100	1.0	2.1	16.0	ND	ND	ND
METALS	Aluminum	78,000	14,700	6,260	7,030	7,890	6,290	5,510
	Arsenic	0.37	6.5	4.5	4.8	3.9	3.4	3.9
	Barium	5,500	735	303	223	291	118	571
	Beryllium	0.15	0.84	ND	ND	0.33	0.34	0.34
	Calcium	N/A	121,000	180,000	114,000	58,600	74,800	102,000
	Chromium, total	390	21.6	5.7	10.4	8.4	5.5	5.8
	Cobalt	4,700	15.4	3.4	4.4	5.2	3.7	3.5
	Copper	2,900	223	10.4	12.7	13.4	28.9	40.8
	Iron	N/A	23,800	6,230	8,040	9,540	7,280	6,450
	Lead	400	17.5	3.0	4.1	5.0	14.3	4.0
	Magnesium	N/A	10,400	5,580	5,250	4,170	3,170	3,660
	Manganese	390	549	89.8	99.9	196	98.5	75.0
	Nickel	1,600	188	3.2	6.3	7.0	4.4	4.2
	Potassium	N/A	3,590	852	966	1,360	1,130	789
	Sodium	N/A	787	164	170	118	120	89.5
	Vanadium	550	55.3	25.7	30.4	25.6	19.6	22.8
	Zinc	23,000	114	15.9	20.0	23.5	21.3	24.0
OTHER	pH			8.5	8.4	8.2	8.7	8.7
	Moisture (%)			14.5	13.2	10.3	10.5	11.3

Table 5-26. Summary of Reportable Concentrations for Soil Analyses at SWMU 8-13, Buildings 1001/1002, OWS Lines (ST-221)[1] (Concentrations mg/kg) (Continued)

Chemical Class	Analyte	HHRB Action Level[2]	PQL UTL	Borehole Number and Sample Depth Interval (ft)			
				ST221C-03	*ST221C-06*	*ST221C-07*	*ST221C-08*
				3–5	1–3	6–8	1–6
VOC	Methylene chloride	85.0	0.005	ND	0.012	ND	ND
SVOC	Di-n-butylphthalate	7,800	0.70	1.4	0.65	0.86	ND
TPH	Diesel fraction	100	10.0	ND	ND	830	ND
	Gasoline fraction	100	1.0	ND	ND	7,500	ND
METALS	Aluminum	78,000	14,700	8,220	7,550	6,910	6,790
	Arsenic	0.37	6.5	5.2	3.6	4.1	4.8
	Barium	5,500	735	509	161	132	318
	Beryllium	0.15	0.84	0.35	0.33	0.46	0.33
	Calcium	N/A	121,000	126,000	77,600	28,200	46,700
	Chromium, total	390	21.6	6.7	6.7	8.5	7.1
	Cobalt	4,700	15.4	5.4	4.4	3.8	3.7
	Copper	2,900	223	9.4	13.5	62.7	19.5
	Iron	N/A	23,800	8,440	8,540	9,040	8,180
	Lead	400	17.5	3.5	4.5	5.7	4.0
	Magnesium	N/A	10,400	6,580	3,860	3,680	3,480
	Manganese	390	549	117	124	161	107
	Nickel	1,600	188	6.5	5.4	6.5	5.0
	Potassium	N/A	3,590	1,120	1,330	1,150	1,030
	Sodium	N/A	787	229	130	111	106
	Vanadium	550	55.3	33.2	23.2	25.9	31.4
	Zinc	23,000	114	21.2	20.4	33.6	20.4
OTHER	pH			8.5	8.7	8.4	8.3
	Moisture (%)			14.5	10.4	12.9	8.6

The SVOC analyte di-n-butylphthalate (0.65 to 1.4 mg/kg) was detected in five of the nine soil samples collected at SWMU 8-13. The concentrations do not exceed the HHRB action level of 7,800 mg/kg (Table 5-26).

Petroleum Hydrocarbons

Diesel range hydrocarbons were detected in three of the nine soil samples collected at SWMU 8-13 at a concentrations ranging from 16 to 830 mg/kg. In two samples, ST-221C-01 and ST-221C-07, the concentrations exceeded the NMED action level of 100 mg/kg (Table 5-26).

Gasoline range hydrocarbons were detected in three out of the nine soil samples at concentrations ranging from 2.1 to 7500 mg/kg. In one sample, ST-221C-07, the concentration exceeded the NMED action level of 100 mg/kg.

Metals

Table 5-26 lists all reportable metal concentrations detected at SWMU 8-13 and the respective UTL and HHRB action level concentrations. Arsenic (3.4 to 5.2 mg/kg) was detected in all nine of the soil samples at concentrations above the HHRB action level of 0.37 mg/kg. No arsenic concentration exceeded the UTL of 6.5 mg/kg. Beryllium (0.33 to 0.46 mg/kg) was detected in seven of the nine soil samples at concentrations above the HHRB action level of 0.15; this concentration appears to be naturally occurring at Kirtland AFB. No beryllium concentrations exceeded the UTL of 0.84 mg/kg.

Soil pH and Moisture

Soil pH values ranged from 8.2 to 8.7 in these samples. Soil moisture values ranged from 8.6 to 14.5 percent (Table 5-26).

5.17.5 Conclusions and Recommendations

Conclusions

- One VOC and one SVOC were detected in the soil samples collected from this site; all concentrations were below HHRB action levels.
- Gasoline range hydrocarbons were detected at concentrations exceeding the NMED action level in one soil sample.
- Diesel range hydrocarbons were detected at concentrations exceeding the NMED action level in two soil samples.
- Arsenic and beryllium were the only metals detected at concentrations exceeding the HHRB action level; these concentrations appear to be naturally occurring throughout Kirtland AFB.
- The analytical results at SWMU 8-13 indicate that a release of contaminants may have occurred at this site.

Recommendations

- Based on analytical results of soil samples collected, it is recommended that additional soil sampling be conducted around the perimeter of the area drain adjacent to borehole ST-221C-07. Additional soil sampling is also recommended at 10-ft intervals along the line leading from the above-mentioned drain to SWMU 8-13. Such an effort will allow for the evaluation of the vertical and horizontal extent of petroleum hydrocarbons in the soil in the vicinity of boreholes ST-221C-07 and ST-221C-01.

5.18 SWMU 10-7, Building 1031, OWS Lines (ST-222)

5.18.1 Site Description and Environmental Setting

ST-222 is between Building 1031 and a NMANG jet engine test cell in the western portion of Kirtland AFB. The building and the test cell are used for testing and maintaining jet engines. The general location of the unit and the associated lines are shown on Figure 5-15. The inflow line to ST-222 carries flow from area drain ST-224 and a drain inside Building 1031. The outflow line discharges separated oils to holding tank ST-225 and water to sewage ejector unit ST-223.

The inflow and outflow lines serving ST-222 are in the urban/industrial zone. Three production wells are near this site: KAFB-2, 2,400 ft southeast; KAFB-7, 2,400 ft southwest; and KAFB-1, 4,800 ft east-northeast.

5.18.2 Study Area Investigation

5.18.2.1 Previous Investigations

During the Stage 2B RFI, subsurface soil samples were collected from the perimeter of OWS ST-222. Analytical results did not indicate that contaminants had been released at the site.

5.18.2.2 Data Gaps

Prior to the Appendix III RFI, no data were available that indicated a release occurred from ST-222 wastelines.

5.18.2.3 RFI Field Investigation

The objective of the investigation was to determine if contamination exists in the adjacent soil. Location of the lines and sample borehole designation were completed prior to the soil sampling effort. The soil investigation was limited to the near surface vadose zone.

Analytical results from samples collected during Stage 2B RFI activities were used to characterize the soil adjacent to the inflow and outflow lines within a 50-ft radius of each unit investigated. Based on

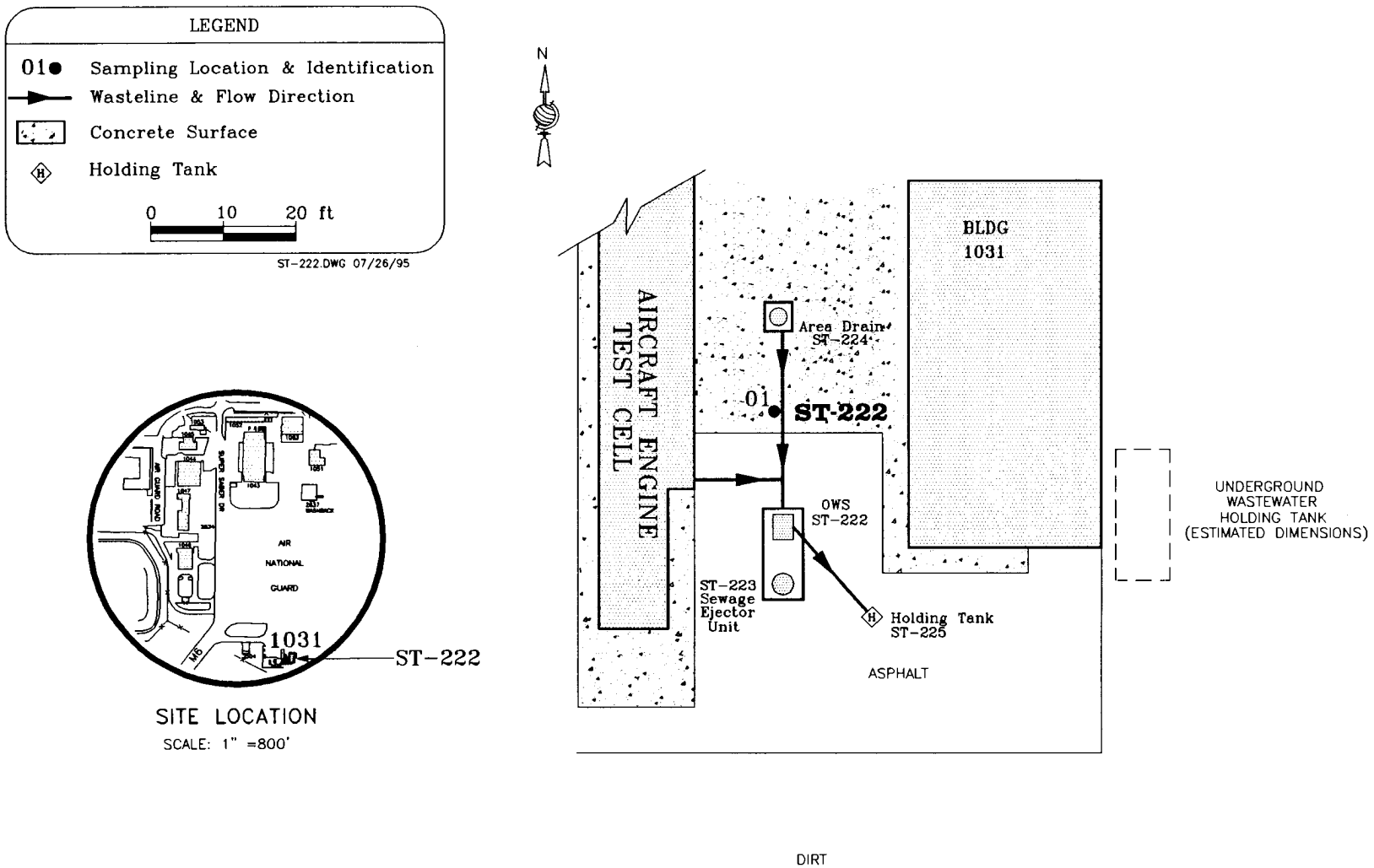


Figure 5-15. Soil Sampling Locations at SWMU 10-7, Building 1031, OWS Lines (ST-222)

engineering drawings, one inflow line to ST-222 runs approximately 25 ft south from area drain ST-224, which receives inflow from Building 1031 and the aircraft engine test cell (Section 6.5). The second inflow line runs from the test cell 12 ft east to join with the first inflow line. The oil-phase outflow line runs about 15 ft southeast to holding tank ST-225. The water-phase discharge from ST-222 flows to sewage ejector ST-223 a few feet to the south. The discharge from ST-223 flows to a wastewater holding tank 50 ft to the east (Section 10.2). Subsurface line locations were confirmed using methods described in Section 3.0.

On February 2, 1995, one borehole was drilled and sampled using a Geoprobe. The sample interval at the borehole location was driven from the depth of the line to 5 ft below the line. From this interval, two samples were collected from the borehole: one at a depth equal to the base of the line, the other from 3 ft below the base of the line. Both samples were field-screened with a FID organic vapor meter and only the sample with the highest FID reading was submitted to the laboratory for analysis. If no FID readings were detected, the sample collected at the depth closest to the base of the line was submitted for analysis. Along the lines serving ST-222, two soil samples were collected, including one replicate sample, and submitted for laboratory analysis during the Appendix III RFI.

Because of the proximity of ST-222, ST-223, ST-224, and ST-225, the analytical results from ST-222-01, collected during the Stage 2B RFI, were used as background concentration data for samples collected at these units.

Sampling operations and sample handling procedures are described in Section 3.0. The sample and field replicate submitted for analysis, at borehole ST-222-01 southwest of Building 1031, were sampled at depths between 2 and 7 ft. The FID measurement at the sample interval was not elevated above background concentrations. Soil boring logs for the borehole drilled and sampled at ST-222 are in Appendix C.

5.18.2.4 Laboratory Analysis

The soil samples were analyzed for VOCs, SVOCs, TPH, metals, mercury (the potential contaminants associated with normal operations at this site), soil pH, and soil moisture. The four brass tubes in each 2-ft sample interval were field-screened for possible contamination using a beta-gamma meter and a FID. All field-screening instrument readings remained at background levels throughout drilling and sampling activities at ST-222.

ST-222-01, collected during Stage 2B RFI work, was used as a background sample during the investigation of the inflow and outflow lines at ST-222. The soil sampling and analysis at the background hole included analyses for TPH, VOCs, SVOCs, metals, soil pH, and soil moisture.

5.18.3 Site Characteristics

5.18.3.1 Geology

The Building 1031 area is underlain by unconsolidated alluvial sediment that is predominantly very fine-grained to fine-grained sand to silty sand and sandy silt. One 7 ft-deep borehole was drilled at Building 1031; it did not penetrate into the Santa Fe Group sediments that presumably underlie this area. A discussion of the general geology at Kirtland AFB is presented in Section 2.4.

As a result of ST-222 line installation, it is probable that backfill material is present adjacent to each line to a depth at least equal to the total depth of each line. Borehole logs for this area are presented in Appendix C.

5.18.3.2 Hydrogeology

Groundwater beneath ST-222 is found within the Upper Santa Fe sediments and is generally thought to be unconfined in the upper portion of the aquifer. This area is within the HR1 saturated zone setting as defined by SNL (Figure 2-9) (SNL, 1994). Hydrogeologic characterization in this portion of Kirtland AFB is complicated by the presence of numerous production wells (Figure 2-11). It is probable that uniform groundwater conditions do not exist in this region. Local cones of depression associated with groundwater withdrawal have altered the groundwater flow direction in the vicinity of the well fields (Figure 2-7).

The gradient is probably north at this site. Three production wells are near this site: KAFB-2 is 2,400 ft southeast, KAFB-1 is 4,800 ft east-northeast, and KAFB-7 is 2,400 ft southwest. All three wells are probably upgradient of Building 1031 (Figures 2-7 and 2-11). Depth to groundwater is estimated to be 350 ft below grade (Figure 2-10); however, shallower perched water zones may occur. Hydraulic conductivity within HR1 is estimated at 2 to 171 ft/day (SNL, 1994). A general discussion of the hydrogeology at Kirtland AFB is presented in Section 2.5.

5.18.4 Nature and Extent of Contamination

The following sections describes the nature and extent of contamination based on the analytical results. Analytical results for ST-222 are summarized in Table 5-27, where only the reportable concentrations are listed. Full analytical results are presented in Appendix F and laboratory validation reports are presented in Appendix G.

Organic Compounds

There were no VOC or SVOC analytes detected in either of the soil samples collected at ST-222.

Petroleum Hydrocarbons

Diesel range hydrocarbons were detected in both of the soil samples collected at ST-222 at concentrations equal to 12 and 9 mg/kg. These concentrations are below the NMED action level of 100 mg/kg (Table 5-27).

Metals

Table 5-27 lists all reportable metal concentrations detected at ST-222 and the respective UTL and HHRB action level concentrations. Arsenic (3.8 and 3.2 mg/kg) was detected in both of the soil samples at concentrations above the HHRB action level of 0.37 mg/kg, but below the UTL of 6.5 mg/kg.

Table 5-27. Summary of Reportable Concentrations for Soil Analyses at SWMU 10-7, Building 1031, OWS Lines (ST-222)[1]
(Concentrations mg/kg)

Chemical Class	Analyte	HHRB Action Level[2]	PQL UTL	Borehole Number and Sample Depth Interval (ft)	
				ST222C-01	
				2–7 FR	2–7
TPH	Diesel fraction	100	10.0	12.0	9.0
METALS	Aluminum	78,000	14,700	3,460	4,920
	Arsenic	0.37	6.5	3.8	3.2
	Barium	5,500	735	220	159
	Calcium	N/A	121,000	108,000	51,000
	Chromium, total	390	21.6	2.4	4.3
	Cobalt	4,700	15.4	3.3	3.4
	Copper	2,900	223	15.2	12.1
	Iron	N/A	23,800	4,680	6,870
	Lead	400	17.5	2.3	3.5
	Magnesium	N/A	10,400	3,110	3,640
	Manganese	390	549	54.6	88.6
	Nickel	1,600	188	ND	4.4
	Potassium	N/A	3,590	378	752
	Sodium	N/A	787	60.3	79.3
	Vanadium	550	55.3	18.2	22.7
	Zinc	23,000	114	11.9	16.9
OTHER	pH			8.6	8.8
	Moisture (%)			13.4	9.6

FOOTNOTES

1	Complete laboratory analytical results and method detection limits are presented in Appendix K.
2	Action level of RCRA Proposed Rule Subpart S (55 FR 30814, 7/27/90).
*	TPH action level is 100 mg/kg adopted from NMED UST regulations (NMED, 1990). SW-8015 analyzes volatile and semivolatile petroleum hydrocarbon fractions separately. The total concentration of the two fractions analyzed under SW-8015 will be used to assess compliance with stipulated action levels for the purpose of this RFI.
#	Denotes TCLP analysis, results in mg/l.
--	No Data.
FR	Field Replicate.
HHRB	Human health risk based.
J	Estimated value.
N/A	Not Applicable.
NA	Not Analyzed.
ND	Not detected above the method detection limit.
pCi/g	picocuries per gram.
PQL	Practical quantitation limits (defines VOC, SVOC, and TPH).
R	Reject NDs due to interference.
RAD	Radionuclides.
RE	Resample.
SVOC	Semivolatile organic compounds.
TPH	Total petroleum hydrocarbons.
U	Accept data (positive results may be influenced by lab contamination).
UJ	Estimated nondetect.
UTL	Upper tolerance limits (defines metals).
VOC	Volatile organic compounds.

Soil pH and Moisture

Soil pH values were equal to 8.6 and 8.8 in these samples. Soil moisture values were equal to 13.4 and 9.6 percent (Table 5-27).

5.18.5 Conclusions and Recommendations

Conclusions

- No VOCs or SVOCs were detected in the soil samples collected from this site.
- No gasoline or diesel range hydrocarbons were detected at concentrations above the NMED action levels. This diesel range hydrocarbon concentrations were similar to those measured in background samples collected during the Appendix III RFI.
- Arsenic and beryllium were the only metals detected at concentrations exceeding the respective HHRB action levels; these concentrations appear to be naturally occurring throughout Kirtland AFB.
- The analytical results at ST-222 are not indicative of a release from this site.

Recommendations

- Based on the findings of the RFI, no further action is necessary; therefore, ST-222 does not require further investigation. A No Further Action proposal should be prepared.

5.19 SWMU 10-7, Building 1031, Holding Tank Lines (ST-225)

5.19.1 Site Description and Environmental Setting

ST-225 is between Building 1031 and a jet engine test cell; the building is used for testing and maintaining jet engines. Inflow to ST-225 is the oil-phase discharge from OWS ST-222 15 ft northwest, which in turn receives flow from area drain ST-224 and from a drain in Building 1031. ST-225 has no discharge.

The inflow and outflow lines serving ST-225 are in the urban/industrial zone. The nearest production wells to this site are KAFB-2, 2,400 ft southeast; KAFB-1, 4,800 ft east-northeast; and KAFB-7, 2,400 ft southwest.

5.19.2 Study Area Investigation

5.19.2.1 Previous Investigations

During the Stage 2B RFI, subsurface soil samples were collected from the perimeter of ST-225. Analytical results from the Stage 2B RFI did not indicate that contaminants had been released at the site.

5.19.2.2 Data Gaps

Prior to the Appendix III RFI, no data were available that indicated a release occurred from ST-225 wastelines.

5.19.2.3 RFI Field Investigation

The inflow line to ST-225 is the 15-ft long outflow line from OWS ST-222 (Section 5.18), which receives flow from an area drain in ST-224 (Section 6.5) and from a drain in Building 1031. Line location activities were performed as described in Section 3.0. Because the units are within 50 ft of each other and none of the lines are greater than 50 ft in length, the samples collected at the holding tank and the OWS unit during the Stage 2B RFI were used to characterize the soil adjacent to inflow and outflow lines within 50 ft of ST-225.

5.19.3 Conclusions and Recommendations

Conclusions

- The analytical results from the Stage 2B RFI are not indicative of a release from this unit.

Recommendations

- Based on the findings of the FRI, no further action is necessary. A No Further Action proposal should be prepared.

5.20 SWMU 10-7, Building 1037, OWS Line (ST-226)

5.20.1 Site Description and Environmental Setting

ST-226 is near the north side of Building 1037, a fuel systems maintenance facility. The general location of the unit and the associated lines are shown on Figure 5-16. The inflow line to ST-226 conveys flow from floor drains inside the building. Oil-phase discharge is southeast to holding tank ST-227; water-phase discharge is east to the sanitary sewer.

The lines serving ST-226 are in the urban/industrial zone. The nearest production wells to these sites are KAFB-14, 3,050 ft west-northwest, and KAFB-2, 2,300 ft south-southeast.

5.20.2 Study Area Investigation

5.20.2.1 Previous Investigations

During the Stage 2B RFI, subsurface soil samples were collected from the perimeter of ST-226. Analytical results from the Stage 2B RFI did not indicate contaminants had been released at the site.

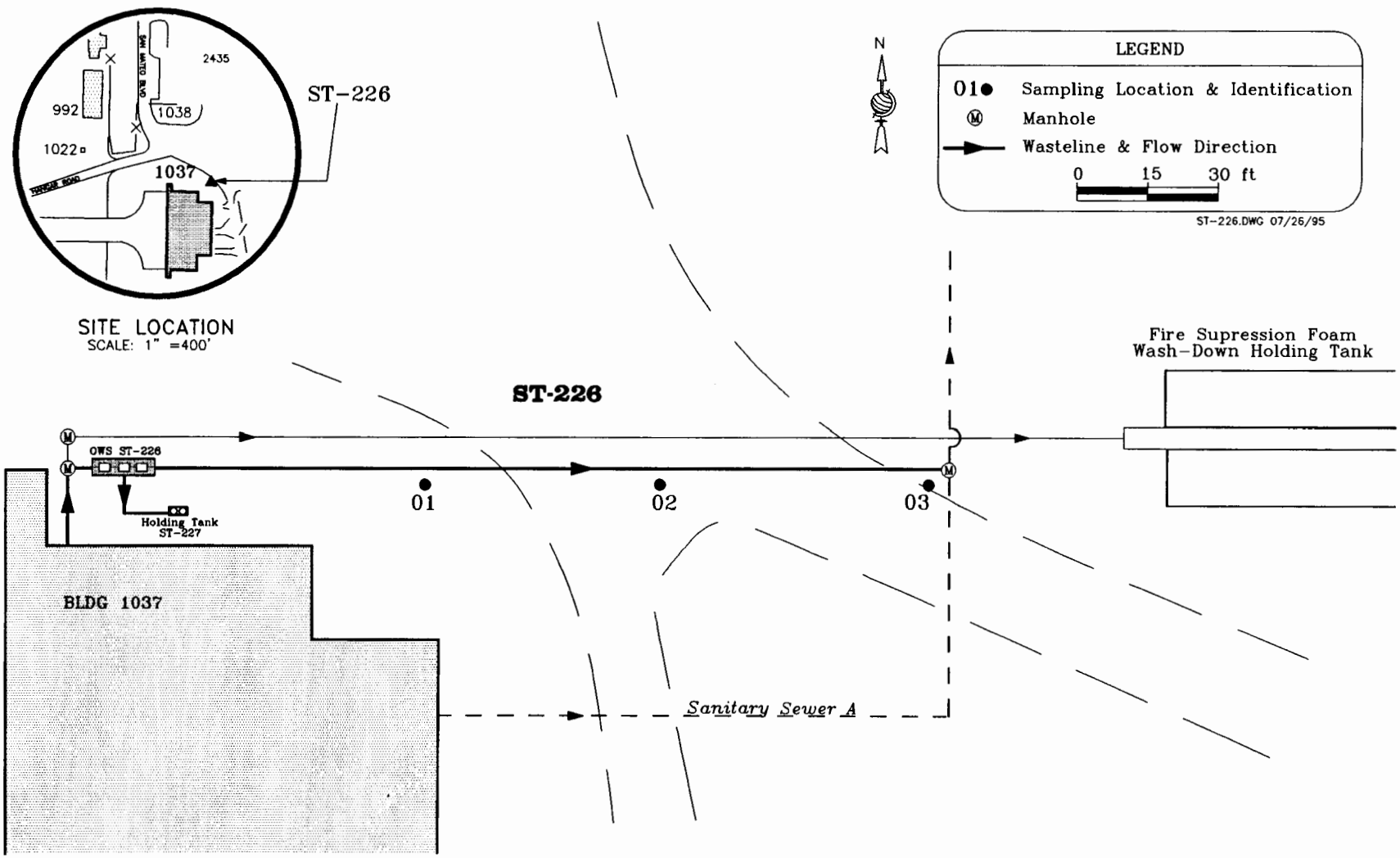


Figure 5-16. Soil Sampling Locations at SWMU 10-7, Building 1037, OWS Line (ST-226)

5.20.2.2 Data Gaps

Prior to the Appendix III RFI, no data were available that indicated contaminants were released from the ST-226 wastelines.

5.20.2.3 RFI Field Investigation

The objective of the investigation was to determine if contamination exists in the adjacent soil. Location of the lines and sample borehole designation was completed prior to the soil sampling effort. The soil investigation was limited to the shallow subsurface.

Analytical results from samples collected during Stage 2B RFI activities were used to characterize the soil adjacent to the inflow and outflow lines within a 50-ft radius of ST-226. Based on engineering drawings, the inflow line runs north for 16 ft from Building 1037 to a manhole 5 ft west of ST-226 and then runs from the manhole into the OWS. The inflow line inside the building is estimated to be 24 ft long. The oil-phase outflow line runs 8 ft south and 10 ft east to holding tank ST-227. The water-phase discharge runs approximately 170 ft east to the sanitary sewer lateral east of Building 1037. Subsurface line locations were confirmed using methods described in Sections 3.0.

On January 6, 1995, three boreholes were sampled using the Geoprobe. The sample interval at each borehole location was driven from the depth of the line to 5 ft below the line. From this interval, two samples were collected from each borehole: one at a depth equal to the base of the line, the other from 3 ft below the base of the line. Both samples were field-screened with a FID organic vapor meter and the sample with the highest FID reading was submitted to the laboratory for VOC analysis. If no elevated FID readings were detected, the sample collected at the depth closest to the base of the line was submitted for analysis. Along the lines serving ST-226, four soil samples were collected, including one replicate sample, and submitted for laboratory analysis during the Appendix III RFI.

Because of the close proximity of ST-226 and ST-227, analytical results from ST-206-01, collected during the Stage 2B RFI, were used as background concentration data for samples collected at ST-226 during the Appendix III RFI.

Sampling operations and sample handling procedures are described in Section 3.0. Sample depths, sample locations, and replicate samples collected during the Appendix III RFI are listed in Table 5-28. The corresponding soil boring logs for the boreholes drilled and sampled at ST-226 are in Appendix C.

Table 5-28. Boreholes and Samples Analyzed from Site SWMU 10-7, Building 1037, OWS Line (ST-226)

Borehole	Borehole Location	Sample Depths (ft)
01	3 ft W and 33 ft N from the NE corner of Building 1037	4-6
02	50 ft E of borehole 01	5-10[a]
03	58 ft E of borehole 02	5-7

a. Replicate sample also collected at this interval.

5.20.2.4 Laboratory Analysis

The soil samples were analyzed for VOCs, SVOCs, TPH, metals, mercury (the potential contaminants associated with normal operations at this site), soil pH, and soil moisture. The four brass tubes in each 2-ft sample interval were field-screened for possible contamination using a beta-gamma meter and a FID. All field-screening instrument readings remained at background levels throughout Appendix III RFI sampling activities at ST-226.

ST-208-01, collected during the Stage 2B RFI, was used as a background sample during the investigation of the inflow and outflow lines at ST-226. The soil sampling and analysis at the background borehole included analyses for TPH, VOCs, SVOCs, metals, soil pH, and soil moisture.

5.20.3 Site Characteristics

5.20.3.1 Geology

The Building 1037 area is underlain by unconsolidated alluvial sediment that is predominantly fine-grained sand and very fine-grained to fine-grained silty sand. Three boreholes were drilled at Building 1037 reaching a maximum depth of 10 ft below grade. No boreholes penetrated into the Santa Fe Group sediments that presumably underlie this area. A discussion of the general geology at Kirtland AFB is presented in Section 2.4.

As a result of ST-226 line installation, it is probable that backfill material is present adjacent to each line to a depth at least equal to the total depth of each line. Borehole logs for this area are presented in Appendix C.

5.20.3.2 Hydrogeology

Groundwater beneath ST-226 and ST-227 is found within the Upper Santa Fe sediments and is generally thought to be unconfined in the upper portion of the aquifer. This area is within the HR1 saturated zone setting as defined by SNL studies (Figure 2-9) (SNL, 1994). Hydrogeologic characterization in this portion of Kirtland AFB is complicated by the presence of numerous production wells (Figure 2-11). It is probable that uniform groundwater conditions do not exist in this region. Local cones of depression associated with groundwater withdrawal have altered the groundwater flow direction in the vicinity of the well fields (Figure 2-7).

The gradient is probably north at this site. Two production wells are near these sites: KAFB-14 is downgradient 3,050 ft west-northwest and KAFB-2 is upgradient 2,300 ft south-southeast (Figures 2-7 and 2-11). Depth to groundwater is estimated to be 350 ft below grade; however, shallower perched water zones may occur (Figure 2-10). Hydraulic conductivity within HR1 is estimated at 2 to 171 ft/day (SNL, 1994). A general discussion of the hydrogeology at Kirtland AFB is presented in Section 2.5.

5.20.4 Nature and Extent of Contamination

The following section describes the nature and extent of contamination based on soil sampling results. Analytical results for Appendix III RFI soil samples at ST-226 are summarized in Table 5-29, where only the reportable concentrations are listed. Full analytical results are presented in Appendix F and laboratory validation reports are presented in Appendix K.

Organic Compounds

The VOC analyte methylene chloride (0.006 mg/kg) was detected in all of the soil samples collected at ST-226. The detection was below the HHRB action level of 85.0 mg/kg (Table 5-29).

There were no SVOC analytes detected in any of the soil samples collected at ST-226.

Petroleum Hydrocarbons

Diesel range hydrocarbons were detected in one soil sample at a concentration of 4.4 mg/kg. The concentration did not exceed the NMED action level of 100 mg/kg (Table 5-29).

Metals

Table 5-29 lists all reportable metal concentrations detected at ST-226 and the respective UTL and HHRB action level concentrations. Arsenic (3.9 to 4.3 mg/kg) was detected in all four of the soil samples at concentrations above the HHRB action level of 0.37 mg/kg, but below the UTL of 6.5 mg/kg. Beryllium was detected in all four of the samples with concentrations ranging from 0.32 to 0.45 mg/kg; this concentration may be naturally occurring at Kirtland AFB.

Soil pH and Moisture

Soil pH values ranged from 8.2 to 8.7 in these samples. Soil moisture values ranged from 7.1 to 11.9 percent (Table 5-29).

5.20.5 Conclusions and Recommendations

Conclusions

- One VOC and no SVOCs were detected in the soil samples collected from this site; all concentrations were below HHRB action levels.
- No gasoline or diesel range hydrocarbons were detected at concentrations above the NMED action levels.

Table 5-29. Summary of Reportable Concentrations for Soil Analyses at SWMU 10-7, Building 1037, OWS Line (ST-226)[1]
(Concentrations mg/kg)

Chemical Class	Analyte	HHRB Action Level[2]	PQL UTL	Borehole Number and Sample Depth Interval (ft)			
				ST226C-01	*ST226C-02*		*ST226C-03*
				4–6	5–10 FR	5–10	5–7
VOC	Methylene chloride	85.0	0.005	0.006	0.006	0.006	0.006
TPH	Diesel fraction	100	10.0	4.4	ND	ND	ND
METALS	Aluminum	78,000	14,700	6,240	9,140	9,600	9,370
	Arsenic	0.37	6.5	3.9	3.9	4.0	4.3
	Barium	5,500	735	250	351	110	159
	Beryllium	0.15	0.84	0.32	0.45	0.45	0.45
	Calcium	N/A	121,000	32,100	43,900	53,300	65,500
	Chromium, total	390	21.6	6.2	8.5	8.9	8.0
	Cobalt	4,700	15.4	5.0	6.0	5.4	6.0
	Copper	2,900	223	21.0	7.4	10.6	12.7
	Iron	N/A	23,800	10,200	11,500	11,900	12,600
	Lead	400	17.5	4.5	5.6	5.4	6.0
	Magnesium	N/A	10,400	3,370	4,140	4,470	4,840
	Manganese	390	549	151	153	159	189
	Nickel	1,600	188	5.8	7.0	6.5	8.9
	Potassium	N/A	3,590	1,250	1,450	1,590	1,760
	Sodium	N/A	787	84.5	233	195	177
	Thallium	N/A	N/A	0.15	0.15	0.12	0.12
	Vanadium	550	55.3	29.2	30.0	31.9	32.0
	Zinc	23,000	114	25.1	23.7	24.0	27.4
OTHER	pH			8.5	8.7	8.6	8.2
	Moisture (%)			7.1	11.9	11.9	11.0

FOOTNOTES

1	Complete laboratory analytical results and method detection limits are presented in Appendix K.
2	Action level of RCRA Proposed Rule Subpart S (55 FR 30814, 7/27/90).
*	TPH action level is 100 mg/kg adopted from NMED UST regulations (NMED, 1990). SW-8015 analyzes volatile and semivolatile petroleum hydrocarbon fractions separately. The total concentration of the two fractions analyzed under SW-8015 will be used to assess compliance with stipulated action levels for the purpose of this RFI.
#	Denotes TCLP analysis, results in mg/l.
--	No Data.
FR	Field Replicate.
HHRB	Human health risk based.
J	Estimated value.
N/A	Not Applicable.
NA	Not Analyzed.
ND	Not detected above the method detection limit.
pCi/g	picocuries per gram.
PQL	Practical quantitation limits (defines VOC, SVOC, and TPH).
R	Reject NDs due to interference.
RAD	Radionuclides.
RE	Resample.
SVOC	Semivolatile organic compounds.
TPH	Total petroleum hydrocarbons.
U	Accept data (positive results may be influenced by lab contamination).
UJ	Estimated nondetect.
UTL	Upper tolerance limits (defines metals).
VOC	Volatile organic compounds.

- Arsenic and beryllium were the only metals detected at concentrations exceeding the HHRB action level; these concentrations appear to be naturally occurring throughout Kirtland AFB.
- The analytical results at ST-226 are not indicative of a release from this site.

Recommendations

- Based on the findings of the RFI, no further action is necessary; therefore, ST-226 does not require further investigation. A No Further Action proposal should be prepared.

5.21 SWMU 10-7, Building 1037, Holding Tank Lines (ST-227)

5.21.1 Site Description and Environmental Setting

ST-227 is near the north side of Building 1037, the Flight Systems Maintenance Dock. ST-227 receives the oil-phase discharge flow from ST-226, an OWS 9 ft northwest, which in turn receives flow from Building 1037. ST-227 has no discharge.

The inflow line to ST-227 is in the urban/industrial zone. The nearest production wells are KAFB-14, 3,050 ft west-northwest, and KAFB-2, 2,300 ft south-southeast.

5.21.2 Study Area Investigation

5.21.2.1 Previous Investigations

During the Stage 2B RFI subsurface soil samples were collected from the perimeter of ST-226 and ST-227. Analytical results did not indicate that contaminants had been released at these sites.

5.21.2.2 Data Gaps

Prior to the Appendix III RFI, no data were available that indicated a release occurred from ST-227 wastelines.

5.21.2.3 RFI Field Investigation

The inflow line to ST-227 is an 18-ft long outflow line from ST-226 (Section 5.20) that receives flow from Building 1037. Line location activities were performed as described in Section 3.0. The samples collected for the holding tank and the OWS unit during Stage 2B RFI activities were used to characterize the soil adjacent to line lengths within 50 ft from the unit(s). In this instance, samples collected during Stage 2B RFI activities adequately characterize soil conditions surrounding the inflow line.

5.21.3 Conclusions and Recommendations

Conclusions

- The analytical results from the Stage 2B RFI are not indicative of a release from ST-227.

Recommendations

- On the basis of the Stage 2B RFI analytical results, no further action is necessary; therefore, ST-227 does not require further investigation. A No Further Action proposal should be prepared.

5.22 SWMU 10-7, Building 1046, OWS Lines (ST-230)

5.22.1 Site Description and Environmental Setting

ST-230 is near the west side of Building 1046, the NMANG Weapons Shop. The general location of the unit and the associated lines are shown on Figure 5-17. The inflow lines to ST-230 carry flow from floor drains inside Building 1046. Oil-phase discharge from this unit flows to holding tank ST-231. Water-phase discharge from ST-230 flows to sewage ejector ST-232 and then to the sanitary sewer.

The lines serving ST-230 are in the urban/industrial zone. The nearest production wells to this site are KAFB-7, 2,800 ft south-southeast; KAFB-2, 3,000 ft south-southwest; and KAFB-14, 6,000 ft west.

5.22.2 Study Area Investigation

5.22.2.1 Previous Investigations

During the Stage 2B RFI, subsurface soil samples were collected from the perimeter of ST-230. Analytical results did not indicate that a release of contamination had occurred at the site.

5.22.2.2 Data Gaps

Prior to the Appendix III RFI, no data were available that indicated contaminants were released from ST-230.

5.22.2.3 RFI Field Investigation

The objective of the investigation was to determine if contamination exists in the adjacent soil. Location of the lines and sample borehole designation were completed prior to the soil sampling effort. The soil investigation was limited to the shallow subsurface.

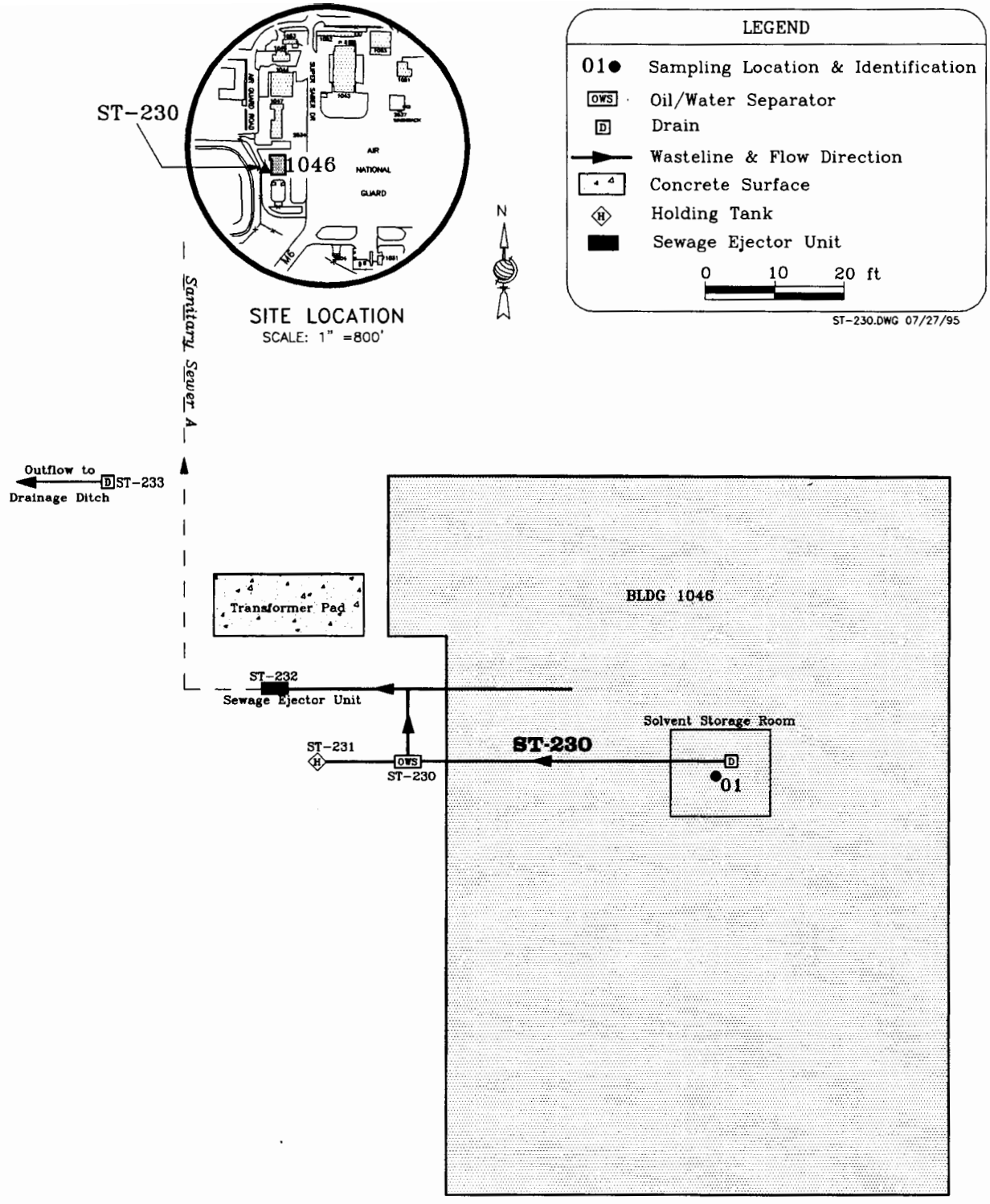


Figure 5-17. Soil Sampling Locations at SWMU 10-7, Building 1046, OWS Lines (ST-230)

Analytical results from samples collected during Stage 2B RFI activities were used to characterize the soil adjacent to the inflow and outflow lines within a 50-ft radius of ST-230. Based on engineering drawings, the inflow line to ST-230 runs 49 ft west from a floor drain in Building 1046. The oil-phase outflow line runs 11 ft west to holding tank ST-231. The water-phase discharge runs 10 ft north, 20 ft west to sewage ejector ST-232, and then to the sanitary sewer. Subsurface line locations were confirmed using methods described in Section 3.0.

On January 18, 1995, one borehole was sampled using the Geoprobe. The sample interval extended from the depth of the line to 5 ft below the line. From this interval, two samples were collected from the borehole: one at a depth equal to the base of the line, the other from 3 ft below the base of the line. Both samples were field-screened with a FID organic vapor meter and only the sample with the highest FID reading was submitted to the laboratory for analysis. If no FID readings were detected, the sample collected at the depth closest to the base of the line was submitted for analysis. A FID reading of 62 ppm_V was detected in the 1- to 3-ft sample. As a result, that sample was submitted for laboratory analysis.

Because of the close proximity of ST-230, ST-231, ST-232, and ST-233, analytical results from ST-233-01, collected during the Stage 2B RFI, were used as background concentration data for samples collected at ST-230 during the Appendix III RFI.

5.22.2.4 Laboratory Analysis

The soil samples were analyzed for VOCs, SVOCs, TPH, metals, mercury (the potential contaminants associated with normal operations at this site), soil pH, and soil moisture. The four brass tubes in each 2-ft sample interval were field-screened for possible contamination using a beta-gamma meter and a FID.

ST-233-01, collected during the Stage 2B RFI, was used as a background sample during the investigation of the inflow and outflow lines at ST-230. The soil sampling and analysis at the background hole included analyses for TPH, VOCs, SVOCs, metals, soil pH, and soil moisture.

5.22.3 Site Characteristics

5.22.3.1 Geology

Building 1046 area is underlain by unconsolidated alluvial sediment that is predominantly fine-grained sand and very fine-grained to fine-grained silty sand. Occasional sub-angular pebbles were present at various depths. A maximum depth of 3 ft below grade was attained at borehole ST-230C-01. No borehole penetrated into the Santa Fe Group sediments that presumably underlie this area. A discussion of the general geology at Kirtland AFB is presented in Section 2.4.

As a result of ST-230 line installation, it is probable that backfill material is present adjacent to each line to a depth at least equal to the total depth of each line. Borehole logs for this area are presented in Appendix C.

5.22.3.2 Hydrogeology

Groundwater beneath ST-230, ST-231, and ST-232 is found within the Upper Santa Fe sediments and is generally thought to be unconfined in the upper portion of the aquifer. This area is within the HR1 saturated zone setting as defined by SNL studies (Figure 2-9) (SNL, 1994). Hydrogeologic characterization in this portion of Kirtland AFB is complicated by the presence of numerous production wells (Figure 2-11). It is probable that uniform groundwater conditions do not exist in this region. Local cones of depression associated with groundwater withdrawal have altered the groundwater flow direction in the vicinity of the well fields (Figure 2-7).

The gradient is probably north at this site. Two production wells are upgradient: KAFB-7 is 2,800 ft south-southeast and KAFB-2 is 3,000 ft south-southwest. KAFB-14 is cross-gradient 6,000 ft west (Figures 2-7 and 2-11). Depth to groundwater is estimated to be about 350 ft below grade (Figure 2-10); however, shallower perched water zones may occur. Hydraulic conductivity in the vicinity of HR1 is estimated at 2 to 171 ft/day (SNL, 1994). A general discussion of the hydrogeology at Kirtland AFB is presented in Section 2.5.

5.22.4 Nature and Extent of Contamination

The following section describes the nature and extent of contamination based on soil sampling results. Analytical results for Appendix III RFI soil samples at ST-230 are summarized in Table 5-30, where only the reportable concentrations are listed. Full analytical results are presented in Appendix F and laboratory validation reports are presented in Appendix K.

Organic Compounds

There were no VOC or SVOC analytes detected in the soil sample collected at ST-230.

Petroleum Hydrocarbons

No petroleum range hydrocarbons were detected in the soil sample collected at ST-230.

Metals

Table 5-30 lists all reportable metal concentrations detected at ST-230 and the respective UTL and HHRB action level concentrations. Arsenic (0.68 mg/kg) was detected in the soil sample at a concentration above the HHRB action level of 0.4 mg/kg, but below the UTL of 6.5 mg/kg.

Soil pH and Moisture

The soil pH value was 8.4 in this sample. The soil moisture value was 2.4 percent (Table 5-30).

Table 5-30. Summary of Reportable Concentrations for Soil Analyses at SWMU 10-7, Building 1046, OWS Lines (ST-230)[1]
(Concentrations mg/kg)

Chemical Class	Analyte	HHRB Action Level[2]	UTL	Borehole Number and Sample Depth Interval (ft)	
				ST230C-01	
				1–3	
METALS	Aluminum	78,000	14,700	3,900	
	Arsenic	0.37	6.5	0.68	
	Barium	5,500	735	53.5	
	Calcium	N/A	121,000	29,400	
	Chromium, total	390	21.6	5.4	
	Cobalt	4,700	15.4	5.7	
	Copper	2,900	223	39.3	
	Iron	N/A	23,800	9,760	
	Lead	400	17.5	3.5	
	Magnesium	N/A	10,400	2,870	
	Manganese	390	549	215	
	Nickel	1,600	188	3.8	
	Potassium	N/A	3,590	1,160	
	Sodium	N/A	787	51.6	
	Vanadium	550	55.3	17.0	
	Zinc	23,000	114	32.9	
OTHER	pH			8.4	
	Moisture (%)			2.4	

FOOTNOTES

1	Complete laboratory analytical results and method detection limits are presented in Appendix K.
2	Action level of RCRA Proposed Rule Subpart S (55 FR 30814, 7/27/90).
*	TPH action level is 100 mg/kg adopted from NMED UST regulations (NMED, 1990). SW-8015 analyzes volatile and semivolatile petroleum hydrocarbon fractions separately. The total concentration of the two fractions analyzed under SW-8015 will be used to assess compliance with stipulated action levels for the purpose of this RFI.
#	Denotes TCLP analysis, results in mg/l.
--	No Data.
FR	Field Replicate.
HHRB	Human health risk based.
J	Estimated value.
N/A	Not Applicable.
NA	Not Analyzed.
ND	Not detected above the method detection limit.
pCi/g	picocuries per gram.
PQL	Practical quantitation limits (defines VOC, SVOC, and TPH).
R	Reject NDs due to interference.
RAD	Radionuclides.
RE	Resample.
SVOC	Semivolatile organic compounds.
TPH	Total petroleum hydrocarbons.
U	Accept data (positive results may be influenced by lab contamination).
UJ	Estimated nondetect.
UTL	Upper tolerance limits (defines metals).
VOC	Volatile organic compounds.

5.22.5 Conclusions and Recommendations

Conclusions

- No VOCs or SVOCs were detected in the soil samples collected from this site.
- No gasoline or diesel range hydrocarbons were detected at concentrations above the NMED action levels.
- Arsenic was the only metal detected at concentrations exceeding the HHRB action level; these concentrations appear to be naturally occurring throughout Kirtland AFB.
- The analytical results at ST-230 are not indicative of a release from this site.

Recommendations

- Based on the findings of the RFI, no further action is necessary; therefore, ST-230 does not require further investigation. A No Further Action proposal should be prepared.

5.23 SWMU 10-7, Building 1046, Holding Tank Lines (ST-231)

5.23.1 Site Description and Environmental Setting

ST-231 is approximately 20 ft west of Building 1046, the NMANG Weapons Shop. ST-231 receives the oil-phase flow from OWS ST-230 11 ft east, which in turn receives flow from drains within the building. ST-231 has no discharge.

The line serving ST-231 is in the urban/industrial zone. The nearest production wells to this site are KAFB-7, 2,800 ft south-southeast, and KAFB-2, 3,000 ft south-southwest.

5.23.2 Study Area Investigation

5.23.2.1 Previous Investigations

During the Stage 2B RFI, subsurface soil samples were collected from the perimeter of ST-230 and ST-231. Analytical results from the Stage 2B RFI did not indicate that contaminants had been released at these sites.

5.23.2.2 Data Gaps

Prior to the Appendix III RFI, no data were available to indicate whether a release occurred from ST-231 wastelines.

5.23.2.3 RFI Field Investigation

The inflow line to ST-231 is the 11-ft long oil-phase outflow line that runs west from ST-230 to ST-231. Line location activities were performed as described in Section 3.0. The samples collected for the holding tank and the OWS unit during Stage 2B RFI were used to characterize the soil adjacent to line lengths within 50 ft of the unit. In this instance, samples collected at ST-230 and ST-231 during the Stage 2B RFI adequately characterize soil conditions surrounding the inflow line.

5.23.3 Conclusions and Recommendations

Conclusions

- The analytical results from the Stage 2B RFI are not indicative of a release from this unit.
- The analytical results from the Appendix III RFI sampling at the adjacent ST-230 wasteline are not indicative of a release from this site.

Recommendations

- Based on the findings of the RFI, no further action is necessary; therefore, ST-231 does not require further investigation. A No Further Action proposal should be prepared.

5.24 SWMU 10-7, Building 1051, OWS Lines (ST-234)

5.24.1 Site Description and Environmental Setting

ST-234 is near the east side of Building 1051, which is the AGE Maintenance Shop. The general location of the unit and the associated lines are shown on Figure 5-18. One inflow line to this unit is from area drain ST-237 (Section 6.8), 40 ft south, which receives inflow from the asphalt driveway between Buildings 1051, 1060, and 1061. The other inflow line is from area drain ST-228 (Section 6.6), 115 ft north, which receives inflow from the driveway and parking area north of Buildings 1060 and 1051. The OWS receives inflow on the north and east ends and discharges south to an east-flowing sanitary sewer lateral on the south side of Building 1060.

The lines serving this unit are in the urban/industrial zone. The nearest production wells to this site are KAFB-1, 4,600 ft east; KAFB-7, 2,900 ft southeast; and KAFB-2, 3,800 ft southwest.

5.24.2 Study Area Investigation

5.24.2.1 Previous Investigations

During the Stage 2B RFI, subsurface soil samples were collected from the perimeter of ST-234. Analytical results did not indicate that contamination had been released at the site.

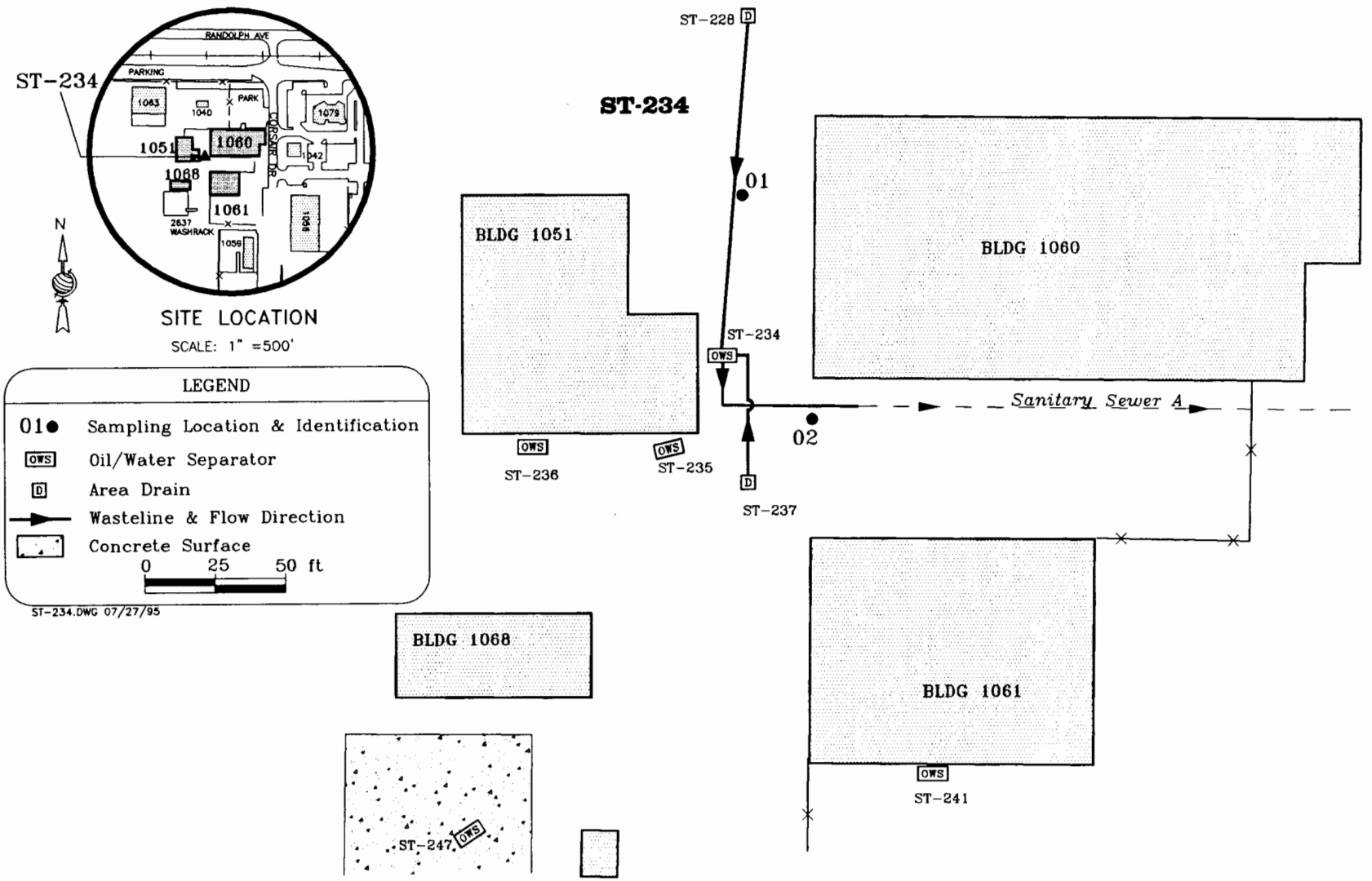


Figure 5-18. Soil Sampling Locations at SWMU 10-7, Building 1051, OWS Lines (ST-234)

5.24.2.2 Data Gaps

Prior to the Appendix III RFI, no data were available that indicated a release of contaminants occurred from the ST-234 wastelines.

5.24.2.3 RFI Field Investigation

The objective of the investigation was to determine if contamination exists in the adjacent soil. Location of the lines and sample borehole designation were completed prior to the soil sampling effort. The soil investigation was limited to the shallow subsurface.

Analytical results from samples collected during Stage 2B RFI activities were used to characterize the soil adjacent to the inflow and outflow lines within a 50-ft radius of ST-234. Based on engineering drawings, the inflow line from area drain ST-228 runs 115 ft south to enter ST-234 on the north side. The inflow line from area drain ST-237 runs 43 ft north before turning west for about 4 ft to enter ST-234 on the east side. The discharge line exits ST-234 to the south and runs 15 ft, turns east for 50 ft, and joins the lateral sanitary sewer on the south side of Building 1060. Subsurface line locations were confirmed using methods described in Section 3.0.

On January 18, 1995, two boreholes were sampled using the Geoprobe. The sample interval at each borehole location extended from the depth of the line to 5 ft below the line. From this interval, two samples were collected from each borehole: one at a depth equal to the base of the line, the other from 3 ft below the base of the line. Both samples were field-screened with a FID organic vapor meter and only the sample with the highest FID reading was submitted to the laboratory for analysis. If no FID readings were detected, the sample collected at the depth closest to the base of the line was submitted for analysis. Along the lines serving ST-234, two soil samples were collected and submitted for laboratory analysis during the Appendix III RFI.

Because of the close proximity of ST-234, ST-235, ST-236, and ST-237, analytical results from ST-234-01, collected during the Stage 2B RFI, were used as background concentration data for samples collected at ST-234 during Appendix III RFI activities.

Sampling operations and sample handling procedures are described in Section 3.0. Sample depths, sample locations, and replicate samples collected during the Appendix III RFI are listed in Table 5-31. Soil boring logs for the boreholes drilled and sampled at ST-234 are in Appendix C.

Table 5-31. Boreholes and Samples Analyzed from SWMU 10-7, Building 1051, OWS Lines (ST-234)

Borehole	Borehole Location	Sample Depths (ft)
01	38.8 ft E and 3.5 ft N of the E corner of Building 1051	1-3
02	14.7 ft S of the SW corner of Building 1060	3-5

5.24.2.4 Laboratory Analysis

The soil samples were analyzed for VOCs, SVOCs, TPH, metals, mercury (the potential contaminants associated with normal operations at this site), soil pH, and soil moisture. The four brass tubes in each 2-ft sample interval were field-screened for possible contamination using a beta-gamma meter and a FID. All field-screening instrument readings remained at background levels throughout the Appendix III RFI sampling activities at ST-234.

ST-234-01, collected during Stage 2B RFI, was used as a background sample during the investigation of the inflow and outflow lines at ST-234. The soil sampling and analysis at the background hole included analyses for TPH, VOCs, SVOCs, metals, soil pH, and soil moisture.

5.24.3 Site Characteristics

5.24.3.1 Geology

The Building 1051 area is underlain by unconsolidated alluvial sediment that is predominantly very fine-grained to fine-grained sand and silty sand. Coarser grained sediment was occasionally encountered. An iron oxide-stained patch was noted at a depth of 3 ft in boreholes ST-234C-01, ST-234C-02, and ST-236C-01. Nine boreholes were drilled and sampled in this area with a maximum depth of 8 ft. No borehole at these sites penetrated into the Santa Fe Group sediments that presumably underlie this area. A discussion of the general geology at Kirtland AFB is presented in Section 2.4.

As a result of ST-234 line installation, it is probable that backfill material is present adjacent to each line to a depth at least equal to the total depth of each line. Borehole logs for this area are presented in Appendix C.

5.24.3.2 Hydrogeology

Groundwater beneath this area is found within the Upper Santa Fe sediments and is generally thought to be unconfined in the upper portion of the aquifer. This area is within the HR1 saturated zone setting as defined by SNL studies (Figure 2-9) (SNL, 1994). Hydrogeologic characterization in this portion of Kirtland AFB is complicated by the presence of numerous production wells (Figure 2-11). It is probable that uniform groundwater conditions do not exist in this region. Local cones of depression associated with groundwater withdrawal have altered the groundwater flow direction in the vicinity of the well fields (Figure 2-7).

The gradient is probably north at this site. Three production wells are located in this area: KAFB-1 is cross-gradient 4,600 ft east, KAFB-7 is upgradient 2,900 ft southeast, and KAFB-2 is upgradient 3,800 ft southwest (Figures 2-7 and 2-11). Depth to groundwater is estimated to be 350 ft below grade (Figure 2-10); however, shallower perched water zones may occur. Hydraulic conductivity within HR1 is estimated at 2 to 171 ft/day (SNL, 1994). A general discussion of the hydrogeology at Kirtland AFB is presented in Section 2.5.

5.24.4 Nature and Extent of Contamination

The following section describes the nature and extent of contamination based on soil sampling results. Analytical results for Appendix III RFI soil samples at ST-234 are summarized in Table 5-32, where only the reportable concentrations are listed. Full analytical results are presented in Appendix F and laboratory validation reports are presented in Appendix K.

Organic Compounds

There were no VOC or SVOC analytes detected in any of the soil samples collected at ST-234.

Petroleum Hydrocarbons

No petroleum hydrocarbons were detected in the soil sample collected at ST-234.

Metals

Table 5-32 lists all reportable metal concentrations detected at ST-234 and the respective UTL and HHRB action level concentrations. Arsenic (2.1 and 0.47 mg/kg) was detected in both of the soil samples at concentrations above the HHRB action level of 0.37 mg/kg, but below the UTL of 6.5 mg/kg. Beryllium was detected in one of the two samples with a concentration of 0.33 mg/kg; this concentration may be naturally occurring at Kirtland AFB.

Soil pH and Moisture

Soil pH values were 8.5 and 8.8 in these samples. Soil moisture values were 9.3 and 2.1 percent (Table 5-32).

5.24.5 Conclusions and Recommendations

Conclusions

- No VOCs or SVOCs were detected in the soil samples collected from this site.
- No gasoline or diesel range hydrocarbons were detected at concentrations above the NMED action levels.
- Arsenic and beryllium were the only metals detected at concentrations exceeding the HHRB action level; these concentrations appear to be naturally occurring throughout Kirtland AFB.
- The analytical results at ST-234 are not indicative of a release from this site.

Table 5-32. Summary of Reportable Concentrations for Soil Analyses at SWMU 10-7, Building 1051, OWS Lines (ST-234)[1]
(Concentrations mg/kg)

Chemical Class	Analyte	HHRB Action Level[2]	UTL	Borehole Number and Sample Depth Interval (ft)	
				ST234C-01	*ST234C-02*
				1–3	3–5
METALS	Aluminum	78,000	14,700	4,690	3,890
	Arsenic	0.37	6.5	2.1	0.47
	Barium	5,500	735	231	31.7
	Beryllium	0.15	0.84	0.33	ND
	Calcium	N/A	121,000	65,200	7,900
	Chromium, total	390	21.6	4.0	4.3
	Cobalt	4,700	15.4	3.5	6.1
	Copper	2,900	223	57.2	53.9
	Iron	N/A	23,800	6,510	9,310
	Lead	400	17.5	3.4	3.1
	Magnesium	N/A	10,400	3,780	3,020
	Manganese	390	549	96.5	206
	Nickel	1,600	188	4.6	2.3
	Potassium	N/A	3,590	752	1,500
	Sodium	N/A	787	85.7	148
	Vanadium	550	55.3	18.9	15.0
	Zinc	23,000	114	32.1	39.0
OTHER	pH			8.5	8.8
	Moisture (%)			9.3	2.1

FOOTNOTES

1	Complete laboratory analytical results and method detection limits are presented in Appendix K.
2	Action level of RCRA Proposed Rule Subpart S (55 FR 30814, 7/27/90).
*	TPH action level is 100 mg/kg adopted from NMED UST regulations (NMED, 1990). SW-8015 analyzes volatile and semivolatile petroleum hydrocarbon fractions separately. The total concentration of the two fractions analyzed under SW-8015 will be used to assess compliance with stipulated action levels for the purpose of this RFI.
#	Denotes TCLP analysis, results in mg/l.
--	No Data.
FR	Field Replicate.
HHRB	Human health risk based.
J	Estimated value.
N/A	Not Applicable.
NA	Not Analyzed.
ND	Not detected above the method detection limit.
pCi/g	picocuries per gram.
PQL	Practical quantitation limits (defines VOC, SVOC, and TPH).
R	Reject NDs due to interference.
RAD	Radionuclides.
RE	Resample.
SVOC	Semivolatile organic compounds.
TPH	Total petroleum hydrocarbons.
U	Accept data (positive results may be influenced by lab contamination).
UJ	Estimated nondetect.
UTL	Upper tolerance limits (defines metals).
VOC	Volatile organic compounds.

Recommendations

- Based on the findings of the RFI, no further action is necessary; therefore, ST-234 does not require further investigation. A No Further Action proposal should be prepared.

5.25 SWMU 10-7, Building 1051, OWS Lines (ST-235)

5.25.1 Site Description and Environmental Setting

ST-235 is near the southeast corner of Building 1051, which is the AGE Maintenance Shop. Inflow sources to this unit include OWS ST-236, which receives flow from a floor drain in the building (Section 5.26), and OWS ST-247, which receives flow from surface drainage from the middle of the NMANG wash rack area (Section 5.36). Outflow discharges east to the sanitary sewer.

The lines serving this unit are in the urban/industrial zone. The nearest production wells to this site are KAFB-1, 4,400 ft east; KAFB-7, 2,950 ft south-southeast; and KAFB-2, 3,800 ft southwest.

5.25.2 Study Area Investigation

5.25.2.1 Previous Investigations

During the Stage 2B RFI, subsurface soil samples were collected from the perimeter of ST-235. Analytical results did not indicate that contaminants had been released at these sites.

5.25.2.2 Data Gaps

Prior to the Appendix III RFI, no data were available that indicated a release occurred from ST-235 wastelines.

5.25.2.3 RFI Field Investigation

The inflow line to ST-235 consists of the 38-ft discharge line from OWS ST-236 to west, and the 146-ft discharge line from OWS ST-247 to the southwest. The discharge line from ST-235 runs about 60 ft east-northeast to join the sanitary sewer lateral that runs along the south side of Building 1060. Line location activities were performed as described in Section 3.0. The samples collected for ST-235 and ST-236 during Stage 2B RFI activities were used to characterize the soil adjacent to line lengths within 50 ft from the unit(s). In this instance, samples collected during Stage 2B RFI activities adequately characterize soil conditions surrounding the line between ST-236 and ST-235. The inflow line to ST-235 from ST-247 is discussed in Section 5.31. The sampling of the area where the ST-235 outflow line joins the sanitary sewer is the same immediate area where the outflow of ST-234 joins the sanitary sewer and is discussed in Section 5.24.

5.25.3 Conclusions and Recommendations

Conclusions

- The analytical results from the Stage 2B RFI are not indicative of a release from ST-235.

Recommendations

- Based on the finding of the RFI, no further action is necessary; therefore, ST-235 does not require further investigation. A No Further Action proposal should be prepared.

5.26 SWMU 10-7, Building 1051, OWS Lines (ST-236)

5.26.1 Site Description and Environmental Setting

ST-236 is directly south of Building 1051, the AGE Maintenance Shop. The general location of the unit and the associated lines are shown on Figure 5-19. The inflow source to this unit is from a floor drain in Building 1051. Outflow is east to OWS ST-235, which discharges to the sanitary sewer running along the south side of Building 1060 (Section 5.25).

The lines serving this unit are in the urban/industrial zone. The nearest production wells to this site are KAFB-1, 4,600 ft east; KAFB-7, 2,900 ft southeast; and KAFB-2, 3,800 ft southwest.

5.26.2 Study Area Investigation

5.26.2.1 Previous Investigations

During the Stage 2B RFI, subsurface soil samples were collected from the perimeter of OWS ST-236. Analytical results did not indicate that contaminants had been released at the site.

5.26.2.2 Data Gaps

Prior to the Appendix III RFI, no data were available that indicated a release occurred from the ST-236 wastelines.

5.26.2.3 RFI Field Investigation

The objective of the investigation was to determine if contamination exists in the adjacent soil. Location of the lines and sample borehole designations were completed prior to the soil sampling effort. The soil investigation was limited to the shallow subsurface.

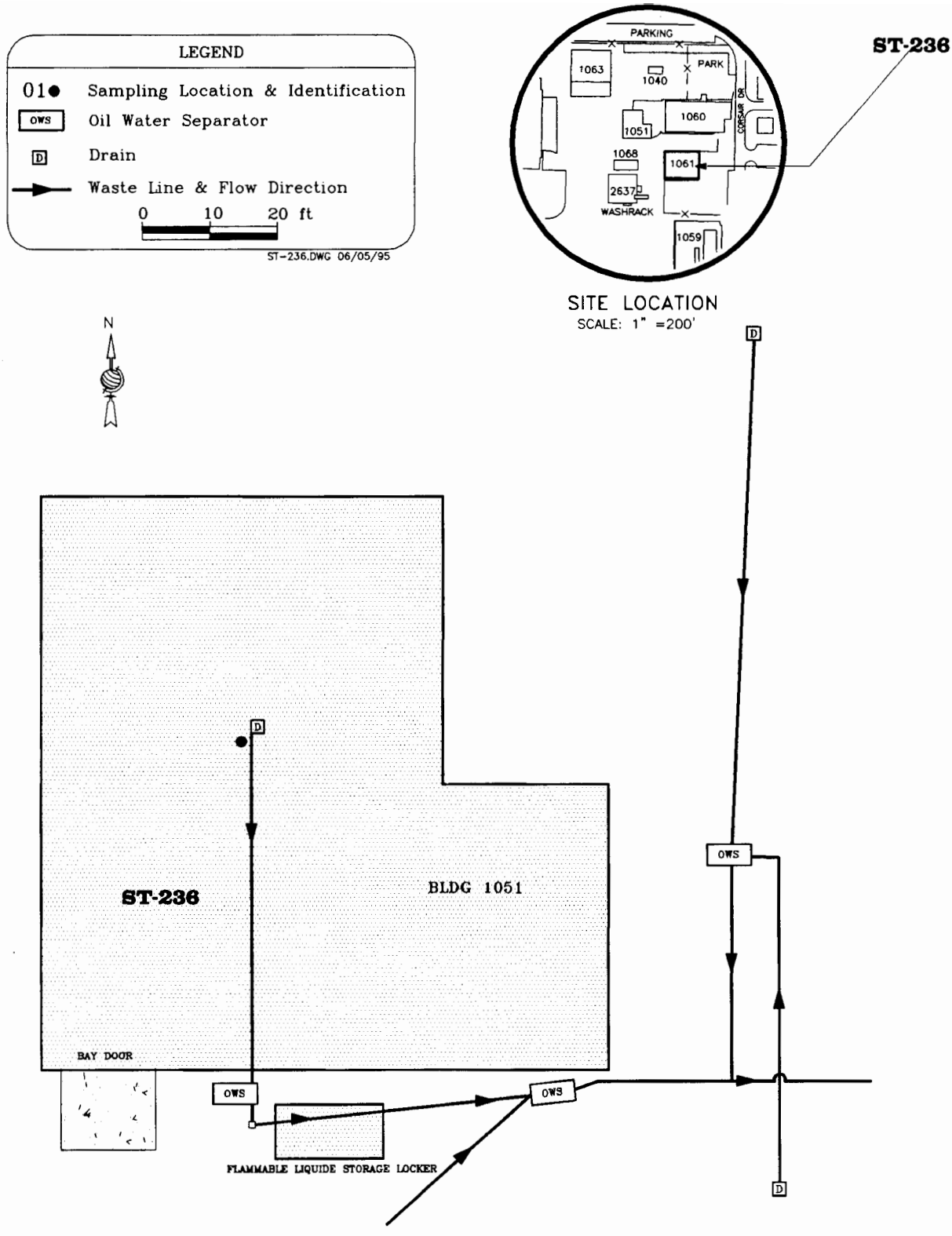


Figure 5-19. Soil Sampling Locations at SWMU 10-7, Building 1051, OWS Lines (ST-236)

Analytical results from samples collected during Stage 2B RFI activities were used to characterize the soil adjacent to the inflow and outflow lines within a 50-ft radius of ST-236. Based on engineering drawings, the inflow line to ST-236 runs 60 ft south from the building floor drain to the unit. The outflow line runs 37 ft to OWS ST-235, which discharges into the sanitary sewer lateral that runs along the south side of Building 1060. Subsurface line locations were confirmed using methods described in Section 3.0.

On January 8, 1995, one borehole was sampled using the Geoprobe. The sample interval at the borehole location extended from the depth of the line to 5 ft below the line. From this interval, two samples were collected: one at a depth equal to the base of the line, the other from 3 ft below the base of the line. Both samples were field-screened with a FID organic vapor meter and only the sample with the highest FID reading was submitted to the laboratory for analysis. If no FID readings were detected, the sample collected at the depth closest to the base of the line was submitted for analysis. One soil sample was collected from along the lines serving ST-236 and submitted for laboratory analysis during the Appendix III RFI.

Because of the close proximity of ST-234, ST-235, ST-236, and ST-237, analytical results from ST-234-01, collected during the Stage 2B RFI, were used as background concentration data for samples collected at ST-236 during Appendix III RFI activities.

Sampling operations and sample handling procedures are described in Section 3.0. Soil boring logs for the borehole drilled and sampled at ST-236 are in Appendix C.

5.26.2.4 Laboratory Analysis

The soil sample was analyzed for VOCs, SVOCs, TPH, metals, mercury (the potential contaminants associated with normal operations at this site), soil pH, and soil moisture. The four brass tubes in each 2-ft sample interval were field-screened for possible contamination using a beta-gamma meter and a FID. All field-screening instrument readings remained at background levels throughout the Appendix III RFI sampling activities at ST-236.

ST-234-01, collected during Stage 2B RFI, was used as a background sample during the investigation of the inflow and outflow lines at ST-236. The soil sampling and analysis at the background hole included analyses for TPH, VOCs, SVOCs, metals, soil pH, and soil moisture.

5.26.3 Site Characteristics

5.26.3.1 Geology

The Building 1051 area is underlain by unconsolidated alluvial sediment that is predominantly very fine-grained to fine-grained sand and silty sand. Coarser grained sediment was occasionally encountered. An iron oxide-stained patch was noted at a depth of 3 ft in boreholes ST-234C-01, ST-234C-02, and ST-236C-01. Nine boreholes were drilled and sampled in this area with a maximum depth of 8 ft. No borehole at these sites penetrated into the Santa Fe Group sediments that presumably underlie this area. A discussion of the general geology at Kirtland AFB is presented in Section 2.4.

As a result of ST-236 line installation, it is probable that backfill material is present adjacent to each line to a depth at least equal to the total depth of each line. Borehole logs for this area are presented in Appendix C.

5.26.3.2 Hydrogeology

Groundwater beneath this area is found within the Upper Santa Fe sediments and is generally thought to be unconfined in the upper portion of the aquifer. This area is within the HR1 saturated zone setting as defined by SNL studies (Figure 2-9) (SNL, 1994). Hydrogeologic characterization in this portion of Kirtland AFB is complicated by the presence of numerous production wells (Figure 2-11). It is probable that uniform groundwater conditions do not exist in this region. Local cones of depression associated with groundwater withdrawal have altered the groundwater flow direction in the vicinity of the well fields (Figure 2-7).

The gradient is probably north at this site. Three production wells are located in this area of Kirtland AFB: KAFB-1 is cross-gradient 4,600 ft east, KAFB-7 is upgradient 2,900 ft southeast, and KAFB-2 is upgradient 3,800 ft southwest (Figures 2-7 and 2-11). Depth to groundwater is estimated to be approximately 350 ft below grade (Figure 2-10); however, shallower perched water zones may occur. Hydraulic conductivity within HR1 is estimated at 2 to 171 ft/day (SNL, 1994). A general discussion of the hydrogeology at Kirtland AFB is presented in Section 2.5.

5.26.4 Nature and Extent of Contamination

The following section describes the nature and extent of contamination based on soil sampling results. Analytical results for Appendix III RFI soil samples at ST-236 are summarized in Table 5-33, where only the reportable concentrations are listed. Full analytical results are presented in Appendix F and laboratory validation reports are presented in Appendix G.

Organic Compounds

There were no VOC or SVOC analytes detected in the soil sample collected at ST-236.

Petroleum Hydrocarbons

No petroleum range hydrocarbons were detected the soil sample collected at ST-236.

Metals

Table 5-33 lists all reportable metal concentrations detected at ST-236 and the respective UTL and HHRB action level concentrations. Arsenic (2.6 mg/kg) was detected in the soil sample at a concentration above the HHRB action level of 0.37 mg/kg, but below the UTL of 6.5 mg/kg.

5.26.4.4 Soil pH and Moisture

The soil pH value was 8.6 in this sample. The soil moisture value was 11.6 percent (Table 5-33).

Table 5-33. Summary of Reportable Concentrations for Soil Analyses at SWMU 10-7, Building 1051, OWS Lines (ST-236)[1]
(Concentrations mg/kg)

Chemical Class	Analyte	HHRB Action Level[2]	PQL UTL	Borehole Number and Sample Depth Interval (ft) ST236C-01 1–3
METALS	Aluminum	78,000	14,700	4,490
	Arsenic	0.37	6.5	2.6
	Barium	5,500	735	206
	Calcium	N/A	121,000	81,600
	Chromium, total	390	21.6	4.6
	Cobalt	4,700	15.4	4.1
	Copper	2,900	223	12.6
	Iron	N/A	23,800	6,780
	Lead	400	17.5	3.3
	Magnesium	N/A	10,400	3,870
	Manganese	390	549	85.4
	Nickel	1,600	188	3.6
	Potassium	N/A	3,590	694
	Sodium	N/A	787	390
	Vanadium	550	55.3	21.3
	Zinc	23,000	114	15.4
OTHER	pH			8.6
	Moisture (%)			11.6

FOOTNOTES

1	Complete laboratory analytical results and method detection limits are presented in Appendix K.
2	Action level of RCRA Proposed Rule Subpart S (55 FR 30814, 7/27/90).
*	TPH action level is 100 mg/kg adopted from NMED UST regulations (NMED, 1990). SW-8015 analyzes volatile and semivolatile petroleum hydrocarbon fractions separately. The total concentration of the two fractions analyzed under SW-8015 will be used to assess compliance with stipulated action levels for the purpose of this RFI.
#	Denotes TCLP analysis, results in mg/l.
--	No Data.
FR	Field Replicate.
HHRB	Human health risk based.
J	Estimated value.
N/A	Not Applicable.
NA	Not Analyzed.
ND	Not detected above the method detection limit.
pCi/g	picocuries per gram.
PQL	Practical quantitation limits (defines VOC, SVOC, and TPH).
R	Reject NDs due to interference.
RAD	Radionuclides.
RE	Resample.
SVOC	Semivolatile organic compounds.
TPH	Total petroleum hydrocarbons.
U	Accept data (positive results may be influenced by lab contamination).
UJ	Estimated nondetect.
UTL	Upper tolerance limits (defines metals).
VOC	Volatile organic compounds.

5.26.5 Conclusions and Recommendations

Conclusions

- No VOCs and SVOCs were detected in the soil sample collected from this site.
- No gasoline or diesel range hydrocarbons were detected in the soil sample collected from this site.
- Arsenic was the only metal detected at a concentration exceeding the HHRB action level; the concentration appears to be naturally occurring throughout Kirtland AFB.
- The analytical results at ST-236 are not indicative of a release from this site.

Recommendations

- Based on the findings of the RFI, no further action is necessary; therefore, ST-236 does not require further investigation. A No Further Action proposal should be prepared.

5.27 SWMU 10-7, Building 1058, OWS Lines (ST-238)

5.27.1 Site Background and Environmental Setting

ST-238 is centrally located in a wash rack area near the west side of Building 1058, the NMANG Vehicle Maintenance Shop. OWS ST-238 has no inflow lines; it receives surface flow from the wash rack area drain on the west side of Building 1058. The outflow runs to the sanitary sewer 20 ft north.

The lines serving this unit are in the urban/industrial zone. The nearest production wells to this site are KAFB-1, 4,000 ft east, and KAFB-7, 2,400 ft south-southeast.

5.27.2 Study Area Investigation

5.27.2.1 Previous Investigations

During the Stage 2B RFI, subsurface soil samples were collected from the perimeter of ST-238. Analytical results did not indicate that contaminants had been released at the site.

5.27.2.2 Data Gaps

Prior to the Appendix III RFI investigation, no data were available that indicated a release occurred from the ST-238 wastelines.

5.27.2.3 RFI Field Investigation

Based on engineering drawings, the inflow source to ST-238 is the wash rack west of Building 1058 and the outflow destination is the sanitary sewer approximately 20 ft north. Line location activities were performed as described in Section 3.0. The soil samples collected for the OWS unit during Stage 2B RFI activities were used to characterize the soil adjacent to line lengths within 50 ft of the unit(s). In this instance, samples collected during the Stage 2B RFI adequately characterized soil conditions surrounding inflow and outflow lines.

5.27.3 Conclusions and Recommendations

Conclusions

- The analytical results from the Stage 2B RFI are not indicative of a release from this unit.
- The analytical results from the Appendix III RFI soil sampling at the adjacent ST-239 wasteline are not indicative of a release from this site.

Recommendations

- Based on the findings of the RFI, no further action is necessary; therefore, ST-238 does not require further investigation. A No Further Action proposal should be prepared.

5.28 SWMU 10-7, Building 1058, OWS Lines (ST-239)

5.28.1 Site Background and Environmental Setting

ST-239 is at the east bay of Building 1058, the NMANG Vehicle Maintenance Shop. The general location of the unit and the associated lines are shown on Figure 5-20. Inflow to OWS ST-239 consists of surface flow from the east garage bay in the building; it has no inflow lines. According to engineering drawings, oil-phase liquid is discharged through a buried pipe that extends to holding tank ST-240 north of the Building 1058. Water-phase liquid is discharged through a separate buried line that ties into the sanitary sewer along the north side of the building.

The lines serving this unit are in the urban/industrial zone. The nearest production wells to this site are KAFB-1, 4,200 ft east, and KAFB-7, 2,400 ft south-southeast.

5.28.2 Study Area Investigation

5.28.2.1 Previous Investigations

During the Stage 2B RFI, subsurface soil samples were collected from the perimeter of OWS ST-239. Analytical results did not indicate that a release of contamination had occurred at the site.

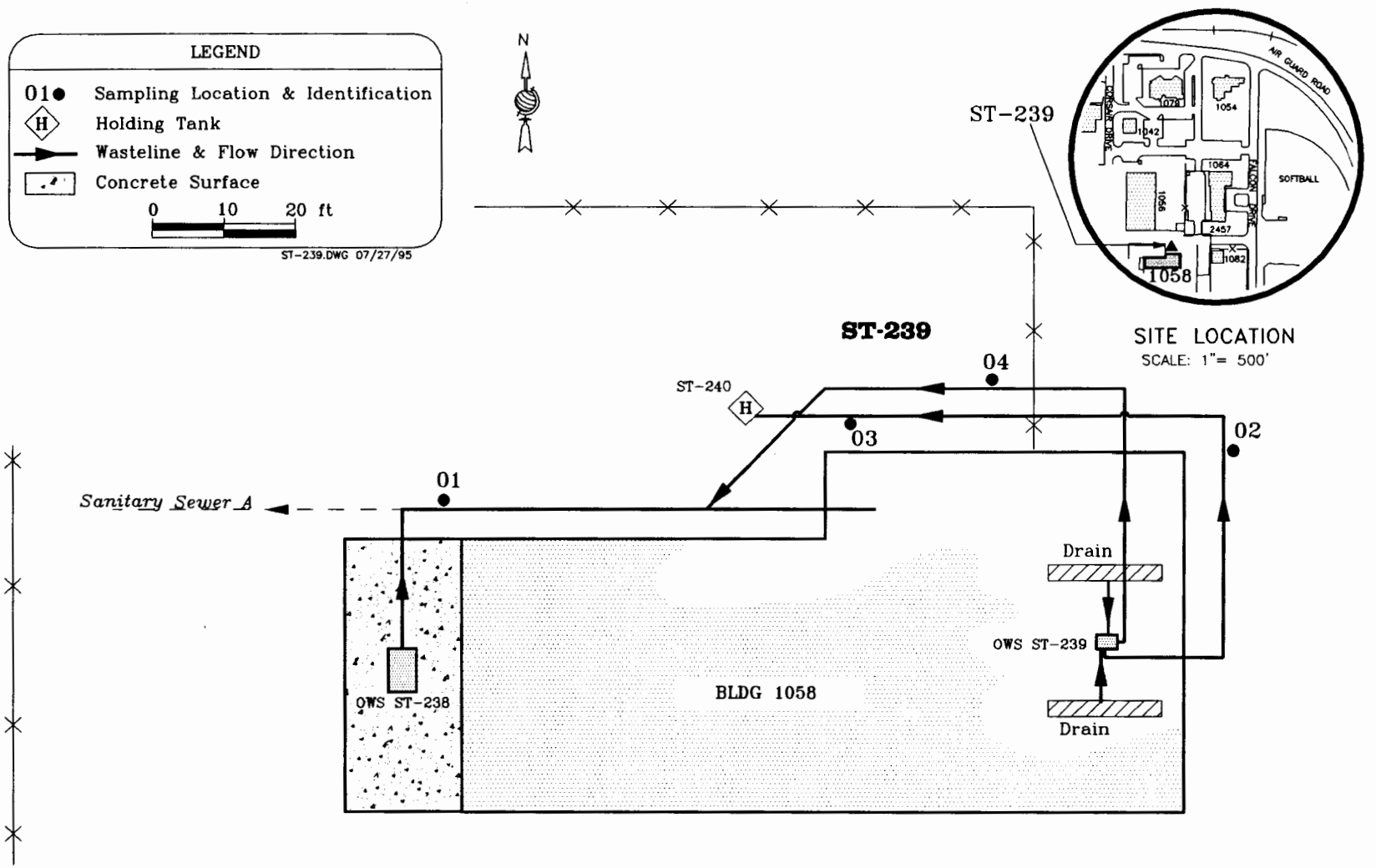


Figure 5-20. Soil Sampling Locations at SWMU 10-7, Building 1058, OWS Lines (ST-239)

5.28.2.2 Data Gaps

Prior to the Appendix III RFI, no data were available that indicated contaminants were released from the ST-239 wastelines.

5.28.2.3 RFI Field Investigation

The objective of the investigation was to determine if contamination exists in the adjacent soil. Location of the outflow lines and sample borehole designation was completed prior to startup of the soil sampling effort. The soil investigation was limited to the shallow subsurface.

Analytical results from samples collected during Stage 2B RFI activities were used to characterize the soil adjacent to the inflow and outflow lines within a 50-ft radius of ST-239. Based on engineering drawings, the inflow sources to ST-239 include two inside drains, each 10 ft north and south of the unit. Outflow of oil-phase liquid is discharged through a buried pipe that exits the OWS to the east, angles north to the northeast corner of the building where it angles 90 degrees west, and extends to holding tank ST-240. Water-phase liquid is discharged through a separate buried line that extends north from ST-239 until it ties into the east-west oriented sanitary sewer lateral that runs along the north side of the building. Subsurface line locations were confirmed using methods described in Section 3.0.

On December 19, 1994, four boreholes were sampled using the Geoprobe. The sample interval at each borehole location extended from the depth of the line to 5 ft below the line. From this interval, two samples were collected from each borehole: one at a depth equal to the base of the line, the other from 3 ft below the base of the line. Both samples were field-screened with a FID organic vapor meter and only the sample with the highest FID reading was submitted to the laboratory for analysis. If no FID readings were detected, the sample collected at the depth closest to the base of the line was submitted for analysis. Along the lines serving ST-239 and ST-240, four soil samples were collected and submitted for laboratory analysis during the Appendix III RFI.

Because of the close proximity of ST-238, ST-239, and ST-240, analytical results from ST-238-01, collected during the Stage 2B RFI, were used as background concentration data for samples collected at ST-239 during Appendix III RFI activities.

Sampling operations and sample handling procedures are described in Section 3.0. Sample depths, sample locations, and replicate samples collected during the Appendix III RFI are listed in Table 5-34. Soil boring logs for the boreholes drilled and sampled at ST-239 are in Appendix C.

Table 5-34. Boreholes and Samples Analyzed from SWMU 10-7, Building 1058, OWS Lines (ST-239)

Borehole	Borehole Location	Sample Depths (ft)
01	17.5 ft E and 4.3 ft N of NW corner of Building 1058	3-5
02	6 ft E and 1.5 ft N of NE corner of Building 1058	2-4
03	51.5 ft W and 1.2 ft N of borehole 01	3-5
04	26.6 ft W and 9.2 ft N of NE corner of Building 1058	2-4

5.28.2.4 Laboratory Analysis

The samples were analyzed for VOCs, SVOCs, TPH, metals, mercury (the potential contaminants associated with normal operations at this site), soil pH, and soil moisture. The four brass tubes in each 2-ft sample interval were field-screened for possible contamination using a beta-gamma meter and a FID. All field-screening instrument readings remained at background levels throughout Appendix III RFI sampling activities at ST-239.

ST-238-01, collected during Stage 2B RFI, was used as a background sample during the investigation of the inflow and outflow lines at ST-239. The soil sampling and analysis at the background hole included analyses for TPH, VOCs, SVOCs, metals, soil pH, and soil moisture.

5.28.3 Site Characteristics

5.28.3.1 Geology

The Building 1058 area is underlain by unconsolidated alluvial sediment that is predominantly fine-grained sand and very fine-grained to fine-grained silty sand. Four boreholes were drilled at Building 1058. A maximum depth of 8 ft below grade was attained at borehole ST-239C-01. No borehole penetrated into the Santa Fe Group sediments that presumably underlie this area. A discussion of the general geology at Kirtland AFB is presented in Section 2.4.

As a result of ST-239 line installation, it is probable that backfill material is present adjacent to each line to a depth equal to the total depth of each line. Borehole logs for these sites are presented in Appendix C.

5.28.3.2 Hydrogeology

Groundwater beneath Building 1058 is found within the Upper Santa Fe sediments and is generally thought to be unconfined in the upper portion of the aquifer. This area is within the HR1 saturated zone setting as defined by SNL studies (Figure 2-9) (SNL, 1994). Hydrogeologic characterization in this portion of Kirtland AFB is complicated by the presence of numerous production wells (Figure 2-11). It is probable that uniform groundwater conditions do not exist in this region. Local cones of depression associated with groundwater withdrawal have altered the groundwater flow direction in the vicinity of the well fields (Figure 2-7).

The gradient is probably north at this site. Two production wells are in this area: KAFB-1 is cross-gradient 4200 ft east and KAFB-7 is 2,400 ft south-southeast (Figures 2-7 and 2-11). Depth to groundwater is estimated to be approximately 350 ft below grade; however, shallower perched water zones may occur (Figure 2-10). Hydraulic conductivity in the vicinity of HR1 is estimated at 2 to 171 ft/day (SNL, 1994). A more detailed discussion of the hydrogeology at Kirtland AFB is presented in Section 2.5.

5.28.4 Nature and Extent of Contamination

The following sections describe the nature and extent of contamination based on the analytical results. Analytical results for ST-239 are presented in Table 5-35, where only the reportable concentrations are listed. Full analytical results are presented in Appendix F and laboratory validation reports are presented in Appendix K.

Organic Compounds

There were no VOC or SVOC analytes detected in any of the soil samples collected at ST-239.

Petroleum Hydrocarbons

No petroleum hydrocarbons were detected in any of the soil samples collected at ST-239.

Metals

Table 5-35 lists all reportable metal concentrations detected at ST-239 and the respective UTL and HHRB action level concentrations. Arsenic (0.75 to 3.8 mg/kg) was detected in all soil samples above the HHRB action level of 0.37 mg/kg, but below the UTL of 6.5 mg/kg. Beryllium (0.33 mg/kg) was detected in one sample; this concentration may be naturally occurring at Kirtland AFB.

5.28.4.4 Soil pH and Moisture

Soil pH ranged from 8.3 to 8.6 in these samples. Soil moisture values ranged from 5 to 11.3 percent.

Table 5-35. Summary of Reportable Concentrations for Soil Analyses at SWMU 10-7, Building 1058, OWS Lines (ST-239)[1]
(Concentrations mg/kg)

Chemical Class	Analyte	HHRB Action Level[2]	PQL UTL	Borehole Number and Sample Depth Interval (ft)			
				ST239C-01 3–5	*ST239C-02* 2–4	*ST239C-03* 3–5	*ST239C-04* 2–4
METALS	Aluminum	78,000	14,700	4,340	2,970	5,970	3,470
	Arsenic	0.37	6.5	0.75	2.5	3.8	2.1
	Barium	5,500	735	76.4	77.3	191	119
	Beryllium	0.15	0.84	ND	ND	0.33	ND
	Calcium	N/A	121,000	21,400	52,100	54,700	67,600
	Chromium, total	390	21.6	3.6	3.2	4.8	3.2
	Cobalt	4,700	15.4	5.1	1.4	4.3	1.7
	Copper	2,900	223	32.9	9.7	29.5	51.6
	Iron	N/A	23,800	9,860	3,590	9,310	4,120
	Lead	400	17.5	2.7	2.6	4.4	2.4
	Magnesium	N/A	10,400	3,700	2,040	5,320	2,960
	Manganese	390	549	196	42.2	152	44.9
	Nickel	1,600	188	2.9	2.5	8.2	2.8
	Potassium	N/A	3,590	1,630	408	786	435
	Sodium	N/A	787	117	53.6	114	58.9
	Vanadium	550	55.3	18.7	10.4	24.2	13.2
	Zinc	23,000	114	33.6	12.1	24.5	24.7
OTHER	pH			8.3	8.4	8.5	8.6
	Moisture (%)			5.0	11.3	10.1	10.6

FOOTNOTES

1	Complete laboratory analytical results and method detection limits are presented in Appendix K.
2	Action level of RCRA Proposed Rule Subpart S (55 FR 30814, 7/27/90).
*	TPH action level is 100 mg/kg adopted from NMED UST regulations (NMED, 1990). SW-8015 analyzes volatile and semivolatile petroleum hydrocarbon fractions separately. The total concentration of the two fractions analyzed under SW-8015 will be used to assess compliance with stipulated action levels for the purpose of this RFI.
#	Denotes TCLP analysis, results in mg/l.
--	No Data.
FR	Field Replicate.
HHRB	Human health risk based.
J	Estimated value.
N/A	Not Applicable.
NA	Not Analyzed.
ND	Not detected above the method detection limit.
pCi/g	picocuries per gram.
PQL	Practical quantitation limits (defines VOC, SVOC, and TPH).
R	Reject NDs due to interference.
RAD	Radionuclides.
RE	Resample.
SVOC	Semivolatile organic compounds.
TPH	Total petroleum hydrocarbons.
U	Accept data (positive results may be influenced by lab contamination).
UJ	Estimated nondetect.
UTL	Upper tolerance limits (defines metals).
VOC	Volatile organic compounds.

5.28.5 Conclusions and Recommendations

Conclusions

- No VOCs or SVOCs were detected in the soil samples collected from this site.
- No gasoline or diesel range hydrocarbons were detected in the soil samples collected from this site.
- Arsenic and beryllium were the only metals detected at concentrations exceeding the HHRB action level; these concentrations appear to be naturally occurring throughout Kirtland AFB.
- The analytical results at ST-236 are not indicative of a contaminant release from this site.

Recommendations

- Based on the findings of the RFI, no further action is necessary; therefore, ST-236 does not require further investigation. A No Further Action proposal should be prepared.

5.29 SWMU 10-7, Building 1058, Holding Tank Lines (ST-240)

5.29.1 Site Background and Environmental Setting

ST-240 is 17 ft north of Building 1058, the NMANG Vehicle Maintenance shop. According to engineering drawings, the oil-phase flows to ST-240 from OWS ST-239, 50 ft southeast in the building. Drainage flows to ST-239 from service bays inside the building. ST-240 has no discharge line. ST-240 and associated lines are shown on Figure 5-20.

ST-240 is in the urban/industrial zone. The nearest production wells to this site are KAFB-1, 4,000 ft east, and KAFB-7, 2,400 ft south-southeast.

5.29.2 Study Area Investigation

5.29.2.1 Previous Investigations

During the Stage 2B RFI, subsurface soil samples were collected from the perimeter of holding tank ST-240. Analytical results did not indicate that contaminants were released at the site.

5.29.2.2 Data Gaps

Prior to the Appendix III RFI, no data were available that indicated whether a release of contaminants occurred from the inflow line of ST-240.

5.29.2.3 RFI Field Investigation

Line location activities were performed as described in Section 3.0. Because of the close proximity of ST-239, ST-240, and the wastelines associated with these units, samples collected at the sites during the Stage 2B RFI and during the Appendix III RFI adequately characterize soil conditions surrounding the inflow and outflow lines at ST-240.

5.29.3 Conclusions and Recommendations

Conclusions

- The analytical results from the Stage 2B RFI are not indicative of a release from this unit.
- The analytical results from the Appendix III RFI soil sampling of ST-239 wastelines are not indicative of a release from this site.

Recommendations

- Based on the findings of the RFI, no further action is necessary; therefore, ST-240 does not require further investigation. A No Further Action proposal should be prepared.

5.30 SWMU 10-7, Building 1061, OWS Lines (ST-241)

5.30.1 Site Background and Environmental Setting

ST-241 is near the south side of Building 1061, the NMANG Propulsion Branch shop. The general location of the unit and its associated lines are shown on Figure 5-21. Based on engineering drawings, the inflow sources to ST-241 include area drains within the building; the outflow line runs 25 ft west and 150 ft north and discharges into sanitary sewer A (ST-278).

The lines serving this unit are in the urban/industrial zone. The nearest production wells to these sites are KAFB-1, 4,400 ft east, and KAFB-7, 2,800 ft south-southeast.

5.30.2 Study Area Investigation

5.30.2.1 Previous Investigations

During the Stage 2B RFI, subsurface soil samples were collected from around the perimeter of OWS ST-241. Analytical results from the Stage 2B RFI did not indicate that a release of contaminants had occurred at the site.

5.30.2.2 Data Gaps

Prior to the Appendix III RFI, no data were available that indicated whether a release of contaminants occurred from the ST-241 wastelines.

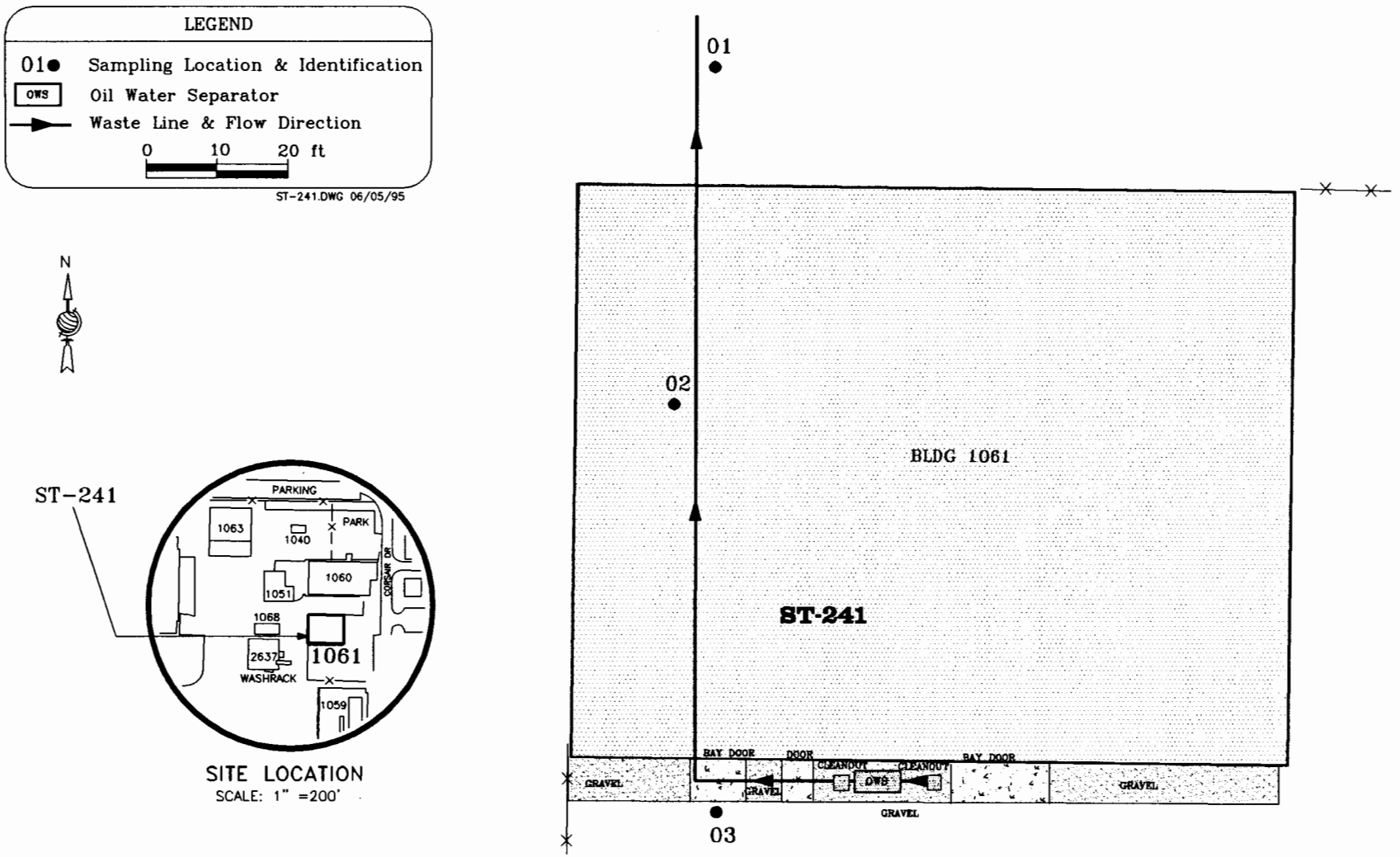


Figure 5-21. Soil Sampling Locations at SWMU 10-7, Building 1061, OWS Lines (ST-241)

5.30.2.3 RFI Field Investigation

The objective of the investigation was to determine if contamination exists in the adjacent soil and to determine the location of the lines. Location of the outflow lines and sample borehole designation were completed prior to startup of the soil sampling effort. Subsurface line locations were confirmed using methods described in Section 3.0. The soil investigation was limited to the near surface vadose zone.

Analytical results from samples collected during Stage 2B RFI were used to characterize the soil adjacent to the inflow and outflow lines within a 50-ft radius of ST-241. Based on engineering drawings, the inflow line to this unit conveys drainage from the floor drains in the building; discharge is west and north to the sanitary sewer.

On January 18, 1995, three boreholes were sampled using a Geoprobe. The sample interval at each borehole location extended from the depth of the line to 5 ft below the line. From this interval, two samples were collected from each borehole: one at a depth equal to the base of the line, the other from 3 ft below the base of the line. Both samples were field-screened with a FID organic vapor meter and only the sample with the highest FID reading was submitted to the laboratory for analysis. If no FID readings were detected, the sample collected at the depth closest to the base of the line was submitted for analysis. Along the lines serving ST-241, four soil samples, including one replicate sample, were collected and submitted for laboratory analysis during the Appendix III RFI.

The analytical results from ST-241-01, collected during the Stage 2B RFI were used as background concentration data for samples collected at ST-241 during the Appendix III RFI.

Sampling operations and sample handling procedures are described in Section 3.0. Sample depths, sample locations, and replicate sample collected during the Appendix III RFI are listed in Table 5-36. Soil boring logs for the boreholes drilled and sampled at ST-241 are in Appendix C.

Table 5-36. Boreholes and Samples Analyzed from SWMU 10-7, Building 1061, OWS Lines (ST-241)

Borehole	Borehole Location	Sample Depths (ft)
01	18.5 ft E and 16.5 ft N of NW corner of Building 1061	3-5
02	Inside, 5.5 ft W and 47.5 ft S of borehole 01	2-7[a]
03	14 ft E and 7.5 ft S of SW corner of Building 1061	1-3

a. Replicate sample also collected at this interval.

5.30.2.4 Laboratory Analysis

The soil samples were analyzed for VOCs, SVOCs, TPH, metals, mercury (the potential contaminants associated with normal operations at this site), soil pH, and soil moisture. The four brass tubes in each 2-ft sample interval were field-screened for possible contamination using a beta-gamma meter and a FID. All field-screening instrument readings remained at background levels throughout Appendix III RFI sampling activities at ST-241.

ST-241-01, collected during the Stage 2B RFI, was used as a background sample during the investigation of the inflow and outflow lines at ST-241. The soil sampling and analysis at the background hole included analyses for TPH, VOCs, SVOCs, metals, soil pH, and soil moisture.

5.30.3 Site Characteristics

5.30.3.1 Geology

The Building 1061 area is underlain by unconsolidated alluvial sediment that is predominantly silty sand to very fine-grained to fine-grained sand and gravelly sand. Caliche was present in the background borehole and ST-241C-01 as lightly to heavily stained zones and patches. Three 10-ft deep boreholes were drilled at ST-241. No boreholes penetrated into the Santa Fe Group sediments that presumably underlie this area. A discussion of the general geology at Kirtland AFB is presented in Section 2.4.

As a result of ST-241 line installation, it is probable that backfill material is present adjacent to each line to a depth equal to the line's total depth. Borehole logs for this area are presented in Appendix C.

5.30.3.2 Hydrogeology

Groundwater beneath ST-241 is found within the Upper Santa Fe sediments and is generally thought to be unconfined in the upper portion of the aquifer. This area is within the HR1 saturated zone setting as defined by SNL studies (Figure 2-9) (SNL, 1994). Hydrogeologic characterization in this portion of Kirtland AFB is complicated by the presence of numerous production wells (Figure 2-11). It is probable that uniform groundwater conditions do not exist in this region. Local cones of depression associated with groundwater withdrawal have altered the groundwater flow direction in the vicinity of the well fields (Figure 2-7).

The gradient is probably north at this site. Two production wells are in this area: KAFB-1 is cross-gradient 4,400 ft east and KAFB-7 is upgradient 2,800 ft south-southeast (Figures 2-7 and 2-11). Depth to groundwater is estimated to be approximately 350 ft below grade; however, shallower perched water zones may occur (Figure 2-10). Hydraulic conductivity within HR1 is estimated to range from 2 to 171 ft/day (SNL, 1994). A general discussion of the hydrogeology at Kirtland AFB is in Section 2.5.

5.30.4 Nature and Extent of Contamination

The following sections describe the nature and extent of contamination based on the analytical results. Analytical results for ST-241 are presented in Table 5-37, where only the reportable concentrations are listed. Full analytical results are presented in Appendix F and laboratory validation reports are presented in Appendix K.

Table 5-37. Summary of Reportable Concentrations for Soil Analyses at SWMU 10-7, Building 1061, OWS Lines (ST-241)[1]
(Concentrations mg/kg)

Chemical Class	Analyte	HHRB Action Level[2]	PQL UTL	Borehole Number and Sample Depth Interval (ft)			
				ST241C-01	*ST241C-02*		*ST241C-03*
				3–5	2–7 FR	2–7	1–3
METALS	Aluminum	78,000	14,700	3,860	6,730	6,290	5,200
	Arsenic	0.37	6.5	0.79	2.7	2.8	4.4
	Barium	5,500	735	93.9	36.7	39.3	139
	Beryllium	0.15	0.84	ND	0.42	0.31	ND
	Calcium	N/A	121,000	24,100	11,600	8,410	34,000
	Chromium, total	390	21.6	4.4	8.3	5.4	4.5
	Cobalt	4,700	15.4	4.5	5.1	4.6	5.1
	Copper	2,900	223	22.5	19.0	21.3	19.1
	Iron	N/A	23,800	11,900	11,000	10,400	10,100
	Lead	400	17.5	2.9	5.9	4.5	4.2
	Magnesium	N/A	10,400	2,770	4,270	3,640	4,690
	Manganese	390	549	121	210	177	166
	Nickel	1,600	188	4.0	6.5	4.9	2.7
	Potassium	N/A	3,590	773	1,040	1,080	494
	Sodium	N/A	787	267	517	453	65.8
	Vanadium	550	55.3	25.2	22.3	20.8	30.8
	Zinc	23,000	114	24.7	29.6	28.0	22.8
OTHER	pH			7.8	8.6	8.3	8.2
	Moisture (%)			3.0	5.5	4.7	10.4

FOOTNOTES

1	Complete laboratory analytical results and method detection limits are presented in Appendix K.
2	Action level of RCRA Proposed Rule Subpart S (55 FR 30814, 7/27/90).
*	TPH action level is 100 mg/kg adopted from NMED UST regulations (NMED, 1990). SW-8015 analyzes volatile and semivolatile petroleum hydrocarbon fractions separately. The total concentration of the two fractions analyzed under SW-8015 will be used to assess compliance with stipulated action levels for the purpose of this RFI.
#	Denotes TCLP analysis, results in mg/l.
--	No Data.
FR	Field Replicate.
HHRB	Human health risk based.
J	Estimated value.
N/A	Not Applicable.
NA	Not Analyzed.
ND	Not detected above the method detection limit.
pCi/g	picocuries per gram.
PQL	Practical quantitation limits (defines VOC, SVOC, and TPH).
R	Reject NDs due to interference.
RAD	Radionuclides.
RE	Resample.
SVOC	Semivolatile organic compounds.
TPH	Total petroleum hydrocarbons.
U	Accept data (positive results may be influenced by lab contamination).
UJ	Estimated nondetect.
UTL	Upper tolerance limits (defines metals).
VOC	Volatile organic compounds.

Organic Compounds

There were no VOC or SVOC analytes detected in the soil samples collected at ST-241.

Petroleum Hydrocarbons

No petroleum hydrocarbons were detected in the soil samples collected at ST-241.

Metals

Table 5-37 lists all reportable metal concentrations detected at ST-241 and the respective UTL and HHRB action level concentrations. Arsenic (0.79 to 4.4 mg/kg) was detected in all soil samples above the HHRB action level of 0.37 mg/kg; the concentrations were below the UTL of 6.5 mg/kg. Beryllium concentrations ranged from ND to 0.42 mg/kg. These concentrations are above the HHRB action level of 1.15 mg/kg, but are below the 0.84 mg/kg UTL. These arsenic and beryllium concentrations may be naturally occurring at Kirtland AFB as discussed in Section 4.2.2.

Soil pH and Moisture

Soil pH ranged from 7.8 to 8.6 in these samples. Soil moisture values ranged from 3.0 to 10.4 percent (Table 5-37).

5.30.5 Conclusions and Recommendations

Conclusions

- No VOCs or SVOCs were detected in the soil samples collected from this site.
- No gasoline or diesel range hydrocarbons were detected in soil samples from this site.
- Arsenic and beryllium were the only metals detected at concentrations exceeding the HHRB action level; these concentrations appear to be naturally occurring throughout Kirtland AFB.
- The analytical results at ST-241 are not indicative of a contaminant release from this site.

Recommendations

- Based on the findings of the RFI, no further action is necessary; therefore, ST-241 does not require further investigation. A No Further Action proposal should be prepared.

5.31 SWMU 8-26, Building 1063, OWS Lines (ST-242)

5.31.1 Site Background and Environmental Setting

ST-242 is near the south side of Building 1063, NMANG Corrosion Control and Fuel Management Operations shop. The general location of the unit and its associated lines are shown on Figure 5-22. Inflow line sources to ST-242 include building floor drains; outflow discharges 6 ft west into ST-243 and then to a sanitary sewer lateral.

The lines serving this site are in the urban/industrial zone. Four production wells are near this site: KAFB-7, 3,200 ft south-southeast; KAFB-2, 3,700 ft south-southwest; KAFB-1, 4,500 ft east; and KAFB-3, 6,500 ft north-northeast.

5.31.2 Study Area Investigation

5.31.2.1 Previous Investigations

During the Stage 2B RFI, subsurface soil samples were collected from the perimeter of OWS ST-242. Analytical results did not indicate a release from this unit. These results are presented in the Stage 2B RFI Report (USAF, 1995).

5.31.2.2 Data Gaps

Prior to the Appendix III RFI, no data were available to determine if a release occurred from the ST-242 wastelines.

5.31.2.3 RFI Field Investigation

The objective of the investigation was to determine the presence or absence of contamination in soil adjacent to the wastelines. Line location and sample borehole designations were completed prior to the soil sampling effort. The soil investigation was limited to the shallow subsurface.

Analytical results from soil samples collected during the Stage 2B RFI were used to characterize the soil adjacent to the OWS inflow and outflow lines within a 50-ft length of ST-242. Based on engineering drawings, the inflow lines to ST-242 convey drainage from the floor drains in Building 1063. Discharge is 6 ft west to OWS ST-243. Subsurface line locations were determined using methods described in Section 3.0.

On January 24, 1995, three boreholes were sampled using a Geoprobe. The sample interval at each borehole location was from the base of the line to 5 ft below the line. From this interval, two samples were collected from each borehole: one at a depth equal to the base of the line, the other from 3 ft below the base of the line. Both samples were field-screened with a FID organic vapor meter and only the sample with the highest FID reading was submitted to the laboratory for analysis. If no elevated FID readings were detected, the sample collected at the depth closest to the base of the line was submitted for analysis. Along the lines serving ST-242, three soil samples were collected and submitted for laboratory analysis during the Appendix III RFI.

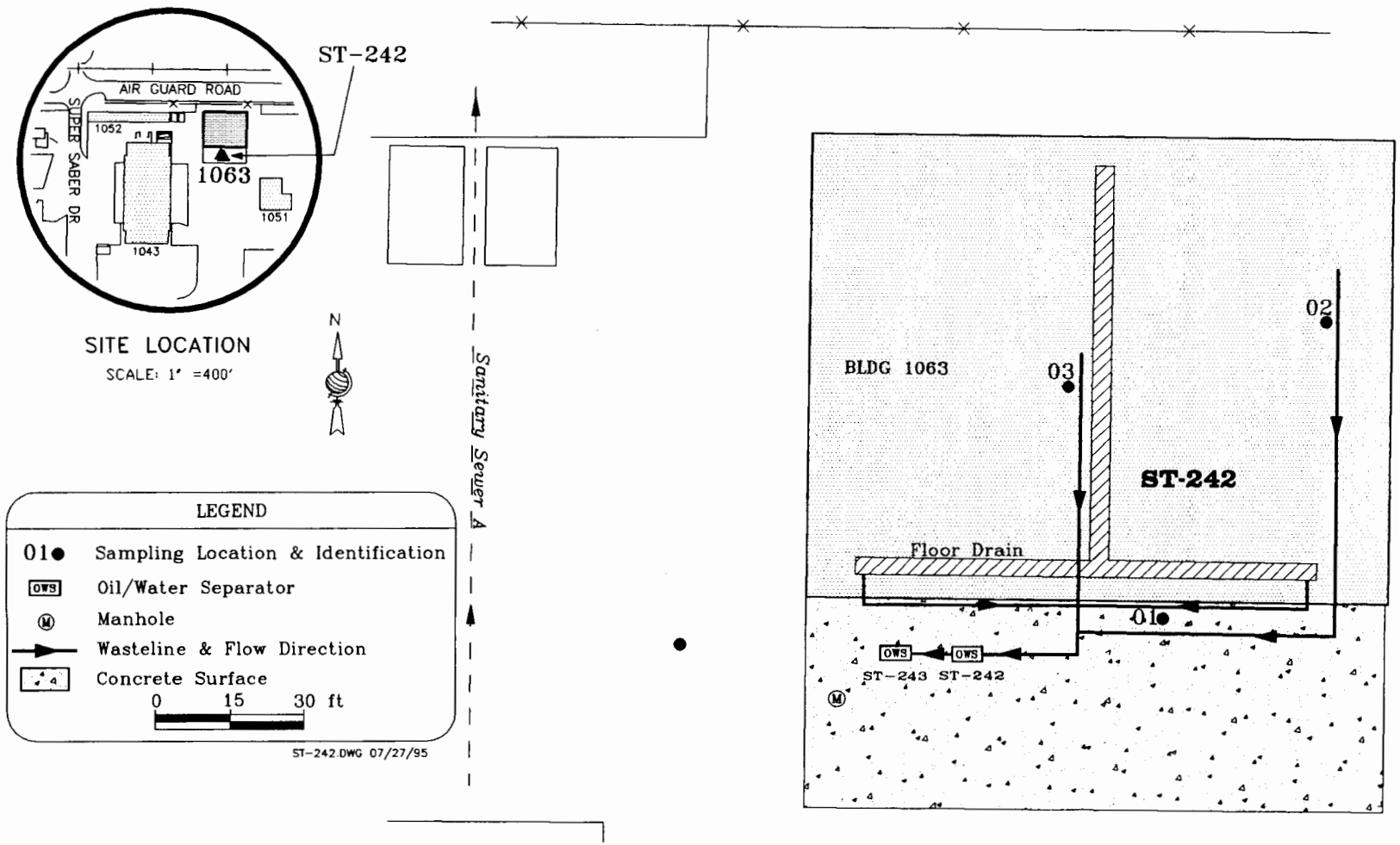


Figure 5-22. Soil Sampling Locations at SWMU 8-26, Building 1063, OWS Lines (ST-242)

Because of the proximity of ST-243, analytical results from borehole ST-243-01, collected during the Stage 2B RFI, were used as background concentration data for samples collected at ST-242 during the Appendix III RFI.

Sampling operations and sample handling procedures are described in Section 3.0. Borehole locations, and samples submitted for analysis during the Appendix III RFI are listed in Table 5-38. Corresponding soil boring logs for the boreholes drilled and sampled at ST-242 are in Appendix C.

Table 5-38. Boreholes and Samples Analyzed from SWMU 8-26, Building 1063, OWS Lines (ST-242)

Borehole	Borehole Location	Sample Depths (ft)
01	38.5 ft W and 4.5 S of SE corner of Building 1063	2-4
02	Inside, 10 ft W and 36 ft S of NE corner of Building 1063	1-3
03	49.5 ft W and 15 ft S of borehole 02	2-6

5.31.2.4 Laboratory Analysis

Soil samples were analyzed for VOCs, SVOCs, TPH, metals, mercury (the potential contaminants associated with normal operations at this site), soil pH, and soil moisture. The four brass tubes in each 2-ft sample interval were field-screened for possible contamination using a beta-gamma meter and a FID. All field-screening instrument readings remained at background levels throughout the ST-242 drilling and sampling activities.

ST-243-01, collected during Stage 2B RFI, was used as a background sample during the investigation of the wastelines at ST-242. Sample analysis for ST-243-01 included analyses for TPH, VOCs, SVOCs, metals, soil pH, and soil moisture.

5.31.3 Site Characteristics

5.31.3.1 Geology

Building 1063 is underlain by unconsolidated alluvial sediment that is predominantly fine-grained sand and very fine-grained to fine-grained silty sand. Three boreholes were drilled and sampled and a maximum depth of 8 ft below grade was attained in borehole ST-242C-03. No boreholes penetrated into the Santa Fe Group sediments that presumably underlie this area. A discussion of the general geology at Kirtland AFB is presented in Section 2.4.

As a result of line installation, it is probable that backfill material is present adjacent to each line to a depth at least equal to the total depth of the line. Borehole logs for this area are presented in Appendix C.

5.31.3.2 Hydrogeology

Groundwater beneath Building 1063 is found within the Upper Santa Fe sediments and is generally thought to be unconfined in the upper portion of the aquifer. This area is within the HR1 saturated zone setting as defined by SNL studies (Figure 2-9) (SNL, 1994). Hydrogeologic characterization in this portion of Kirtland AFB is complicated by the presence of numerous production wells (Figure 2-11). It is probable that uniform groundwater conditions do not exist in this region. Local cones of depression associated with groundwater withdrawal have altered the groundwater flow direction in the vicinity of the well fields (Figure 2-7).

The gradient is probably north at this site. Four production wells are near this site: KAFB-7 is 3,200 ft south-southeast and KAFB-2 is 3,700 ft south-southwest upgradient; KAFB-1 is 4,500 ft east cross-gradient and KAFB-3 is 6,500 ft north-northeast downgradient (Figures 2-7 and 2-11). Depth to groundwater is estimated to be approximately 350 ft below grade; however, shallower perched water zones may occur (Figure 2-10). Hydraulic conductivity within HR1 is estimated at 2 to 171 ft/day (SNL, 1994). A general discussion of the hydrogeology at Kirtland AFB is presented in Section 2.5

5.31.4 Nature and Extent of Contamination

The following section describes the nature and extent of contamination based on the analytical results for soil samples submitted for analysis from ST-242. Analytical results are summarized in Table 5-39, where only the reportable concentrations are listed. Full analytical results are presented in Appendix F and laboratory validation reports are presented in Appendix K.

Organic Compounds

Methylene chloride was the only VOC analyte detected in soil samples submitted for analysis at ST-242. It was detected in two of the three samples. The detected concentrations of 0.006 mg/kg do not exceed the HHRB action level of 85 mg/kg (Table 5-39). Methylene chloride was also detected in associated QC samples and is believed to be the result of laboratory contamination as discussed in Section 3.5.1.

The SVOC analyte di-n-butylphthalate was detected in one of the soil samples collected at ST-242. The concentration of 0.63 mg/kg was below the HHRB action level of 7,800 mg/kg (Table 5-39).

Petroleum Hydrocarbons

Diesel range hydrocarbons were detected in all three soil samples collected at ST-242 at concentrations ranging from 4.7 to 12 mg/kg. The concentrations did not exceed the NMED action level of 100 mg/kg (Table 5-39). Gasoline range hydrocarbons were not detected at this site.

Table 5-39. Summary of Reportable Concentrations for Soil Analyses at SWMU 8-26, Building 1063, OWS Lines (ST-242)[1]
(Concentrations mg/kg)

Chemical Class	Analyte	HHRB Action Level[2]	PQL UTL	Borehole Number and Sample Depth Interval (ft)		
				ST242C-01	*ST242C-02*	*ST242C-03*
				2–4	1–3	2–6
VOC	Methylene chloride	85.0	0.005	0.006	0.006	ND
SVOC	Di-n-butylphthalate	7,800	0.70	ND	ND	0.63
TPH	Diesel fraction	100	10.0	7.5	4.7	12.0
METALS	Aluminum	78,000	14,700	7,070	6,830	6,290
	Arsenic	0.37	6.5	4.0	3.2	5.1
	Barium	5,500	735	271	200	381
	Beryllium	0.15	0.84	0.34	0.33	ND
	Cadmium	39.0	N/A	ND	ND	5.4
	Calcium	N/A	121,000	129,000	60,900	155,000
	Chromium, total	390	21.6	7.0	5.3	7.8
	Cobalt	4,700	15.4	4.4	4.0	2.8
	Copper	2,900	223	10.0	18.2	53.1
	Iron	N/A	23,800	7,540	9,170	6,320
	Lead	400	17.5	2.9	5.4	4.7
	Magnesium	N/A	10,400	8,580	3,960	6,250
	Manganese	390	549	111	145	131
	Mercury	23.0	N/A	ND	0.12	ND
	Nickel	1,600	188	4.7	5.3	3.7
	Potassium	N/A	3,590	730	1,300	830
	Sodium	N/A	787	138	181	131
	Vanadium	550	55.3	29.4	23.3	20.5
	Zinc	23,000	114	17.2	31.5	34.4
OTHER	pH			8.9	8.2	8.6
	Moisture (%)			11.1	9.8	18.6

FOOTNOTES

1	Complete laboratory analytical results and method detection limits are presented in Appendix K.
2	Action level of RCRA Proposed Rule Subpart S (55 FR 30814, 7/27/90).
*	TPH action level is 100 mg/kg adopted from NMED UST regulations (NMED, 1990). SW-8015 analyzes volatile and semivolatile petroleum hydrocarbon fractions separately. The total concentration of the two fractions analyzed under SW-8015 will be used to assess compliance with stipulated action levels for the purpose of this RFI.
#	Denotes TCLP analysis, results in mg/l.
--	No Data.
FR	Field Replicate.
HHRB	Human health risk based.
J	Estimated value.
N/A	Not Applicable.
NA	Not Analyzed.
ND	Not detected above the method detection limit.
pCi/g	picocuries per gram.
PQL	Practical quantitation limits (defines VOC, SVOC, and TPH).
R	Reject NDs due to interference.
RAD	Radionuclides.
RE	Resample.
SVOC	Semivolatile organic compounds.
TPH	Total petroleum hydrocarbons.
U	Accept data (positive results may be influenced by lab contamination).
UJ	Estimated nondetect.
UTL	Upper tolerance limits (defines metals).
VOC	Volatile organic compounds.

Metals

Table 5-39 lists all metal concentrations detected at ST-242 and the respective UTL and HHRB action level concentrations. Arsenic was detected in all soil samples at concentrations ranging from 3.2 to 5.1 mg/kg, exceeding the HHRB action level of 0.37 mg/kg, but below the 6.5 mg/kg UTL. Beryllium was detected in two samples at concentrations (0.33 and 0.34 mg/kg) exceeding the HHRB action level of 0.15 mg/kg, but below the 0.84 mg/kg UTL. These concentrations of arsenic and beryllium appear to be naturally occurring throughout Kirtland AFB as discussed in Section 4.2.2.

Soil pH and Moisture

Soil pH ranged from 8.2 to 8.9 in these samples. Soil moisture values ranged from 9.8 to 18.6 percent (Table 5-39).

5.31.5 Conclusions and Recommendations

Conclusions

- One VOC and one SVOC were detected in the soil samples submitted from this site; all concentrations were below HHRB action levels.
- No gasoline range hydrocarbons were detected from ST-242. Diesel range hydrocarbons were detected in all samples at concentrations below the NMED action level. TPH concentrations from 4.7 to 12 mg/kg measured in three samples at this site were similar to those measured in background samples collected during the Appendix III RFI. The TPH detections alone are not conclusive evidence of a release from this unit. Because no other release components (such as VOCs, SVOCs, or metals) are present, it is probable that a release has not occurred.
- Arsenic and beryllium were the only metals detected at concentrations exceeding the HHRB action level; these concentrations appear to be naturally occurring throughout Kirtland AFB.
- The analytical results at ST-242 are not indicative of a release from this site.

Recommendations

- Based on the findings of the RFI, no further action is necessary; therefore, ST-242 does not require further investigation. A No Further Action proposal should be prepared.

5.32 SWMU 8-26, Building 1063, OWS Lines (ST-243)

5.32.1 Site Background and Environmental Setting

ST-243 is near the south side of Building 1063, the NMANG Corrosion Control and Fuel Management Operations shop. The general location of the unit and its associated lines are shown on Figure 5-23. The inflow line source to ST-243 is from OWS ST-242, 6 ft east, and outflow is discharged to sanitary sewer A (ST-278), 90 ft west.

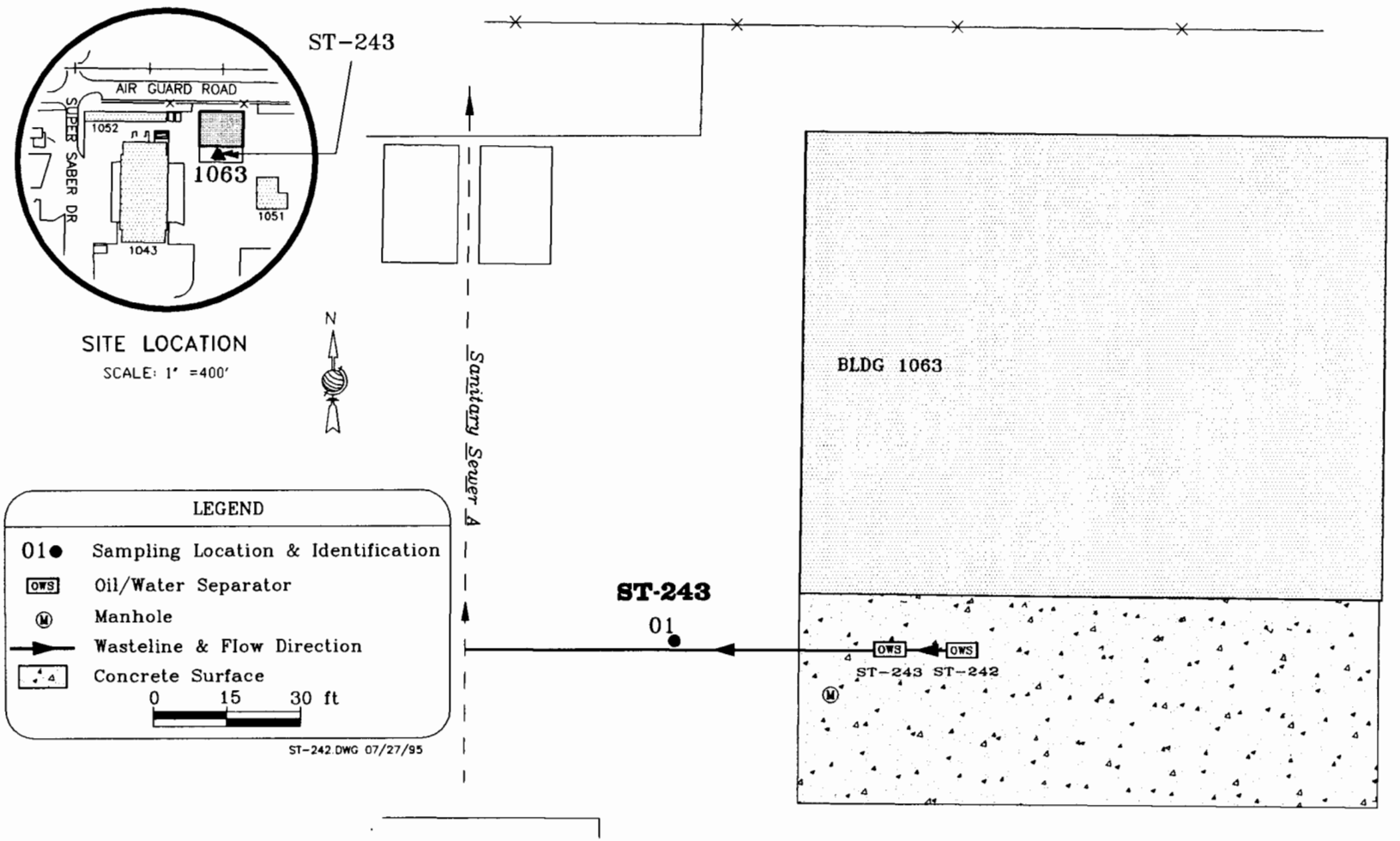


Figure 5-23. Soil Sampling Locations at SWMU 8-26, Building 1063, OWS Lines (ST-243)

The lines serving this site are in the urban/industrial zone. The nearest production wells to this site are KAFB-7, 3,200 ft south-southeast; KAFB-2, 3,700 ft south-southwest; KAFB-1, 4,500 ft east; and KAFB-3, 6,500 ft north-northeast.

5.32.2 Study Area Investigation

5.32.2.1 Previous Investigations

During the Stage 2B RFI, subsurface soil samples were collected from the perimeter of OWS ST-243. Analytical results were not indicative of a release from this unit.

5.32.2.2 Data Gaps

Prior to the Appendix III RFI, no data were available to determine if a release of contaminants occurred from the ST-243 wastelines.

5.32.2.3 RFI Field Investigation

The objective of the investigation was to determine the presence or absence of contamination adjacent to the wastelines. Line location and sample borehole designations were completed prior to the soil sampling effort. The soil investigation was limited to the shallow subsurface.

Analytical results from soil samples collected during the Stage 2B RFI were used to characterize the soil adjacent to the OWS inflow and outflow lines within a 50-ft length of ST-243. Based on engineering drawings, the inflow lines to this unit run 6 ft east from ST-242, which receives drainage from the floor drains in Building 1063. Discharge is to the sanitary sewer 90 ft west. Subsurface line locations were determined using methods described in Section 3.0.

On January 24, 1995, one borehole was sampled using a Geoprobe. The sample interval at the borehole location was driven from the depth of the line to 5 ft below the line. From this interval, two samples were collected from the borehole: one at a depth equal to the base of the line, the other from 3 ft below the base of the line. Both samples were field-screened with a FID organic vapor meter and only the sample with the highest FID reading was submitted to the laboratory for analysis. If no elevated FID readings were detected, the sample collected at the depth closest to the base of the line was submitted for analysis. Along the lines serving ST-243, one soil sample was collected from 1-3 ft and submitted for laboratory analysis during the Appendix III RFI.

The analytical results from ST-243-01, collected during the Stage 2B RFI, were used as background concentration data for the sample collected at ST-243 during the Appendix III RFI.

Sampling operations and sample handling procedures are described in Section 3.0. The soil boring log for the borehole drilled and sampled at ST-243 is in Appendix C.

5.32.2.4 Laboratory Analysis

The soil sample was analyzed for VOCs, SVOCs, TPH, metals, mercury (the potential contaminants associated with normal operations at this site), soil pH, and soil moisture. The four brass tubes in each 2-ft sample interval were field-screened for possible contamination using a beta-gamma meter and a FID. All field-screening instrument readings remained at background levels throughout the ST-243 drilling and sampling activities.

ST-243-01, collected during Stage 2B RFI, was used as a background sample during the investigation of the wasteline at ST-243. Sample analysis for ST-243-01 included analyses for TPH, VOCs, SVOCs, metals, soil pH, and soil moisture.

5.32.3 Site Characteristics

5.32.3.1 Geology

Building 1063 is underlain by unconsolidated alluvial sediment that is predominantly fine-grained sand and very fine-grained to fine-grained silty sand. A maximum depth of 7 ft below grade was attained in borehole ST-243C-01, and the borehole did not penetrate into the Santa Fe Group sediments that presumably underlie this area. A discussion of the general geology at Kirtland AFB is presented in Section 2.4.

As a result of wasteline installation, it is probable that backfill material is present adjacent to each line to a depth at least equal to the total depth of each line. Borehole logs for this area are presented in Appendix C.

5.32.3.2 Hydrogeology

Groundwater beneath Building 1063 is found within the Upper Santa Fe sediments and is generally thought to be unconfined in the upper portion of the aquifer. This area is within the HR1 saturated zone setting as defined by SNL studies (Figure 2-9) (SNL, 1994). Hydrogeologic characterization in this portion of Kirtland AFB is complicated by the presence of numerous production wells (Figure 2-11). It is probable that uniform groundwater conditions do not exist in this region. Local cones of depression associated with groundwater withdrawal have altered the groundwater flow direction in the vicinity of the well fields (Figure 2-7).

The gradient is probably north at this site. Four production wells are near the site: KAFB-7, 3,200 ft south-southeast, and KAFB-2, 3,700 ft south-southwest, are upgradient; KAFB-1, 4,500 ft east, is cross-gradient; and KAFB-3, 6,500 ft north-northeast, is downgradient (Figures 2-7 and 2-11). Depth to groundwater is estimated to be approximately 350 ft below grade; however, shallower perched water zones may occur (Figure 2-10). Hydraulic conductivity within HR1 is estimated at 2 to 171 ft/day (SNL, 1994). A general discussion of the hydrogeology at Kirtland AFB is presented in Section 2.5.

Table 5-40. Summary of Reportable Concentrations for Soil Analyses at SWMU 8-26, Building 1063, OWS Lines (ST-243)[1]
(Concentrations mg/kg)

Chemical Class	Analyte	HHRB Action Level[2]	PQL UTL	Borehole Number and Sample Depth Interval (ft) ST243C-01 4–6
SVOC	Di-n-butylphthalate	7,800	0.70	0.92
METALS	Aluminum	78,000	14,700	8,570
	Arsenic	0.37	6.5	5.6
	Barium	5,500	735	444
	Beryllium	0.15	0.84	0.48
	Calcium	N/A	121,000	88,800
	Chromium, total	390	21.6	7.5
	Cobalt	4,700	15.4	5.1
	Copper	2,900	223	16.2
	Iron	N/A	23,800	11,600
	Lead	400	17.5	4.9
	Magnesium	N/A	10,400	7,010
	Manganese	390	549	221
	Nickel	1,600	188	7.4
	Potassium	N/A	3,590	1,070
	Sodium	N/A	787	191
	Vanadium	550	55.3	38.9
	Zinc	23,000	114	27.4
OTHER	pH			8.8
	Moisture (%)			16.1

FOOTNOTES

1	Complete laboratory analytical results and method detection limits are presented in Appendix K.
2	Action level of RCRA Proposed Rule Subpart S (55 FR 30814, 7/27/90).
*	TPH action level is 100 mg/kg adopted from NMED UST regulations (NMED, 1990). SW-8015 analyzes volatile and semivolatile petroleum hydrocarbon fractions separately. The total concentration of the two fractions analyzed under SW-8015 will be used to assess compliance with stipulated action levels for the purpose of this RFI.
#	Denotes TCLP analysis, results in mg/l.
--	No Data.
FR	Field Replicate.
HHRB	Human health risk based.
J	Estimated value.
N/A	Not Applicable.
NA	Not Analyzed.
ND	Not detected above the method detection limit.
pCi/g	picocuries per gram.
PQL	Practical quantitation limits (defines VOC, SVOC, and TPH).
R	Reject NDs due to interference.
RAD	Radionuclides.
RE	Resample.
SVOC	Semivolatile organic compounds.
TPH	Total petroleum hydrocarbons.
U	Accept data (positive results may be influenced by lab contamination).
UJ	Estimated nondetect.
UTL	Upper tolerance limits (defines metals).
VOC	Volatile organic compounds.

5.32.4 Nature and Extent of Contamination

The following section describes the nature and extent of contamination based on the analytical results for soil samples submitted for analysis from ST-243. Analytical results are summarized in Table 5-40, where only the reportable concentrations are listed. Full analytical results are presented in Appendix F and laboratory validation reports are presented in Appendix K.

Organic Compounds

No VOC analytes were detected in the soil sample collected at ST-243.

The SVOC analyte di-n-butylphthalate was detected at a concentration of 0.92 mg/kg in the soil sample collected at ST-243. This concentration was below the HHRB action level of 7,800 mg/kg.

Petroleum Hydrocarbons

No petroleum hydrocarbons were detected in the sample at ST-243.

Metals

Table 5-40 lists all metal concentrations detected at ST-243 and the respective UTL and HHRB action level concentrations. Arsenic (5.6 mg/kg) was detected in the soil sample above the HHRB action level of 0.37 mg/kg, but below the 6.5 mg/kg UTL. Beryllium was detected at a concentration of 0.48 mg/kg, exceeding the HHRB action level of 0.15 mg/kg, but below the 0.84 mg/kg UTL. These concentrations of arsenic and beryllium appear to be naturally occurring throughout Kirtland AFB as discussed in Section 4.2.2.

Soil pH and Moisture

A soil pH value of 8.8 was found in this sample. The soil moisture value was 16.1 percent (Table 5-40).

5.32.5 Conclusions and Recommendations

Conclusions

- One SVOC was detected in the sample collected from this site; the concentration was below the HHRB action level. No VOCs were detected in the sample collected from this site.
- No gasoline or diesel range hydrocarbons were detected in the sample collected at this site.
- Arsenic and beryllium were the only metals detected at concentrations exceeding the HHRB action level; these concentrations appear to be naturally occurring throughout Kirtland AFB.
- The analytical results at ST-243 are not indicative of a release from this site.

Recommendations

- Based on the findings of the RFI, no further action is necessary; therefore, ST-243 does not require further investigation. A No Further Action proposal should be prepared.

5.33 SWMU 10-7, Building 1064, OWS Lines (ST-244)

5.33.1 Site Background and Environmental Setting

ST-244 is near the west side of Building 1064, the NMANG Civil Engineer office. The general location of the unit and its associated lines are shown on Figure 5-24. Inflow line sources to this unit include floor drains within the building. ST-244 discharges aqueous-phase liquid to the sewer lateral on the north side of the building that drains west into the main sanitary sewer system. The oil-phase liquid discharges 1.5 ft west to holding tank ST-245. The 500-gallon tank has a 2.5-in. diameter fill cap set in a 1.3 ft-square concrete pad. The tank bottom is 5 ft below grade. Holding tank ST-245 is scheduled for removal by the NMANG in 1995.

The lines serving ST-244 and ST-245 are in the urban/industrial zone. The nearest production wells to these sites are KAFB-1, 4,000 ft east; KAFB-7, 2,600 ft south-southeast; KAFB-2, 4,200 ft southwest; and KAFB-14, 6,700 ft west.

5.33.2 Study Area Investigation

5.33.2.1 Previous Investigations

During the Stage 2B RFI, subsurface soil samples were collected from the perimeter of OWS ST-244. Analytical results were not indicative of a release from this unit.

5.33.2.2 Data Gaps

Prior to the Appendix III RFI, no data were available to determine if a release occurred from the ST-244 wastelines.

5.33.2.3 RFI Field Investigation

The objective of the investigation was to determine the presence or absence of contamination in soil adjacent to the wastelines. Line location and sample borehole designations were completed prior to the soil sampling effort. The soil investigation was limited to the shallow subsurface.

Analytical results from soil samples collected during the Stage 2B RFI were used to characterize the soil adjacent to the OWS inflow and outflow lines within a 50-ft length of ST-244. Based on engineering drawings, the inflow lines to this unit carry drainage from the floor drains in Building 1064. Aqueous-phase liquid discharges west to the sanitary sewer; oil-phase discharge is to ST-245 1.5 ft west. Subsurface line locations were determined using methods described in Section 3.0.

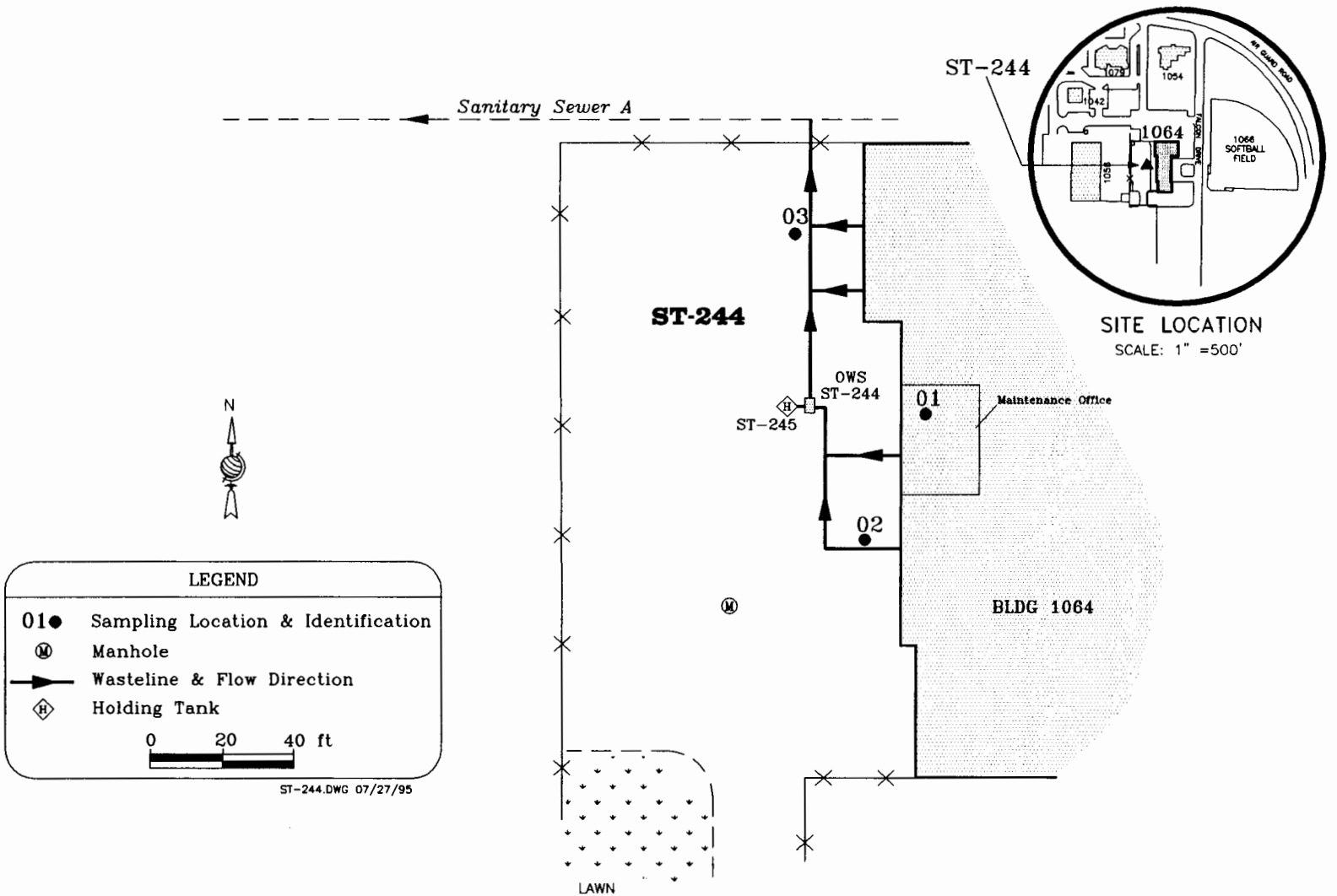


Figure 5-24. Soil Sampling Locations at SWMU 10-7, Building 1064, OWS Lines (ST-244)

On January 19, 1995, three boreholes were sampled using a Geoprobe. The sample interval at each borehole location was driven from the depth of the line to 5 ft below the line. From this interval, two samples were collected from each borehole: one at a depth equal to the base of the line, the other from 3 ft below the base of the line. Both samples were field-screened with a FID organic vapor meter and only the sample with the highest FID reading was submitted to the laboratory for analysis. If no elevated FID readings were detected, the sample collected at the depth closest to the base of the line was submitted for analysis. Three soil samples were collected from along the ST-244 wasteline and submitted for laboratory analysis during the Appendix III RFI.

The analytical results from ST-244-01, collected during the Stage 2B RFI, were used as background concentration data for the sample collected at ST-244 during the Appendix III RFI.

Sampling operations and sample handling procedures are described in Section 3.0. Borehole locations and samples submitted for analysis during the Appendix III RFI are listed in Table 5-41. Corresponding soil boring logs for at ST-244 are in Appendix C.

Table 5-41. Boreholes and Samples Analyzed from SWMU 10-7, Building 1064, OWS Lines (ST-244)

Borehole	Borehole Location	Sample Depths (ft)
01	Inside, 8.5 ft E and 9.5 ft S of the NW corner of the Maintenance Office, Building 1064	1-3
02	9 ft west of Bldg. 1064 and 66 ft N of the south end of Building 1064	3-5
03	18 ft W and 28 ft S of the NW corner of Building 1064	4-6

5.33.2.4 Laboratory Analysis

Soil samples were analyzed for VOCs, SVOCs, TPH, metals, mercury (the potential contaminants associated with normal operations at this site), soil pH, and soil moisture. The four brass tubes in each 2-ft sample interval were field-screened for possible contamination using a beta-gamma meter and a FID. All field-screening instrument readings remained at background levels throughout the ST-244 drilling and sampling activities.

Sample ST-244-01, collected during the Stage 2B RFI, was used as a background sample during the investigation of the wastelines at ST-244. Sample analysis for ST-244-01 included analyses for TPH, VOCs, SVOCs, metals, soil pH, and soil moisture.

5.33.3 Site Characteristics

5.33.3.1 Geology

The Building 1064 area is underlain by unconsolidated alluvial sediment that is dominantly very fine-grained to fine-grained silty sand and sand with occasional clayey sand intervals. Three boreholes were drilled and sampled; a maximum depth of 9 ft below grade was attained in borehole ST-244C-03. No boreholes penetrated into the Santa Fe Group sediments that presumably underlie this area. A discussion of the general geology at Kirtland AFB is presented in Section 2.4.

As a result of line installation, it is probable that backfill material is present adjacent to each line to a depth at least equal to each line's total depth. Borehole logs for this area are presented in Appendix C.

5.33.3.2 Hydrogeology

Groundwater beneath the Building 1064 area is found within the Upper Santa Fe sediments and is generally thought to be unconfined in the upper portion of the aquifer. This area is within the HR1 saturated zone setting as defined by SNL studies (Figure 2-9) (SNL, 1994). Hydrogeologic characterization in this portion of Kirtland AFB is complicated by the presence of numerous production wells (Figure 2-11). Uniform groundwater conditions in this region probably do not exist. Local cones of depression associated with groundwater withdrawal have altered the groundwater flow direction in the vicinity of the well fields (Figure 2-7).

The gradient is probably north at this site. Four production wells are located in this area of Kirtland AFB: KAFB-1 is cross-gradient 4,000 ft east, KAFB-7 is upgradient 2,600 ft south-southeast, KAFB-2 is upgradient 4,200 ft southwest, and KAFB-14 is cross-gradient 6,700 ft west (Figures 2-7 and 2-11). Depth to groundwater is estimated to be approximately 350 ft below grade; however, shallower perched water zones may occur (Figure 2-10). Hydraulic conductivity within HR1 is estimated at 2 to 171 ft/day (SNL, 1994). A general discussion of the hydrogeology at Kirtland AFB is presented in Section 2.5.

5.33.4 Nature and Extent of Contamination

The following sections describe the nature and extent of contamination based on the analytical results for soil samples submitted for analysis at ST-244. Analytical results are summarized in Table 5-42, where only the reportable concentrations are listed. Full analytical results are presented in Appendix F and laboratory validation reports are presented in Appendix K.

Organic Compounds

There were no VOC or SVOC analytes detected in any of the soil samples collected at ST-244.

Petroleum Hydrocarbons

No petroleum hydrocarbons were detected in any of the samples at ST-244.

Table 5-42. Summary of Reportable Concentrations for Soil Analyses at SWMU 10-7, Building 1064, OWS Lines (ST-244)[1] (Concentrations mg/kg)

Chemical Class	Analyte	HHRB Action Level[2]	PQL UTL	Borehole Number and Sample Depth Interval (ft)		
				ST244C-01 1–3	*ST244C-02* 3–5	*ST244C-03* 4–6
METALS	Aluminum	78,000	14,700	6,870	4,620	5,810
	Arsenic	0.37	6.5	2.1	3.5	3.3
	Barium	5,500	735	87.1	268	121
	Beryllium	0.15	0.84	0.43	ND	0.34
	Calcium	N/A	121,000	15,100	81,800	108,000
	Chromium, total	390	21.6	5.8	3.2	5.7
	Cobalt	4,700	15.4	3.8	3.1	4.3
	Copper	2,900	223	35.4	52.6	124
	Iron	N/A	23,800	8,630	5,600	7,770
	Lead	400	17.5	4.4	2.7	3.6
	Magnesium	N/A	10,400	2,680	2,900	5,570
	Manganese	390	549	114	50.1	117
	Nickel	1,600	188	5.5	7.9	12.0
	Potassium	N/A	3,590	1,310	538	632
	Sodium	N/A	787	203	108	139
	Vanadium	550	55.3	17.9	17.2	23.2
	Zinc	23,000	114	28.0	21.5	50.1
OTHER	pH			7.9	8.6	8.3
	Moisture (%)			7.6	9.2	12.2

FOOTNOTES

1	Complete laboratory analytical results and method detection limits are presented in Appendix K.
2	Action level of RCRA Proposed Rule Subpart S (55 FR 30814, 7/27/90).
*	TPH action level is 100 mg/kg adopted from NMED UST regulations (NMED, 1990). SW-8015 analyzes volatile and semivolatile petroleum hydrocarbon fractions separately. The total concentration of the two fractions analyzed under SW-8015 will be used to assess compliance with stipulated action levels for the purpose of this RFI.
#	Denotes TCLP analysis, results in mg/l.
--	No Data.
FR	Field Replicate.
HHRB	Human health risk based.
J	Estimated value.
N/A	Not Applicable.
NA	Not Analyzed.
ND	Not detected above the method detection limit.
pCi/g	picocuries per gram.
PQL	Practical quantitation limits (defines VOC, SVOC, and TPH).
R	Reject NDs due to interference.
RAD	Radionuclides.
RE	Resample.
SVOC	Semivolatile organic compounds.
TPH	Total petroleum hydrocarbons.
U	Accept data (positive results may be influenced by lab contamination).
UJ	Estimated nondetect.
UTL	Upper tolerance limits (defines metals).
VOC	Volatile organic compounds.

Metals

Table 5-42 lists all reportable metal concentrations detected at ST-244 and the respective UTL and HHRB action level concentrations. Arsenic (2.1 to 3.5 mg/kg) was detected in all soil samples above the HHRB action level of 0.37 mg/kg, but below the 6.5 mg/kg UTL. Beryllium was detected in two samples at concentrations (0.43 and 0.34 mg/kg), exceeding the 0.15 mg/kg HHRB action level, but below the 0.84 mg/kg UTL. These concentrations of arsenic and beryllium appear to be naturally occurring throughout Kirtland AFB as discussed in Section 4.2.2.

Soil pH and Moisture

Soil pH ranged from 7.9 to 8.6 in these samples. Soil moisture values ranged from 7.6 to 12.2 percent (Table 5-42).

5.33.5 Conclusions and Recommendations

Conclusions

- No VOCs or SVOCs were detected in the soil samples collected from this site.
- No gasoline or diesel range hydrocarbons were detected in the samples collected from this site.
- Arsenic and beryllium were the only metals detected at concentrations exceeding the HHRB action level; these concentrations appear to be naturally occurring throughout Kirtland AFB.
- The analytical results at ST-244 are not indicative of a release from this site.

Recommendations

- Based on the findings of the RFI, no further action is necessary; therefore, ST-244 does not require further investigation. A No Further Action proposal should be prepared.

5.34 SWMU 10-7, Building 1064, Holding Tank Lines (ST-245)

5.34.1 Site Background and Environmental Setting

ST-245 is 21 ft west of Building 1064, the NMANG Heavy Equipment Maintenance Shop (Figure 5-24). Inflow consists of the oil-phase discharge from ST-244, an OWS 1.5 ft east, and discharge from floor drains inside the building. ST-245 is an underground unit with a 2.5-in. cap set in a 1.3-ft square concrete pad. The approximate size of the tank is 500 gallons. The tank bottom is 5 ft below grade. Holding tank ST-245 is scheduled for removal by the NMANG in late 1995.

The inflow line to holding tank ST-245 is in the urban/industrial zone. The nearest production wells to this site are KAFB-1, 4,000 ft east, and KAFB-7, 2,600 ft south-southeast.

5.34.2 Study Area Investigation

5.34.2.1 Previous Investigations

During the Stage 2B RFI, subsurface soil samples were collected from the perimeter of holding tank ST-245. Analytical results were not indicative of a release from this unit. These results are presented in the Stage 2B RFI (USAF, 1995).

5.34.2.2 Data Gaps

Prior to the Appendix III RFI, no data were available to confirm the presence or absence of contaminants in the subsurface soil surrounding the inflow line to ST-245.

5.34.2.3 RFI Field Investigation

The objective of the investigation was to determine the presence or absence of contamination in soil adjacent to the holding tank inflow line. The inflow line to holding tank ST-245 is also the outflow line from ST-244 (Section 5.33). Therefore, due to the close proximity of ST-245 and ST-244 (1.5 ft), the soil samples collected during the Stage 2B RFI at ST-244 and the three wasteline samples collected at ST-244 during the Appendix III RFI (Section 5.33) were used to characterize soil conditions adjacent to the holding tank inflow line.

5.34.3 Conclusions and Recommendations

Conclusions

- The analytical results from the Stage 2B RFI are not indicative of a release from this unit.
- The analytical results from the Appendix III RFI sampling at the adjacent ST-244 wasteline are not indicative of a release from this site.

Recommendations

- Based on the findings of the RFI, no further action is necessary; therefore, ST-245 does not require further investigation. A No Further Action proposal should be prepared.

5.35 SWMU 10-7, Building 1070, OWS Lines (ST-246)

5.35.1 Site Background and Environmental Setting

ST-246 is 5 ft south of the southwest corner of the asphalt-paved fuel tanker parking lot associated with Building 1070, on the north side of a drainage ditch. The general location of the unit and its associated lines are shown on Figure 5-25. Building 1070 is part of the fuel operations complex of the NMANG in the western portion of Kirtland AFB. The holding tank is 10 ft west of the OWS. Air Force Civil Engineering blueprints indicate that ST-246 receives drainage from the fuel tanker parking lot area drains

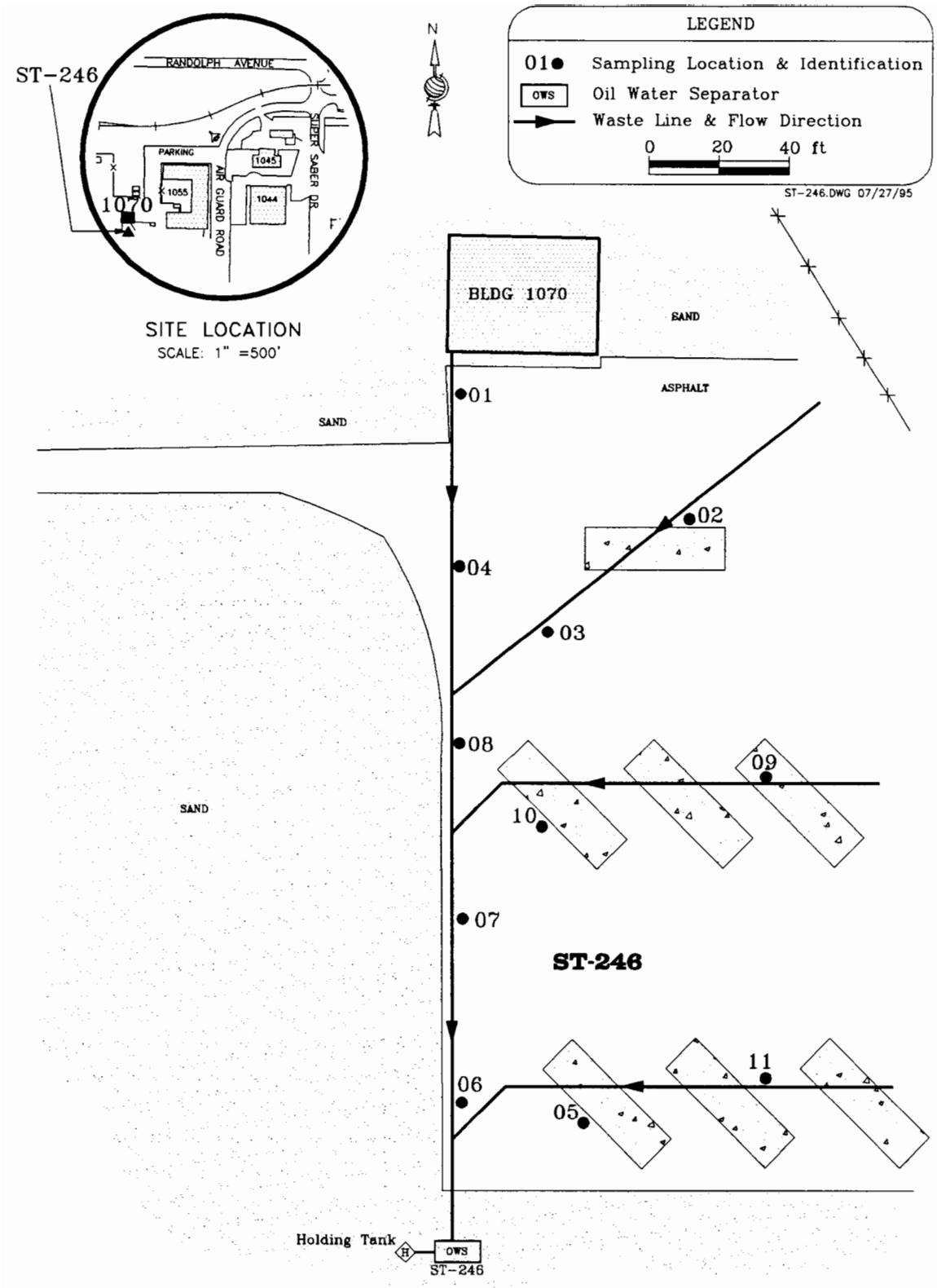


Figure 5-25. Soil Sampling Locations at SWMU 10-7, Building 1070, OWS Lines (ST-246)

and from a floor drain inside Building 1070. Oil-phase liquid discharges from ST-246 to the holding tank, which has no discharge. While ST-246 was being resampled in July 1994, construction activities were underway to connect the OWS water-phase discharge pipe to a sanitary sewage lateral that will run from south to north along the west side of ST-246. Prior to the construction activities, the destination of the liquid-phase discharge was reportedly to the surrounding soil. During field activities at this site, it was observed that the discharge pipe was not connected to any outflow lines and it was obstructed with soil, which inhibited flow from the unit. In all likelihood, this obstruction probably resulted in the merging of both the liquid-phase and oil-phase waste in the unit. The water phase would presumably be routed to the waste holding tank along with the oil-phase waste.

The lines servicing ST-246 are in the urban/industrial zone. The nearest production wells to this site are KAFB-2, 2,600 ft southwest; KAFB-7, 3,300 ft southeast; KAFB-14, 5,600 ft west; and KAFB-1, 5,800 ft east.

5.35.2 Study Area Investigation

5.35.2.1 Previous Investigations

During the Stage 2B RFI, subsurface soil samples were collected from the perimeter of OWS ST-246. Analytical results were not indicative of a release from this unit. These results are presented in the Stage 2B RFI report (USAF, 1995).

5.35.2.2 Data Gaps

Prior to the Appendix III RFI, no data were available to determine if a release occurred from the ST-246 wastelines.

5.35.2.3 RFI Field Investigation

The objective of the investigation was to determine the presence or absence of contamination in soil adjacent to the wastelines. Line location and sample borehole designation were completed prior to the soil sampling effort. The soil investigation was limited to the shallow subsurface.

Analytical results from soil samples collected during the Stage 2B RFI were used to characterize the soil adjacent to the OWS inflow and outflow lines within a 50-ft radius of ST-246. Based on engineering drawings, the inflow lines to this OWS and holding tank unit lead from the fuel tanker parking area drains and a floor drain in Building 1070. Discharge is to the holding tank. Subsurface line locations were determined using methods described in Section 3.0.

On January 25 and 26, 1995, 11 boreholes were sampled using a Geoprobe. The sample interval at each borehole location extended from the depth of the line to 5 ft below the line. From this interval, two samples were collected from each borehole: one at a depth equal to the base of the line, the other from 3 ft below the base of the line. Both samples were field-screened with a FID organic vapor meter and only the sample with the highest FID reading was submitted to the laboratory for analysis. If no elevated FID readings were detected, the sample collected at the depth closest to the base of the line was submitted for analysis. Along the ST-246 wastelines, 12 soil samples, including 1 replicate, were

collected and submitted for laboratory analysis during the Appendix III RFI. Because of the proximity of ST-246, analytical results from borehole ST-246-01, collected during the Stage 2B RFI, were used as background concentration data for the samples collected at ST-246 during the Appendix III RFI.

Sampling operations and sample handling procedures are described in Section 3.0. Sample depths, borehole locations, and replicate sample collected during the Appendix III RFI and submitted for analysis are listed in Table 5-43. The corresponding soil boring logs for the boreholes drilled and sampled at ST-246 are in Appendix C.

Table 5-43. Boreholes and Samples Analyzed from SWMU 10-7, Building 1070, OWS Lines (ST-246)

Borehole	Borehole Location	Sample Depths (ft)
01	1.8 ft E and 12.8 ft S of SW corner of Building 1070	1-3
02	27 ft E and 48 ft S of SE corner of Building 1070	1-3
03	14.5 ft W and 85.5 ft S of SE corner of Building 1070	1-3
04	49 ft S of SE corner of Building 1070	1-3
05	3 ft E and 220 ft S of SE corner of Building 1070	2-4
06	200 ft S of SE corner Building 1070	3-5
07	150 ft S of SE corner of Building 1070	2-4
08	100 ft S of SE corner of Building 1070	2-4
09	50 ft E and 122 ft S of SE corner of Building 1070	1-6
10	15 ft W and 196 ft S of SE corner of Building 1070	2-7[a]
11	48 ft E and 208 ft S of SE corner of Building 1070	2-4

a. Replicate sample also collected at this interval.

5.35.2.4 Laboratory Analysis

Soil samples were analyzed for VOCs, SVOCs, TPH, metals, mercury (the potential contaminants associated with normal operations at this site), soil pH, and soil moisture. The four brass tubes in each 2-ft sample interval were field-screened for possible contamination using a beta-gamma meter and a FID. All instrument readings remained at background levels during ST-246 drilling and sampling activities.

ST-246-01, collected during Stage 2B RFI was used as a background sample during the investigation of the wastelines at ST-246. Sample analysis for ST-246-01 included analyses for TPH, VOCs, SVOCs, metals, soil pH, and soil moisture.

5.35.3 Site Characteristics

5.35.3.1 Geology

The building is underlain by unconsolidated alluvial sediment that is predominantly fine-grained sand and very fine-grained to fine-grained silty sand. Eleven boreholes were drilled at ST-246; a maximum depth of 9 ft below grade was attained at borehole ST-246C-11. No boreholes penetrated into the Santa Fe Group sediments that presumably underlie this area. A discussion of the general geology at Kirtland AFB is presented in Section 2.4.

As a result of line installation, it is probable that backfill material is present adjacent to each line to a depth at least equal to the total depth of each line. Borehole logs for these areas are in Appendix C.

5.35.3.2 Hydrogeology

Groundwater beneath Building 1070 is found within the Upper Santa Fe sediments and is generally thought to be unconfined in the upper portion of the aquifer. This area is within the HR1 saturated zone setting as defined by SNL studies (Figure 2-9) (SNL, 1994). Hydrogeologic characterization in this portion of Kirtland AFB is complicated by the presence of numerous production wells (Figure 2-11). It is probable that uniform groundwater conditions do not exist in this region. Local cones of depression associated with groundwater withdrawal have altered the groundwater flow direction in the vicinity of the well fields (Figure 2-7).

The gradient is probably north at this site. Four production wells are near this site: KAFB-2, 2,600 ft southwest, and KAFB-7, 3,300 ft southeast, are upgradient. KAFB-14, 5,600 ft west, and KAFB-1, 5,800 ft east, are cross-gradient (Figures 2-7 and 2-11). Depth to groundwater is estimated to be approximately 350 ft below grade; however, shallower perched water zones may occur (Figure 2-10). Hydraulic conductivity within HR1 is estimated at 2 to 171 ft/day (SNL, 1994). A general discussion of the hydrogeology at Kirtland AFB is presented in Section 2.5.

5.35.4 Nature and Extent of Contamination

The following sections describe the nature and extent of contamination based on the analytical results for soil samples submitted for analysis from ST-246. Analytical results are summarized in Table 5-44, where only the reportable concentrations are listed. Full analytical results are presented in Appendix F and laboratory validation reports are presented in Appendix K.

Table 5-44. Summary of Reportable Concentrations for Soil Analyses at SWMU 10-7, Building 1070, OWS Lines (ST-246)[1]
(Concentrations mg/kg)

Chemical Class	Analyte	HHRB Action Level[2]	PQL UTL	Borehole Number and Sample Depth Interval (ft)					
				ST246C-01 1–3	*ST246C-02* 1–3	*ST246C-03* 1–3	*ST246C-04* 1–3	*ST246C-05* 2–4	*ST246C-06* 3–5
VOC	Methylene chloride	85.0	0.005	0.006	ND	0.006	0.006	0.006	0.006
SVOC	Benzyl butyl phthalate	16,000	1.3	ND	ND	ND	ND	ND	ND
	Bis(2-ethylhexyl)phthalate	46.0	0.70	ND	ND	0.45	ND	ND	ND
	Di-n-butylphthalate	7,800	0.70	ND	ND	ND	ND	ND	ND
TPH	Diesel fraction	100	10.0	ND	ND	ND	ND	ND	ND
METALS	Aluminum	78,000	14,700	5,530	5,770	5,370	4,610	6,950	5,920
	Arsenic	0.37	6.5	3.2	4.5	2.3	2.9	3.4	3.7
	Barium	5,500	735	189	637	172	196	448	294
	Beryllium	0.15	0.84	ND	ND	ND	ND	ND	ND
	Cadmium	39.0	N/A	ND	ND	ND	ND	ND	ND
	Calcium	N/A	121,000	158,000	126,000	114,000	208,000	98,600	127,000
	Chromium, total	390	21.6	4.4	4.7	4.0	3.2	5.5	5.2
	Cobalt	4,700	15.4	3.3	3.9	2.6	3.5	4.0	4.7
	Copper	2,900	223	15.1	7.0	10.1	12.1	8.5	8.3
	Iron	N/A	23,800	5,610	5,760	6,270	4,660	8,940	6,890
	Lead	400	17.5	3.0	3.3	3.0	2.4	4.2	3.9
	Magnesium	N/A	10,400	5,950	7,560	3,610	3,780	6,960	6,910
	Manganese	390	549	87.8	83.6	82.2	57.2	124	108
	Mercury	23.0	N/A	ND	0.08	ND	ND	ND	ND
	Nickel	1,600	188	4.2	3.0	3.2	4.2	4.9	3.6
	Potassium	N/A	3,590	491	468	702	472	1,090	654
	Sodium	N/A	787	99.5	107	136	116	125	91.9
	Vanadium	550	55.3	24.0	25.1	18.9	14.5	32.5	27.5
	Zinc	23,000	114	16.4	14.8	16.5	13.9	19.1	17.4
OTHER	pH			8.4	8.3	7.9	8.1	8.5	8.5
	Moisture (%)			12.8	12.3	10.7	17.2	16.7	8.4

Table 5-44. Summary of Reportable Concentrations for Soil Analyses at SWMU 10-7, Building 1070, OWS Lines (ST-246)[1] (Concentrations mg/kg) (Continued)

Chemical Class	Analyte	HHRB Action Level[2]	PQL UTL	Borehole Number and Sample Depth Interval (ft)					
				ST246C-07	*ST246C-08*	*ST246C-09*	*ST246C-10*		*ST246C-11*
				2–4	2–4	1–6	2–7 FR	2–7	2–4
VOC	Methylene chloride	85.0	0.005	0.006	0.007	0.006	0.006	0.006	0.006
SVOC	Benzyl butyl phthalate	16,000	1.3	ND	ND	ND	ND	ND	0.82
	Bis(2-ethylhexyl)phthalate	46.0	0.70	ND	ND	ND	ND	ND	ND
	Di-n-butylphthalate	7,800	0.70	ND	ND	ND	1.0	ND	1.8
TPH	Diesel fraction	100	10.0	ND	5.3	ND	9.7	5.7	ND
METALS	Aluminum	78,000	14,700	9,950	7,400	7,100	7,550	4,310	4,050
	Arsenic	0.37	6.5	5.5	6.3	4.1	4.6	2.5	1.7
	Barium	5,500	735	227	193	372	440	372	145
	Beryllium	0.15	0.84	0.45	0.37	ND	0.34	ND	ND
	Cadmium	39.0	N/A	ND	0.74	ND	ND	ND	ND
	Calcium	N/A	121,000	58,400	51,600	112,000	84,900	118,000	37,300
	Chromium, total	390	21.6	8.7	7.7	6.6	8.3	3.9	4.4
	Cobalt	4,700	15.4	5.6	5.1	3.7	4.5	1.9	3.2
	Copper	2,900	223	18.3	15.2	25.4	11.4	8.5	7.4
	Iron	N/A	23,800	11,800	11,400	8,050	9,610	4,940	6,450
	Lead	400	17.5	7.4	6.9	4.0	5.2	2.7	3.4
	Magnesium	N/A	10,400	7,470	6,150	6,740	5,460	3,330	2,850
	Manganese	390	549	197	204	115	143	60.1	105
	Mercury	23.0	N/A	ND	ND	ND	ND	ND	ND
	Nickel	1,600	188	6.9	5.3	5.0	7.5	ND	ND
	Potassium	N/A	3,590	1,100	834	881	897	525	717
	Sodium	N/A	787	161	89.7	138	122	85.1	87.0
	Vanadium	550	55.3	40.3	39.2	35.5	37.7	16.4	18.7
	Zinc	23,000	114	29.4	28.9	26.8	22.1	12.1	15.5
OTHER	pH			8.2	8.7	8.7	8.5	8.5	8.6
	Moisture (%)			11.5	19.3	10.1	10.8	11.0	7.0

FOOTNOTES

1	Complete laboratory analytical results and method detection limits are presented in Appendix K.
2	Action level of RCRA Proposed Rule Subpart S (55 FR 30814, 7/27/90).
*	TPH action level is 100 mg/kg adopted from NMED UST regulations (NMED, 1990). SW-8015 analyzes volatile and semivolatile petroleum hydrocarbon fractions separately. The total concentration of the two fractions analyzed under SW-8015 will be used to assess compliance with stipulated action levels for the purpose of this RFI.
#	Denotes TCLP analysis, results in mg/l.
--	No Data.
FR	Field Replicate.
HHRB	Human health risk based.
J	Estimated value.
N/A	Not Applicable.
NA	Not Analyzed.
ND	Not detected above the method detection limit.
pCi/g	picocuries per gram.
PQL	Practical quantitation limits (defines VOC, SVOC, and TPH).
R	Reject NDs due to interference.
RAD	Radionuclides.
RE	Resample.
SVOC	Semivolatile organic compounds.
TPH	Total petroleum hydrocarbons.
U	Accept data (positive results may be influenced by lab contamination).
UJ	Estimated nondetect.
UTL	Upper tolerance limits (defines metals).
VOC	Volatile organic compounds.

Organic Compounds

Methylene chloride was the only VOC analyte detected in soil samples submitted for analysis at ST-246. It was detected in 11 of the 12 samples. The detected concentrations, ranging from 0.006 to 0.007 mg/kg do not exceed the HHRB action level of 85 mg/kg. Methylene chloride was also detected in associated QC samples and is believed to be the result of laboratory contamination as discussed in Section 3.5.1.

A total of three SVOCs were detected in soil samples at this site. Benzyl butyl phthalate (0.082 mg/kg) was only detected in the sample from borehole ST-246C-11. Bis(2-ethylhexyl)phthalate (0.45 mg/kg) was only detected in the sample from borehole ST-246C-03. Di-n-butylphthalate (1.0 and 1.8 mg/kg) was detected in the replicate sample from borehole ST-246C-10 and the sample from borehole ST-246C-11, respectively. All concentrations are below HHRB action levels.

Petroleum Hydrocarbons

No gasoline range hydrocarbons were detected in the samples collected at this site. Diesel range hydrocarbons (5.3 to 9.7 mg/kg) were detected in soil samples ST-246C-08, ST-246C-10, and the replicate from ST-246C-10. The detected concentrations do not exceed the NMED action level of 100 mg/kg.

Metals

Table 5-44 lists all reportable metal concentrations detected at ST-246 and the respective UTL and HHRB action level concentrations. Arsenic (1.7 to 6.3 mg/kg) was detected in all soil samples exceeding the HHRB action level of 0.37 mg/kg, but below the 6.5 mg/kg UTL. Beryllium was detected in two samples and the field replicate at concentrations (0.34 to 0.45 mg/kg) exceeding the HHRB action level of 0.15 mg/kg, but below the 0.84 mg/kg UTL. These concentrations of arsenic and beryllium appear to be naturally occurring throughout Kirtland AFB as discussed in Section 4.2.2.

Soil pH and Moisture

Soil pH ranged from 7.9 to 8.7 in these samples. Soil moisture values ranged from 7.0 to 19.3 percent (Table 5-44).

5.35.5 Conclusions and Recommendations

Conclusions

- One VOC and three SVOCs were detected in the soil samples collected from this site; all concentrations were below HHRB action levels.
- The diesel range hydrocarbon concentrations are similar to concentrations detected in background samples analyzed during the Appendix III RFI and are not conclusive evidence that a release occurred. Without the presence of other release indicators (VOCs, SVOCs, and metals), it is probable that the diesel range hydrocarbon concentrations are not attributable to a release from the unit.

- Arsenic and beryllium were the only metals detected at concentrations exceeding the HHRB action level; these concentrations appear to be naturally occurring throughout Kirtland AFB.

- The analytical results at ST-246 are not indicative of a release from this site.

Recommendations

- Based on the findings of the RFI, no further action is necessary; therefore, ST-246 does not require further investigation. A No Further Action proposal should be prepared.

5.36 SWMU 10-7, Facility 2637, OWS Line (ST-247)

5.36.1 Site Background and Environmental Setting

ST-247 is centrally located in Facility 2637, an outdoor wash pad used for cleaning F-16 aircraft. It is south of Building 1068 and west-southwest of Building 1061 in the NMANG complex. The general location of the unit and its associated wasteline are shown on Figure 5-26. Inflow source to this separator consists of surface drainage from the middle of the wash rack area where aircraft are serviced. Discharge from this unit flows 150 ft northeast into OWS ST-235 at Building 1051. ST-235 discharges east and joins the sanitary sewer system located south of Building 1060 (Section 5.25).

The line servicing this unit is in the urban/industrial zone. The nearest production wells to this site are KAFB-7, 2,900 ft southeast, and KAFB-2, 3,600 ft southwest.

5.36.2 Study Area Investigation

5.36.2.1 Previous Investigations

During the Stage 2B RFI, subsurface soil samples were collected from the perimeter of ST-247. Analytical results from the soil samples collected at ST-247 indicated shallow soil contamination, possibly by fluid migration through cracks in the wash rack slab. These results are presented in the Stage 2B RFI Report (USAF, 1995).

5.36.2.2 Data Gaps

Prior to the Appendix III RFI, no data were available to determine if a release occurred from the ST-247 wastelines.

5.36.2.3 RFI Field Investigation

The objective of the investigation was to determine the presence or absence of contamination in soil adjacent to the wasteline. Line location and sample borehole designation were completed prior to soil sampling effort. The soil investigation was limited to the shallow subsurface. The subsurface line location was confirmed using methods described in Section 3.0.

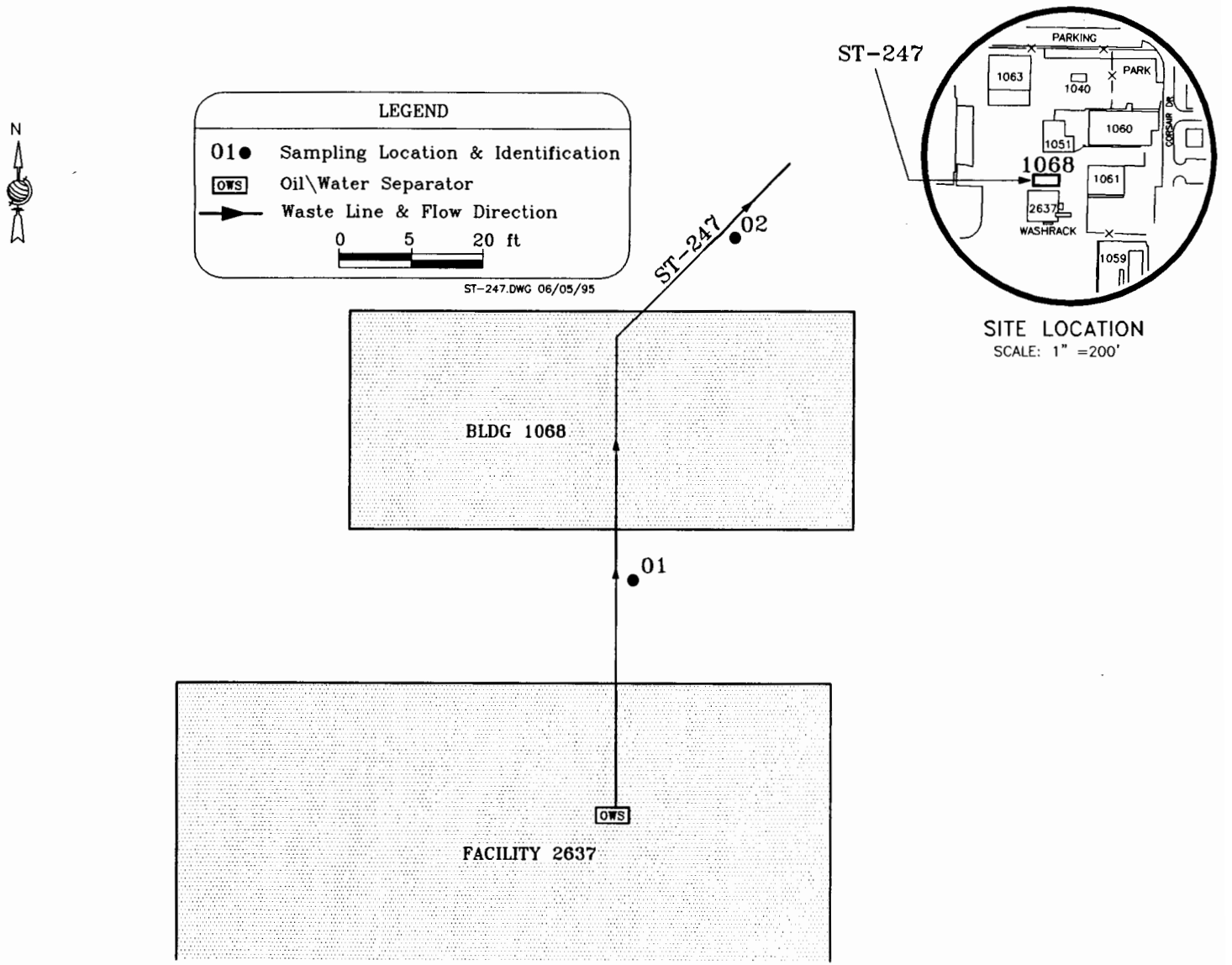


Figure 5-26. Soil Sampling Locations at SWMU 10-7, Facility 2637, OWS Lines (ST-247)

Analytical results from soil samples collected during the Stage 2B RFI were used to characterize the soil adjacent to the OWS outflow line within a 50-ft radius of ST-247. Based on engineering drawings, the inflow source to this OWS unit is surface drainage from the middle of the wash rack area south of Building 1068 and west-southwest of Building 1061. Outflow is to ST-235, 150 ft north-northeast.

On January 18, 1995, two boreholes were sampled using a Geoprobe. The sample interval at each borehole location extended from the depth of the line to 5 ft below the line. From this interval, two samples were collected from each borehole: one at a depth equal to the base of the line, the other from 3 ft below the base of the line. Both samples were field-screened with a FID organic vapor meter and only the sample with the highest FID reading was submitted to the laboratory for analysis. If no elevated FID readings were detected, the sample collected at the depth closest to the base of the line was submitted for analysis. Two soil samples were collected from along the ST-247 wasteline and submitted for laboratory analysis during the Appendix III RFI.

The analytical results from ST-241-01, collected during the Stage 2B RFI, were used as background concentration data for the samples collected at ST-247 during Appendix III RFI.

Sampling operations and sample handling procedures are described in Section 3.0. Borehole locations and samples submitted for analysis during the Appendix III RFI are listed in Table 5-45. Corresponding soil boring logs for the boreholes drilled and sampled at ST-247 are in Appendix C.

Table 5-45. Boreholes and Samples Analyzed from SWMU 10-7, Facility 2637, OWS Lines (ST-247)

Borehole	Borehole Location	Sample Depths (ft)
01	25 ft W and 3 ft S of the SE corner of Building 1068	1-3
02	2 ft E and 12.2 ft N of the NE corner of Building 1068	2-4

5.36.2.4 Laboratory Analysis

Soil samples were analyzed for VOCs, SVOCs, TPH, metals, mercury (the potential contaminants associated with normal operations at this site), soil pH, and soil moisture. The four brass tubes in each 2-ft sample interval were field-screened for possible contamination using a beta-gamma meter (per worker health and safety procedures) and a FID. All field-screening instrument readings remained at background levels throughout the ST-247 drilling and sampling activities.

ST-241-01, collected during Stage 2B work, was used as a background sample during the investigation of the wasteline at ST-247. Sample analysis for ST-241-01 included analyses for TPH, VOCs, SVOCs, metals, soil pH, and soil moisture.

5.36.3 Site Characteristics

5.36.3.1 Geology

The wash rack area is underlain by unconsolidated alluvial sediment that is predominantly very fine-grained to fine-grained sand and silty sand. Two boreholes were drilled and sampled and a maximum depth of 7 ft below grade was attained in borehole ST-247C-02. No borehole penetrated into the Santa Fe Group sediments that presumably underlie this area. A discussion of the general geology at Kirtland AFB is presented in Section 2.4.

As a consequence of the OWS line installation, it is probable that backfill material is present adjacent to the line to a depth at least equal to the total depth of the line. Borehole logs for this site are presented in Appendix C.

5.36.3.2 Hydrogeology

Groundwater beneath this area is found within the Upper Santa Fe sediments and is generally thought to be unconfined in the upper portion of the aquifer. This area is within the HR1 saturated zone setting as defined by SNL studies (Figure 2-9) (SNL, 1994). Hydrogeologic characterization in this portion of Kirtland AFB is complicated by the presence of numerous production wells (Figure 2-11). It is probable that uniform groundwater conditions do not exist in this region. Local cones of depression associated with groundwater withdrawal have altered the groundwater flow direction in the vicinity of the well fields (Figure 2-7).

The gradient is probably north at this site. Two production wells are located in this area of Kirtland AFB. KAFB-7 is upgradient 2,900 ft southeast and KAFB-2 is upgradient 3,600 ft southwest (Figures 2-7 and 2-11). Depth to groundwater is estimated to be approximately 350 ft below grade; however, shallower perched water zones may occur (Figure 2-10). Hydraulic conductivity in the vicinity of HR1 is estimated at 2 to 171 ft/day (SNL, 1994). A general discussion of the hydrogeology at Kirtland AFB is presented in Section 2.5.

5.36.4 Nature and Extent of Contamination

The following sections describe the nature and extent of contamination based on the analytical results for soil sampling submitted for analysis at ST-247. Analytical results are summarized in Table 5-46, where only the reportable concentrations are listed. Full analytical results are presented in Appendix F and laboratory validation reports are presented in Appendix K.

Organic Compounds

There were no VOC or SVOC analytes detected in any of the soil samples collected at ST-247.

Petroleum Hydrocarbons

No petroleum hydrocarbons were detected in any of the soil samples collected at ST-247.

Table 5-46. Summary of Reportable Concentrations for Soil Analyses at SWMU 10-7, Facility 2637, OWS Lines (ST-247)[1]
(Concentrations mg/kg)

Chemical Class	Analyte	HHRB Action Level[2]	PQL UTL	Borehole Number and Sample Depth Interval (ft)	
				ST247C-01	*ST247C-02*
				1–3	2–4
METALS	Aluminum	78,000	14,700	5,880	5,080
	Arsenic	0.37	6.5	5.2	1.1
	Barium	5,500	735	246	55.9
	Beryllium	0.15	0.84	0.34	0.31
	Calcium	N/A	121,000	69,000	8,120
	Chromium, total	390	21.6	4.8	3.9
	Cobalt	4,700	15.4	4.5	4.9
	Copper	2,900	223	10.8	13.5
	Iron	N/A	23,800	9,410	9,910
	Lead	400	17.5	4.0	3.4
	Magnesium	N/A	10,400	6,430	3,650
	Manganese	390	549	152	191
	Nickel	1,600	188	5.4	4.6
	Potassium	N/A	3,590	626	882
	Sodium	N/A	787	345	68.9
	Vanadium	550	55.3	42.4	21.4
	Zinc	23,000	114	23.7	30.4
OTHER	pH			8.0	8.3
	Moisture (%)			11.8	4.7

FOOTNOTES

1	Complete laboratory analytical results and method detection limits are presented in Appendix K.
2	Action level of RCRA Proposed Rule Subpart S (55 FR 30814, 7/27/90).
*	TPH action level is 100 mg/kg adopted from NMED UST regulations (NMED, 1990). SW-8015 analyzes volatile and semivolatile petroleum hydrocarbon fractions separately. The total concentration of the two fractions analyzed under SW-8015 will be used to assess compliance with stipulated action levels for the purpose of this RFI.
#	Denotes TCLP analysis, results in mg/l.
--	No Data.
FR	Field Replicate.
HHRB	Human health risk based.
J	Estimated value.
N/A	Not Applicable.
NA	Not Analyzed.
ND	Not detected above the method detection limit.
pCi/g	picocuries per gram.
PQL	Practical quantitation limits (defines VOC, SVOC, and TPH).
R	Reject NDs due to interference.
RAD	Radionuclides.
RE	Resample.
SVOC	Semivolatile organic compounds.
TPH	Total petroleum hydrocarbons.
U	Accept data (positive results may be influenced by lab contamination).
UJ	Estimated nondetect.
UTL	Upper tolerance limits (defines metals).
VOC	Volatile organic compounds.

Metals

Table 5-46 lists all reportable metal concentrations detected at ST-247 and the respective UTL and HHRB action level concentrations. Arsenic (5.2 and 1.1 mg/kg) was detected in both soil samples above the HHRB action level of 0.37 mg/kg, but below the 6.5 mg/kg UTL. Beryllium was detected in both samples at concentrations (0.34 and 0.31 mg/kg), exceeding the 0.15 mg/kg HHRB action level, but below the 0.84 mg/kg UTL. These concentrations of arsenic and beryllium appear to be naturally occurring throughout Kirtland AFB as discussed in Section 4.2.2.

Soil pH and Moisture

Soil pH values were 8.0 and 8.3 in these samples. Soil moisture values were 11.8 and 4.7 percent (Table 5-46).

5.36.5 Conclusions and Recommendations

Conclusions

- No VOCs or SVOCs were detected in the soil samples collected from this site.
- No gasoline or diesel range hydrocarbons were detected in the samples collected at this site.
- Arsenic and beryllium were the only metals detected at concentrations exceeding the HHRB action level; these concentrations appear to be naturally occurring throughout Kirtland AFB.
- The analytical results at ST-247 are not indicative of a release from this site.

Recommendations

- Based on the findings of the RFI, no further action is necessary; therefore, ST-247 does not require further investigation. A No Further Action proposal should be prepared.

5.37 SWMU 10-7, Building 20205, OWS Lines (ST-248)

5.37.1 Site Background and Environmental Setting

ST-248 is inside a fenced and roofed area at the north end of Building 20205, the east base service station (Figure 5-27). This part of the service station, no longer used for vehicle servicing, is used as a storage area. The OWS receives inflow from the adjacent floor area and drains inside the station service bays. Engineering drawings show that the discharge line runs west then south to join a sanitary sewer lateral of sanitary sewer system E (Figure 5-27). There is no evidence of the hydraulic lift mentioned in the Stage 2B Work Plan (USAF, 1993c).

Site ST-248 is in the urban/industrial zone. The nearest production wells to this site are KAFB-1, 2,400 ft southwest, and KAFB-3, 4,400 ft north-northwest.

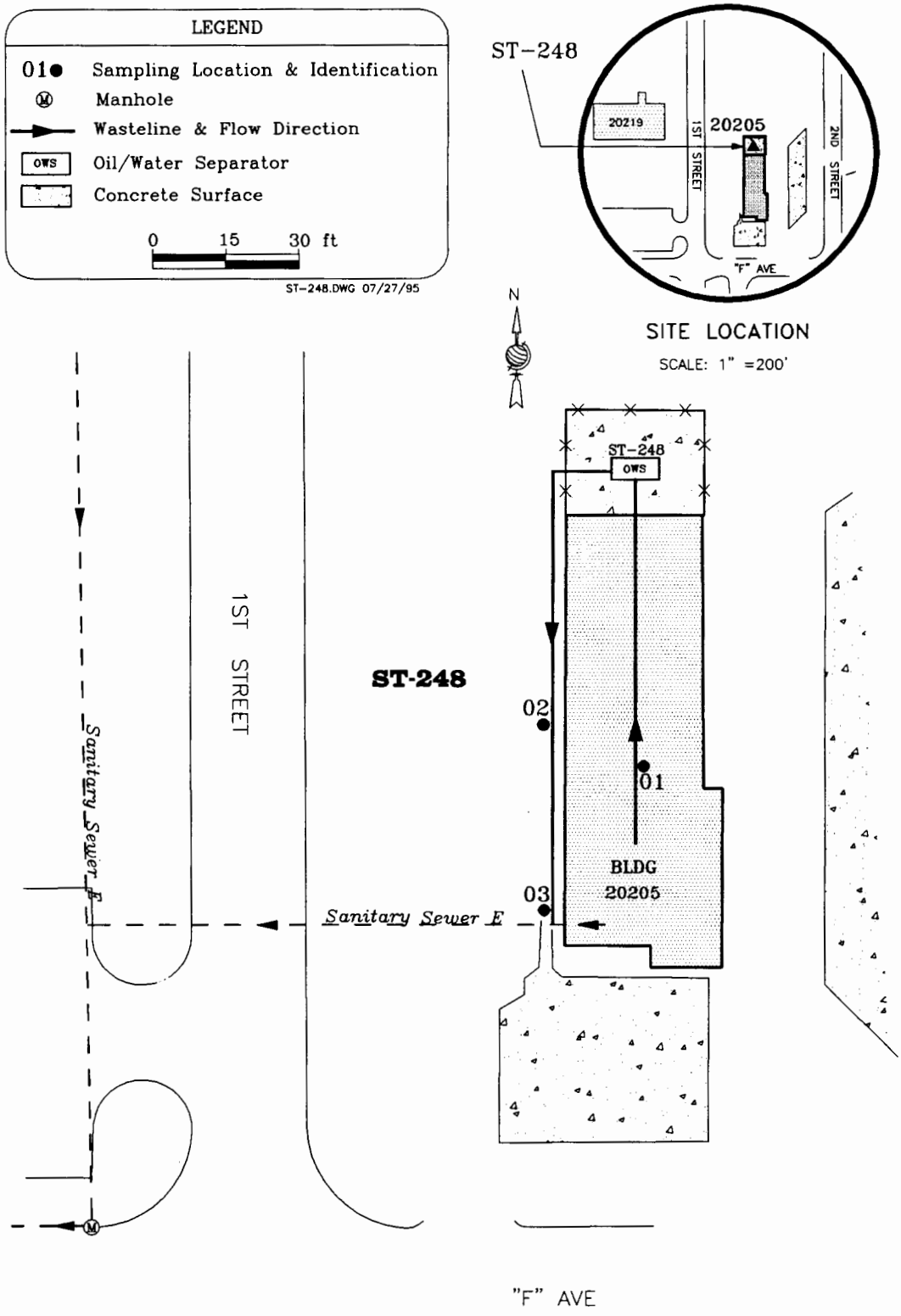


Figure 5-27. Soil Sampling Locations at SWMU 10-7, Building 20205, OWS Lines (ST-248)

5.37.2 Study Area Investigation

5.37.2.1 Previous Investigations

During the Stage 2B RFI, subsurface soil samples were collected from the perimeter of ST-248. Previous investigations sampled source materials as described below. Analytical results did not indicate that contaminants had been released at the site.

5.37.2.2 Data Gaps

Prior to the Appendix III RFI, no data were available to determine if a release occurred from the ST-248 OWS wastelines.

5.37.2.3 RFI Field Investigation

The objective of the investigation was to determine the presence or absence of contamination in soil adjacent to the wastelines. Line location and sample borehole designations were completed prior to the soil sampling effort. The soil investigation was limited to the shallow subsurface.

Analytical results from soil samples collected during the Stage 2B RFI were used to characterize the soil adjacent to the OWS inflow and outflow lines within a 50-ft length of ST-248. Based on engineering drawings, the inflow line to this OWS runs from the area drains within the building. The outflow line runs west and south to connect to a sanitary sewer lateral. Subsurface line locations were confirmed using methods described in Section 3.0.

On January 24, 1995, three boreholes were sampled using a Geoprobe. The sample interval at each borehole extended from the depth of the line to 5 ft below the line. From this interval, two samples were collected: one at a depth equal to the base of the line, the other from 3 ft below the base of the line (i.e., 3 to 5 ft and 6 to 8 ft below grade). Both samples were field-screened with a FID organic vapor meter and only the sample with the highest FID reading was submitted for laboratory analysis. If no elevated FID readings were detected, the sample collected at the depth closest to the base of the line was submitted for analysis. Four soil samples, including one replicate were collected along the ST-248 wastelines and submitted for laboratory analysis during the Appendix III RFI.

The analytical results from borehole ST-248-01, collected during the Stage 2B RFI, were used as background concentration data for samples collected at ST-248 during the Appendix III RFI.

Sampling operations and sample handling procedures are described in Section 3.0. Sample depths, borehole locations, and replicate sample submitted for analysis during the Appendix III RFI are listed in Table 5-47. Soil boring logs for the boreholes drilled and sampled at ST-248 are in Appendix C.

Table 5-47. Boreholes and Samples Analyzed from SWMU 10-7, Building 20205, OWS Lines (ST-248)

Borehole	Borehole Location	Sample Depths (ft)
01	Inside, 18 ft E and 39 ft N of SW corner of Building 20205	1-3
02	6.5 ft W and 30 ft N of SW corner of Building 20205	3-10[a]
03	5.3 ft W and 7 ft N of SW corner of Building 20205	4-6

a. Replicate sample also collected at this interval.

5.37.2.4 Laboratory Analysis

Soil samples were analyzed for VOCs, SVOCs, TPH, metals, mercury (the potential contaminants associated with normal operations at this site), soil pH, and soil moisture. The four brass tubes in each 2-ft sample interval were field-screened for possible contamination using a beta-gamma meter and a FID. All field-screening instrument readings remained at background levels throughout the ST-248 drilling and sampling activities.

5.37.3 Site Characteristics

5.37.3.1 Geology

Building 20205 is underlain by unconsolidated alluvial sediment that is predominantly clayey sand and silt to silty sand to fine-grained sand and gravelly sand. Abundant weathered biotite was common in most samples. Three boreholes were drilled and a maximum depth of 10 ft below grade was reached in borehole ST-248C-02. No boreholes penetrated into the Santa Fe Group sediments that presumably underlie this area. A discussion of the general geology at Kirtland AFB is presented in Section 2.4.

As a result of ST-248 line installation, it is probable that backfill material is present adjacent to each line to a depth equal to the total depth of each line. Borehole logs for this area are presented in Appendix C.

5.37.3.2 Hydrogeology

Groundwater beneath Building 20805 is found within the Upper Santa Fe sediments and is generally thought to be unconfined in the upper portion of the aquifer. This area is within the HR1 saturated zone setting as defined by SNL studies (Figure 2-9) (SNL, 1994). Hydrogeologic characterization in this portion of Kirtland AFB is complicated by the presence of numerous production wells (Figure 2-11). It is probable that uniform groundwater conditions do not exist in this region. Local cones of depression associated with groundwater withdrawal have altered the groundwater flow direction in the vicinity of the well fields (Figure 2-7).

The gradient is probably northwest at this site. Two production wells are located near Building 20205: KAFB-1 is cross-gradient 2,400 ft southwest and KAFB-3 is downgradient 4,400 ft north-northwest (Figures 2-7 and 2-11). Depth to groundwater is estimated to be approximately 350 ft below grade; however, shallower perched water zones may occur (Figure 2-11). Hydraulic conductivity within HR1 is estimated at 2 to 171 ft/day (SNL, 1994). A general discussion of the hydrogeology at Kirtland AFB is presented in Section 2.5.

5.37.4 Nature and Extent of Contamination

The following section describes the nature and extent of contamination based on analytical results for soil samples submitted for analysis from ST-248. Analytical results are presented in Table 5-48, where only the reportable concentrations are listed. Full analytical results are presented in Appendix F and laboratory validation reports are presented in Appendix K.

Organic Compounds

Methylene chloride was the only VOC analyte detected in soil samples submitted for analysis at ST-248 (Table 5-48). It was only detected in the 4- to 6-ft sample from borehole ST-248C-03. The 0.006 mg/kg concentration was below the 85 mg/kg HHRB action level. Methylene chloride was also detected in associated QC samples and is believed to be the result of laboratory contamination as discussed in Section 3.5.1.

The SVOC analyte di-n-butylphthalate (1.4 to 3.8 mg/kg) was detected in all samples submitted for analysis. All concentrations are below the 7,800 mg/kg HHRB action level (Table 5-48).

Petroleum Hydrocarbons

Diesel range hydrocarbons (6.2 mg/kg) were only detected in the 3- to 10-ft replicate sample from borehole ST-248C-03. This concentration is below the 100 mg/kg NMED action level.

Metals

Table 5-48 lists all reportable metal concentrations detected in soil samples submitted for analysis at ST-248. Arsenic, beryllium, and manganese were the only metals detected at concentrations above HHRB action levels. Arsenic (1.9 to 3.1 mg/kg) was detected in all samples. The concentrations were above the HHRB action level of 0.37 mg/kg, but below the 6.5 mg/kg UTL. Beryllium (0.43 to 0.71 mg/kg) was detected in all samples submitted for analysis. These concentrations were above the 0.15 mg/kg HHRB action level, but below the 0.84 mg/kg UTL. Manganese (172 to 456 mg/kg) was detected at concentrations above the 390 mg/kg HHRB action level in the 3- to 10-ft sample and replicate from borehole ST-248C-02. These concentrations were below the 551 mg/kg UTL concentration. These arsenic, beryllium, and manganese concentrations may be naturally occurring at Kirtland AFB as discussed in Section 4.2.2.

Soil pH and Moisture

Soil pH ranged from 7.8 to 8.8 in these samples. Soil moisture values ranged from 8.0 to 15.2 percent (Table 5-48).

Table 5-48. Summary of Reportable Concentrations for Soil Analyses at SWMU 10-7, Building 20205, OWS Lines (ST-248)[1]
(Concentrations mg/kg)

Chemical Class	Analyte	HHRB Action Level[2]	PQL UTL	Borehole Number and Sample Depth Interval (ft)			
				ST248C-01	*ST248C-02*		*ST248C-03*
				1–3	3–10 FR	3–10	4–6
VOC	Methylene chloride	85.0	0.005	ND	ND	ND	0.006
SVOC	Di-n-butylphthalate	7,800	0.70	1.4	2.6	2.7	3.8
TPH	Diesel fraction	100	10.0	ND	6.2	ND	ND
METALS	Aluminum	78,000	14,700	8,550	13,900	16,700	12,400
	Arsenic	0.37	6.5	2.0	1.9	3.1	1.8
	Barium	5,500	735	154	177	185	261
	Beryllium	0.15	0.84	0.43	0.69	0.71	0.59
	Calcium	N/A	121,000	81,700	23,500	45,800	29,700
	Chromium, total	390	21.6	7.0	12.4	13.7	14.4
	Cobalt	4,700	15.4	5.9	8.9	8.9	8.7
	Copper	2,900	223	55.7	60.1	20.4	30.3
	Iron	N/A	23,800	12,600	18,000	19,900	17,600
	Lead	400	17.5	3.9	8.1	9.2	7.0
	Magnesium	N/A	10,400	5,300	7,210	8,120	6,840
	Manganese	390	549	172	456	418	358
	Nickel	1,600	188	7.0	12.1	14.2	11.9
	Potassium	N/A	3,590	1,540	2,800	2,840	2,160
	Sodium	N/A	787	229	597	334	153
	Thallium	N/A	N/A	ND	0.19	0.15	0.14
	Vanadium	550	55.3	27.2	29.3	35.9	31.5
	Zinc	23,000	114	42.0	59.0	50.1	47.6
OTHER	pH			8.8	8.6	7.8	8.4
	Moisture (%)			8.0	12.6	15.0	15.2

FOOTNOTES

1	Complete laboratory analytical results and method detection limits are presented in Appendix K.
2	Action level of RCRA Proposed Rule Subpart S (55 FR 30814, 7/27/90).
*	TPH action level is 100 mg/kg adopted from NMED UST regulations (NMED, 1990). SW-8015 analyzes volatile and semivolatile petroleum hydrocarbon fractions separately. The total concentration of the two fractions analyzed under SW-8015 will be used to assess compliance with stipulated action levels for the purpose of this RFI.
#	Denotes TCLP analysis, results in mg/l.
--	No Data.
FR	Field Replicate.
HHRB	Human health risk based.
J	Estimated value.
N/A	Not Applicable.
NA	Not Analyzed.
ND	Not detected above the method detection limit.
pCi/g	picocuries per gram.
PQL	Practical quantitation limits (defines VOC, SVOC, and TPH).
R	Reject NDs due to interference.
RAD	Radionuclides.
RE	Resample.
SVOC	Semivolatile organic compounds.
TPH	Total petroleum hydrocarbons.
U	Accept data (positive results may be influenced by lab contamination).
UJ	Estimated nondetect.
UTL	Upper tolerance limits (defines metals).
VOC	Volatile organic compounds.

5.37.5 Conclusions and Recommendations

Conclusions

- One VOC and one SVOC were detected in the soil samples submitted from this site; all concentrations were below HHRB action levels.
- The diesel range hydrocarbon detection in borehole ST-248C-03 is probably not indicative of a release. No other constituents indicative of a release (gasoline range hydrocarbons, SVOCs, or metals) were detected in the samples at this location.
- Arsenic, beryllium, and manganese were the only metals detected at concentrations exceeding HHRB action levels; these concentrations appear to be naturally occurring throughout Kirtland AFB.

Recommendations

- Based on the findings of the RFI, no further action is necessary; therefore, ST-248 does not require further investigation. A No Further Action proposal should be prepared.

5.38 SWMU 8-28, Building 20338, OWS Lines (ST-250)

5.38.1 Site Background and Environmental Setting

SWMU 8-28 is in the southeast corner of the covered concrete patio on the north side of Building 20338, the 377th Transportation Squadrons/Allied Trades facility, in the north-central portion of Kirtland AFB. SWMU 8-28 receives inflow from a floor drain system inside the building and from a storm drain near the entrance to the building (Figure 5-28). According to engineering drawings, water-phase liquid discharges west through an outflow pipe and joins a sanitary sewer system D lateral running east-west across the area about 2 ft north of the SWMU 8-28. SWMU 8-28 may be removed in 1996.

SWMU 8-28 is in the urban/industrial zone. The nearest production wells to this site are KAFB-1, 1,900 ft west; KAFB-3, 6,200 ft north-northwest; KAFB-4, 6,000 ft south; and KAFB-7, 6,000 ft southwest.

5.38.2 Study Area Investigation

5.38.2.1 Previous Investigations

During the Stage 2B RFI subsurface soil samples were collected from the perimeter of SWMU 8-28. Analytical results were not indicative of a release from this unit.

5.38.2.2 Data Gaps

Prior to the Appendix III RFI, no data were available to determine if a release occurred from the SWMU 8-28.

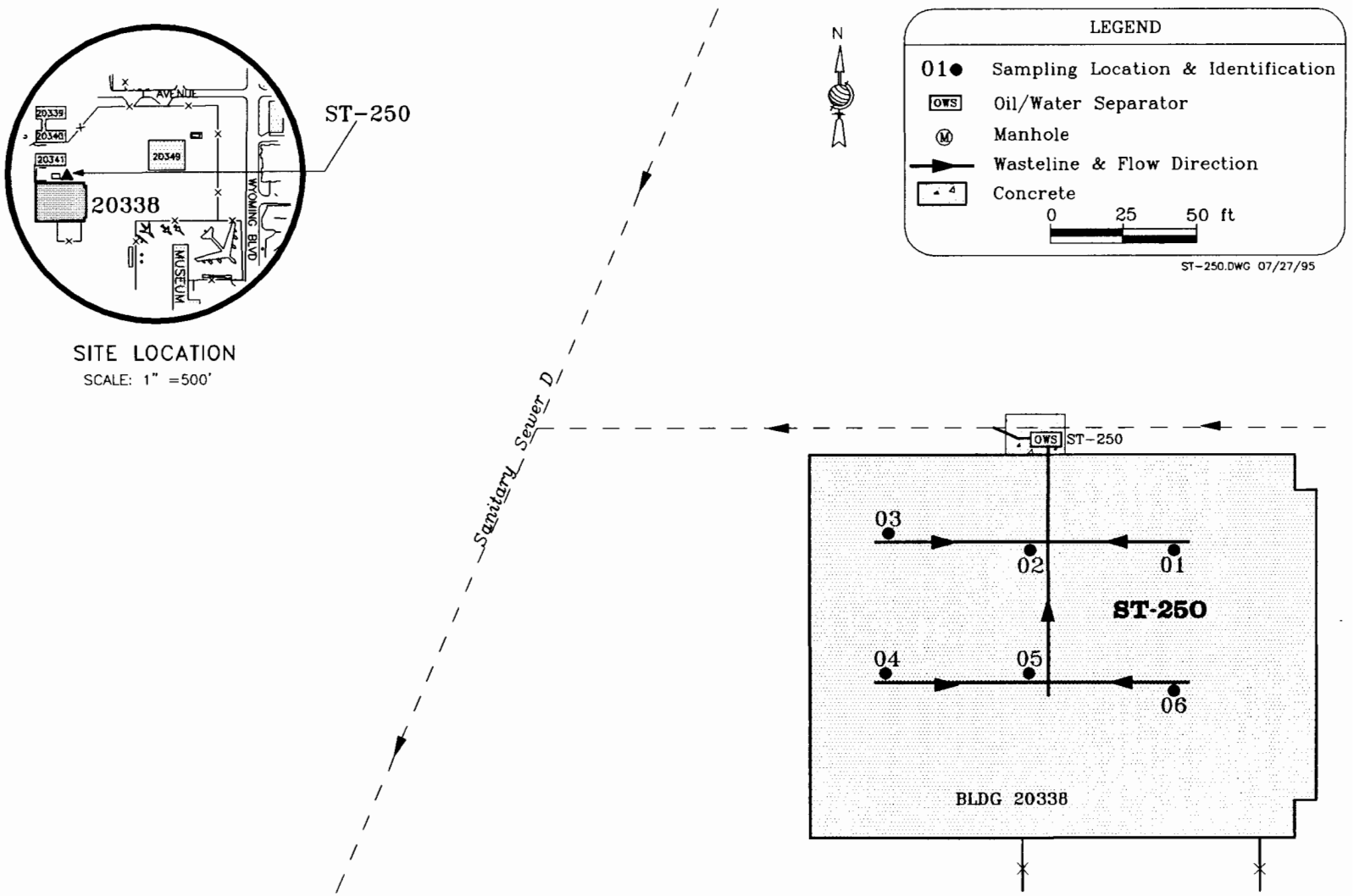


Figure 5-28. Soil Sampling Locations at SWMU 8-28, Building 20338, OWS Lines (ST-250)

5.38.2.3 RFI Field Investigation

The objective of the investigation was to determine if contamination exists in the soil adjacent to the wastelines. Line location lines and sample borehole designation were completed prior to the startup of the soil sampling effort. The soil investigation was limited to the shallow subsurface.

Analytical results from soil samples collected during the Stage 2B RFI were used to characterize the soil adjacent to the OWS inflow and outflow lines within a 50-ft length of SWMU 8-28. Based on engineering drawings, the inflow sources to this OWS are the area drains in the building and a storm drain, running east to west across the entrance walkway to the building. SWMU 8-28 discharges to the sanitary sewer lateral that runs east to west across the area, 2 ft north of the unit. Subsurface line locations were confirmed using methods described in Sections 3.0.

On January 23, 1995, six boreholes were sampled using a Geoprobe. The sample interval at each borehole extended from the depth of the line to 5 ft below the line. From this interval, two samples were collected: one at a depth equal to the base of the line, the other from 3 ft below the base of the line (i.e., 2 to 4 ft and 5 to 7 ft below grade). Both samples were field-screened with a FID organic vapor meter and only the sample with the highest FID reading was submitted to the laboratory for analysis. If no elevated FID readings were detected, the sample collected at the depth closest to the base of the line was submitted for analysis. Including one replicate, seven soil samples were collected along the SWMU 8-28 wastelines and submitted for analysis during the Appendix III RFI.

The analytical results from borehole ST-251-01, collected during the Stage 2B RFI, were used as background concentration data for the samples collected at SWMU 8-28 during the Appendix III RFI.

Sampling operations and sample handling procedures are described in Section 3.0. Sample depths, borehole locations, and replicate sample collected during the Appendix III RFI are listed in Table 5-49. Soil boring logs for the boreholes drilled and sampled at SWMU 8-28 are in Appendix C.

5.38.2.4 Laboratory Analysis

Soil samples were analyzed for VOCs, SVOCs, TPH, metals, mercury (the potential contaminants associated with normal operations at this site), soil pH, and soil moisture. The four brass tubes in each 2-ft sample interval were field-screened for possible contamination using a beta-gamma meter and a FID. All field-screening instrument readings remained at background levels throughout the SWMU 8-28 drilling and sampling activities.

Table 5-49. Boreholes and Samples Analyzed from SWMU 8-28, Building 20338, OWS Lines (ST-250)

Borehole	Borehole Location	Sample Depths (ft)
01	Inside 125 ft E and 98 ft N of the SW corner of Building 20338	2-4
02	Inside 76 ft E and 99 ft N of the SW corner of Building 20338	3-8
03	Inside 27 ft E and 104 ft N of the SW corner of Building 20338	2-7[a]
04	Inside 26 ft E and 56 ft N of the SW corner of Building 20338	1-3
05	Inside 76 ft E and 56 ft N of the SW corner of Building 20338	2-4
06	Inside 125 ft E and 50 ft N of the SW corner of Building 20338	1-3

a. Replicate sample also collected at this interval.

5.38.3 Site Characteristics

5.38.3.1 Geology

Building 20338 is underlain by unconsolidated alluvial sediment that is predominantly fine-grained sand and very fine-grained to fine-grained silty sand. Six boreholes were drilled and a maximum depth of 8 ft below grade was reached in borehole ST-250C-02. No boreholes penetrated into the Santa Fe Group sediments that presumably underlie this area. A discussion of the general geology at Kirtland AFB is presented in Section 2.4.

As a result of SWMU 8-28 line installation, it is probable that backfill material is present adjacent to each line to a depth equal to the total depth of each line. Borehole logs for this site are in Appendix C.

5.38.3.2 Hydrogeology

Groundwater beneath Building 20338 is found within the Upper Santa Fe sediments and is generally thought to be unconfined in the upper portion of the aquifer. This area is within the HR1 saturated zone setting as defined by SNL studies (Figure 2-9) (SNL, 1994). Hydrogeologic characterization in this portion of Kirtland AFB is complicated by the presence of numerous production wells (Figure 2 11). It is probable that uniform groundwater conditions do not exist in this region. Local cones of depression associated with groundwater withdrawal have altered the groundwater flow direction in the vicinity of the well fields (Figure 2-7).

The gradient is probably northwest at this site. Four production wells are near this site: KAFB-1, 1,900 ft west, and KAFB-3, 6,200 ft north-northwest, are downgradient. KAFB-4, 6,000 ft south, and KAFB-7, 6,000 ft southwest, are upgradient (Figures 2-7 and 2-11). Depth to groundwater is estimated to be approximately 350 ft below grade; however, shallower perched water zones may occur (Figure 2-10). Hydraulic conductivity within HR1 is estimated at 2 to 171 ft/day (SNL, 1994). A general discussion of the hydrogeology at Kirtland AFB is presented in Section 2.5.

5.38.4 Nature and Extent of Contamination

The following section describes the nature and extent of contamination based on analytical results for soil samples submitted for analysis from SWMU 8-28. Analytical results are presented in Table 5-50, where only the reportable concentrations are listed. Full analytical results are presented in Appendix F and laboratory validation reports are presented in Appendix K.

Organic Compounds

Methylene chloride (0.005 to 0.006 mg/kg) was detected in four of the seven samples submitted for analysis from SWMU 8-28. It was the only VOC detected. All concentrations were below the 85 mg/kg HHRB action level. Methylene chloride was also detected in associated QC samples and is believed to be the result of laboratory contamination as discussed in Section 3.5.1.

No SVOCs were detected in these samples.

Petroleum Hydrocarbons

No gasoline range hydrocarbons were detected in samples from SWMU 8-28. Diesel range hydrocarbons were only detected in the samples from boreholes ST-250C-04 and ST-250C-05 (Table 5-50). These detected concentrations were below the 100 mg/kg NMED action level. Even though the 74 mg/kg diesel range hydrocarbon concentration in the 1- to 3-ft sample from borehole ST-250C-04 is not accompanied by SVOC or elevated metals concentrations, there probably has been a release in this area.

Metals

Table 5-50 lists all reportable metals concentrations detected at SWMU 8-28 and the respective UTL and HHRB action level concentrations. Arsenic and beryllium were the only metals detected at concentrations above HHRB action levels. Arsenic (1.9 to 8.9 mg/kg) was detected in every sample at a concentration above the HHRB action level concentration of 0.37 mg/kg. The 8.9 mg/kg concentration detected in the 2- to 4-ft sample from borehole ST-250C-01 exceeded the 6.5 mg/kg UTL concentration. Beryllium (0.31 to 0.55 mg/kg) was detected in every sample at concentrations above the 0.15 mg/kg HHRB action level, but below the 0.84 mg/kg UTL concentration. These arsenic and beryllium concentrations appear to be naturally occurring at Kirtland AFB as discussed in Section 4.2.2.

Table 5-50. Summary of Reportable Concentrations for Soil Analyses at SWMU 8-28, Building 20338, OWS Lines (ST-250)[1]
(Concentrations mg/kg)

Chemical Class	Analyte	HHRB Action Level[2]	PQL UTL	Borehole Number and Sample Depth Interval (ft)						
				ST250C-01	*ST250C-02*	*ST250C-03*		*ST250C-04*	*ST250C-05*	*ST250C-06*
				2–4	3–8	2–7 FR	2–7	1–3	2–4	1–3
VOC	Methylene chloride	85.0	0.005	ND	ND	0.006	ND	0.005	0.006	0.006
TPH	Diesel fraction	100	10.0	ND	ND	ND	ND	74.0	4.9	ND
METALS	Aluminum	78,000	14,700	10,200	12,700	7,680	6,470	6,920	7,200	5,580
	Arsenic	0.37	6.5	8.9	4.4	2.4	3.6	1.9	3.1	2.7
	Barium	5,500	735	767	201	160	500	148	347	210
	Beryllium	0.15	0.84	0.35	0.55	0.32	0.32	0.31	0.32	0.33
	Cadmium	39.0	N/A	ND	ND	ND	0.64	ND	1.5	ND
	Calcium	N/A	121,000	114,000	58,200	40,700	109,000	38,600	95,900	184,000
	Chromium, total	390	21.6	6.6	11.9	4.9	5.7	7.0	8.1	6.8
	Cobalt	4,700	15.4	6.1	7.5	4.9	4.8	24.2	4.7	3.8
	Copper	2,900	223	11.5	26.2	12.4	23.4	58.4	39.2	13.7
	Iron	N/A	23,800	12,100	16,400	10,500	7,180	11,200	9,930	5,550
	Lead	400	17.5	3.9	6.9	4.0	3.3	10.1	12.0	3.2
	Magnesium	N/A	10,400	11,600	7,990	4,800	5,470	3,600	5,080	3,790
	Manganese	390	549	162	327	153	92.4	190	152	65.6
	Mercury	23.0	N/A	ND	ND	ND	0.11	ND	0.11	0.15
	Nickel	1,600	188	8.2	15.2	5.3	3.2	6.2	6.6	2.4
	Potassium	N/A	3,590	1,260	2,490	1,280	969	1,710	1,300	976
	Silver	390	N/A	ND	ND	ND	ND	3.4	ND	ND
	Sodium	N/A	787	448	744	691	437	374	314	305
	Thallium	N/A	N/A	0.14	0.11	ND	ND	ND	ND	ND
	Vanadium	550	55.3	64.5	44.0	33.0	27.1	22.6	25.0	15.1
	Zinc	23,000	114	24.7	44.8	23.7	20.7	45.4	37.3	13.9
OTHER	pH			8.9	9.2	8.8	8.6	8.8	8.7	8.7
	Moisture (%)			15.1	9.8	6.9	6.1	4.7	7.3	8.7

FOOTNOTES

1	Complete laboratory analytical results and method detection limits are presented in Appendix K.
2	Action level of RCRA Proposed Rule Subpart S (55 FR 30814, 7/27/90).
*	TPH action level is 100 mg/kg adopted from NMED UST regulations (NMED, 1990). SW-8015 analyzes volatile and semivolatile petroleum hydrocarbon fractions separately. The total concentration of the two fractions analyzed under SW-8015 will be used to assess compliance with stipulated action levels for the purpose of this RFI.
#	Denotes TCLP analysis, results in mg/l.
--	No Data.
FR	Field Replicate.
HHRB	Human health risk based.
J	Estimated value.
N/A	Not Applicable.
NA	Not Analyzed.
ND	Not detected above the method detection limit.
pCi/g	picocuries per gram.
PQL	Practical quantitation limits (defines VOC, SVOC, and TPH).
R	Reject NDs due to interference.
RAD	Radionuclides.
RE	Resample.
SVOC	Semivolatile organic compounds.
TPH	Total petroleum hydrocarbons.
U	Accept data (positive results may be influenced by lab contamination).
UJ	Estimated nondetect.
UTL	Upper tolerance limits (defines metals).
VOC	Volatile organic compounds.

Soil pH and Moisture

Soil pH ranged from 8.6 to 9.2 in these samples. Soil moisture ranged from 4.7 to 15.1 percent.

5.38.5 Conclusions and Recommendations

Conclusions

- No SVOCs and only one VOC and were detected in the soil samples collected from this site. All concentrations were below HHRB action levels.

- Diesel range hydrocarbons were detected at two borehole locations inside Building 20338. The 74 mg/kg concentration in the sample from borehole ST-218C-04 probably indicates that a release has occurred near this location. The 4.9 mg/kg concentration measured in the sample from borehole ST-250C-05 50 ft east may not be related to the diesel detection at borehole ST-250C-04. Neither of these detections is accompanied by SVOCs or elevated metals concentrations that would confirm a release. Although these concentrations are less than the 100 mg/kg NMED action level, higher concentrations may be present in subsurface soil near borehole ST-250C-04.

- Arsenic and beryllium were the only metals detected at concentrations exceeding the HHRB action level; these concentrations appear to be naturally occurring throughout Kirtland AFB.

- The analytical results at SWMU 8-28 indicate a contaminant release has probably occurred near borehole ST-250C-04.

Recommendations

- Based on the findings of the RFI, a release has occurred at SWMU 8-28. Further characterization should be performed near borehole ST-250C-04 to determine the vertical and horizontal extent of potential soil contamination.

5.39 SWMU 8-29, Building 20344, OWS Lines (ST-251)

5.39.1 Site Background and Environmental Setting

SWMU 8-29 is outside on the north side of Building 20344, the 377th Transportation Squadron's Vehicle Maintenance body shop in the north-central portion of Kirtland AFB. According to blueprints from the USAF Civil Engineers, the OWS receives inflow from the Building 20344 floor drains (Figure 5-29). The OWS wasteline system is approximately 250 ft in length. The inflow pipe enters the OWS on the south side and the discharge line exits from the north side. The discharge line ties into lateral of sanitary sewage system D northwest of SWMU 8-29. The OWS may be replaced in 1996.

SWMU 8-29 is in the urban/industrial zone. Four production wells are near this site: KAFB-1, 1,600 ft west; KAFB-3, 6,100 ft north-northwest; KAFB-4, 6,000 ft south; and KAFB-7, 5,800 ft southwest.

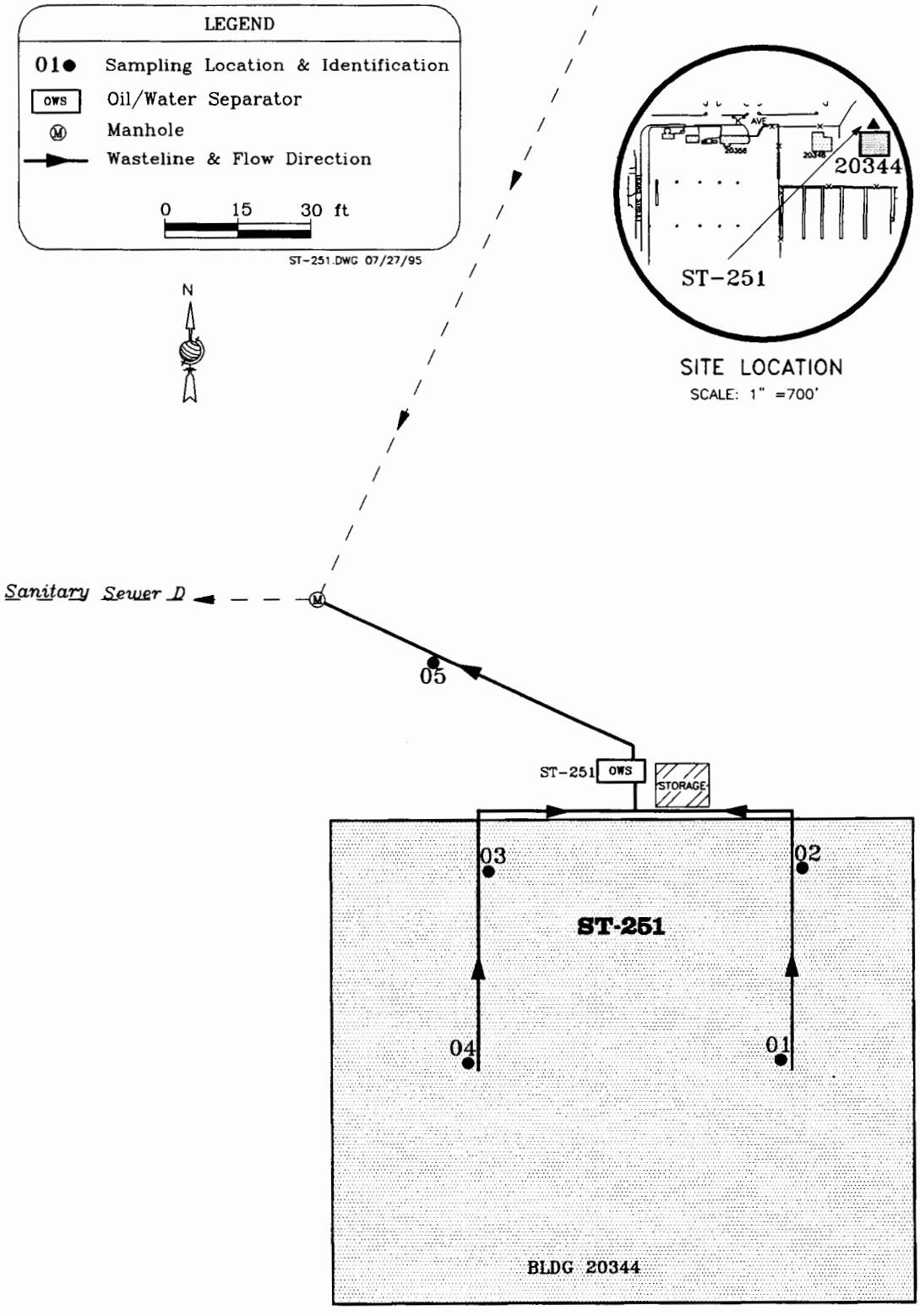


Figure 5-29. Soil Sampling Locations at SWMU 8-29, Building 20344, OWS Lines (ST-251)

5.39.2 Study Area Investigation

5.39.2.1 Previous Investigations

During the Stage 2B RFI, subsurface soil samples were collected from the perimeter of SWMU 8-29. Analytical results from the Stage 2B RFI were not indicative of a release from this unit.

5.39.2.2 Data Gaps

Prior to the Appendix III RFI, no data were available to determine if a release occurred from SWMU 8-29.

5.39.2.3 RFI Field Investigation

The objective of the investigation was to determine the presence or absence of contamination in soil adjacent to the wastelines. Line location and sample borehole designations were completed prior to the soil sampling effort. The soil investigation was limited to the shallow subsurface.

Analytical results from soil samples collected during the Stage 2B RFI were used to characterize the soil adjacent to the OWS inflow and outflow lines within a 50-ft length of SWMU 8-29. Based on engineering drawings, the inflow lines run north from area drains inside the building. The outflow line runs to the sanitary sewer lateral 70 ft northwest. Subsurface line locations were confirmed using methods described in Section 3.0.

On January 31, 1995, five boreholes were sampled using a Geoprobe. The sample interval at each borehole extended from the depth of the line to 5 ft below the line. From this interval, two samples were collected: one at a depth equal to the base of the line, the other from 3 ft below the base of the line (i.e., 1 to 3 ft and 5 to 7 ft below grade). Both samples were field-screened with a FID organic vapor meter and only the sample with the highest FID reading was submitted to the laboratory for analysis. If no FID readings were detected, the sample collected at the depth closest to the base of the line was submitted for analysis. Along the SWMU 8-29 wastelines, six soil samples, including one replicate, were collected and submitted for analysis during the Appendix III RFI.

The analytical results from borehole ST-251-01, collected during the Stage 2B RFI, were used as background concentration data for the samples collected at SWMU 8-29 during the Appendix III RFI.

Sampling operations and sample handling procedures are described in Section 3.0. Sample depths, borehole locations, and replicate sample collected during the Appendix III RFI are listed in Table 5-51. Soil boring logs for the boreholes drilled and sampled at SWMU 8-29 are in Appendix C.

Table 5-51. Boreholes and Samples Analyzed from SWMU 8-29, Building 20344, OWS Lines (ST-251)

Borehole	Borehole Location	Sample Depths (ft)
01	Inside, 27 ft W and 50 ft S of NE corner of Building 20344	1-3
02	Inside, 23 ft W and 10 ft S of NE corner of Building 20344	2-7[a]
03	Inside, 87 ft W and 10 ft S of NE corner of Building 20344	5-7
04	Inside, 92 ft E and 50 ft S of NE corner of Building 20344	1-3
05	21 ft E and 33 ft N of NW corner of Building 20344	4-6

a. Replicate sample also collected at this interval.

5.39.2.4 Laboratory Analysis

Soil samples were analyzed for VOCs, SVOCs, TPH, metals, mercury (the potential contaminants associated with normal operations at this site), soil pH, and soil moisture. The four brass tubes in each 2-ft sample interval were field-screened for possible contamination using a beta-gamma meter and a FID. All field-screening instrument readings remained at background levels throughout the SWMU 8-29 drilling and sampling activities.

5.39.3 Site Characteristics

5.39.3.1 Geology

Building 20344 is underlain by unconsolidated alluvial sediment that is predominantly fine-grained sand and very fine-grained to fine-grained silty sand. A maximum depth of 9 ft below grade was attained in borehole ST-251C-05. No borehole penetrated into the Santa Fe Group sediments that presumably underlie this area. A discussion of the general geology at Kirtland AFB is presented in Section 2.4.

As a result of SWMU 8-29 line installation, it is probable that backfill material is present adjacent to each line to a depth at least equal to the total depth of each line. Borehole logs for this site are presented in Appendix C.

5.39.3.2 Hydrogeology

Groundwater beneath Building 20344 is found within the Upper Santa Fe sediments and is generally thought to be unconfined in the upper portion of the aquifer. This area is within the HR1 saturated zone setting as defined by SNL studies (Figure 2-9) (SNL, 1994). Hydrogeologic characterization in this portion of Kirtland AFB is complicated by the presence of numerous production wells (Figure 2-11). It is probable that uniform groundwater conditions do not exist in this region. Local cones of depression associated with groundwater withdrawal have altered the groundwater flow direction in the vicinity of the well fields (Figure 2-7).

The gradient is probably northwest at this site. Four production wells are near this site: KAFB-1, 1,600 ft west, and KAFB-3, 6,100 ft north-northwest, are downgradient. KAFB-4, 6,000 ft south, and KAFB-7, 5,800 ft southwest, are upgradient (Figures 2-7 and 2-11). Depth to groundwater is estimated to be approximately 350 ft below grade; however, shallower perched water zones may occur (Figure 2-10). Hydraulic conductivity within HR1 is estimated at 2 to 171 ft/day (SNL, 1994). A general discussion of the hydrogeology at Kirtland AFB is presented in Section 2.5.

5.39.4 Nature and Extent of Contamination

The following section describes the nature and extent of contamination based on analytical results for soil samples submitted for analysis from SWMU 8-29. Analytical results for are presented in Table 5-52, where only the reportable concentrations are listed. Full analytical results are presented in Appendix F and laboratory validation reports are presented in Appendix K.

Organic Compounds

Methylene chloride (0.006 to 0.008 mg/kg) was detected in all six samples submitted for analysis from SWMU 8-29. It was the only VOC detected (Table 5-52). All concentrations were below the 85 mg/kg HHRB action level. Methylene chloride was also detected in associated QC samples and is believed to be the result of laboratory contamination as discussed in Section 3.5.1.

Di-n-butylphthalate (0.45 to 1.3 mg/kg) was the only SVOC analyte detected in samples from SWMU 8-29 (Table 5-52). Di-n-butylphthalate was only detected in boreholes ST-251C-03, ST-251C-04, and ST-251C-05. The concentrations detected were below the HHRB action level of 7,800 mg/kg.

Petroleum Hydrocarbons

Diesel range hydrocarbons (up to 7.4 mg/kg) were detected in three samples and one replicate sample from boreholes ST-251C-01, ST-251C-02, and ST-251C-03. All concentrations were below the 100 mg/kg NMED action level.

Table 5-52. Summary of Reportable Concentrations for Soil Analyses at SWMU 8-29, Building 20344, OWS Lines (ST-251)[1]
(Concentrations mg/kg)

Chemical Class	Analyte	HHRB Action Level[2]	PQL UTL	Borehole Number and Sample Depth Interval (ft)					
				ST251C-01	*ST251C-02*		*ST251C-03*	*ST251C-04*	*ST251C-05*
				1–3	2–7 FR	2–7	5–7	1–3	4–6
VOC	Methylene chloride	85.0	0.005	0.008	0.008	0.007	0.007	0.008	0.006
SVOC	Di-n-butylphthalate	7,800	0.70	ND	ND	ND	0.45	0.76	1.3
TPH	Diesel fraction	100	10.0	5.6	7.1	5.7	7.4	ND	ND
METALS	Aluminum	78,000	14,700	8,650	8,790	8,100	8,120	8,510	9,370
	Arsenic	0.37	6.5	6.2	6.1	4.1	4.9	3.8	2.8
	Barium	5,500	735	514	489	243	161	896	140
	Beryllium	0.15	0.84	ND	ND	ND	0.32	ND	0.33
	Calcium	N/A	121,000	159,000	142,000	162,000	65,000	189,000	51,900
	Chromium, total	390	21.6	4.9	4.9	3.9	7.0	4.2	5.1
	Cobalt	4,700	15.4	4.5	4.6	5.3	5.6	3.2	4.1
	Copper	2,900	223	19.5	15.6	7.9	40.1	31.2	19.7
	Iron	N/A	23,800	6,160	5,340	5,720	9,640	5,190	6,690
	Lead	400	17.5	3.3	4.5	3.0	5.9	2.9	4.1
	Magnesium	N/A	10,400	11,200	8,860	10,000	5,220	7,740	4,520
	Manganese	390	549	84.4	91.2	92.1	180	56.2	124
	Mercury	23.0	N/A	ND	ND	ND	0.11	ND	ND
	Nickel	1,600	188	4.5	4.3	6.4	16.2	ND	3.4
	Potassium	N/A	3,590	693	523	539	1,210	649	958
	Sodium	N/A	787	371	164	183	239	350	94.4
	Vanadium	550	55.3	33.4	23.9	22.2	39.8	17.5	22.6
	Zinc	23,000	114	26.8	18.6	17.5	33.7	19.6	21.8
OTHER	pH			8.3	8.5	8.3	10.3	8.0	8.5
	Moisture (%)			15.8	13.9	17.5	7.3	13.7	9.1

FOOTNOTES

1	Complete laboratory analytical results and method detection limits are presented in Appendix K.
2	Action level of RCRA Proposed Rule Subpart S (55 FR 30814, 7/27/90).
*	TPH action level is 100 mg/kg adopted from NMED UST regulations (NMED, 1990). SW-8015 analyzes volatile and semivolatile petroleum hydrocarbon fractions separately. The total concentration of the two fractions analyzed under SW-8015 will be used to assess compliance with stipulated action levels for the purpose of this RFI.
#	Denotes TCLP analysis, results in mg/l.
--	No Data.
FR	Field Replicate.
HHRB	Human health risk based.
J	Estimated value.
N/A	Not Applicable.
NA	Not Analyzed.
ND	Not detected above the method detection limit.
pCi/g	picocuries per gram.
PQL	Practical quantitation limits (defines VOC, SVOC, and TPH).
R	Reject NDs due to interference.
RAD	Radionuclides.
RE	Resample.
SVOC	Semivolatile organic compounds.
TPH	Total petroleum hydrocarbons.
U	Accept data (positive results may be influenced by lab contamination).
UJ	Estimated nondetect.
UTL	Upper tolerance limits (defines metals).
VOC	Volatile organic compounds.

Metals

Table 5-52 lists all reportable metal concentrations detected in soils samples submitted for analysis at SWMU 8-29 and the respective UTL and HHRB action level concentrations. Arsenic and beryllium were the only metals detected at concentrations exceeding the respective HHRB action levels. Arsenic (2.8 to 6.2 mg/kg) was detected in every sample at concentrations above the 0.37 mg/kg HHRB action level but below the 6.5 mg/kg UTL. Beryllium (ND to 0.33 mg/kg) was detected in two of the six samples at concentrations above the 0.15 mg/kg HHRB action level but below the 0.84 mg/kg UTL. The arsenic and beryllium concentrations appear to be naturally occurring at Kirtland AFB as discussed in Section 4.2.2.

Soil pH and Moisture

Soil pH ranged from 8.0 to 10.3 in these samples. Soil moisture ranged from 7.3 to 15.8 percent (Table 5-52).

5.39.5 Conclusions and Recommendations

Conclusions

- One VOC and one SVOC were detected in the soil samples submitted from this site; all concentrations were below HHRB action levels.
- No gasoline range hydrocarbons were detected in soil samples from SWMU 8-29. Diesel range hydrocarbons were detected in three samples and one replicate; all concentrations were below the NMED action level.
- Arsenic and beryllium were the only metals detected at concentrations exceeding the HHRB action level; these concentrations appear to be naturally occurring throughout Kirtland AFB.
- The analytical results at SWMU 8-29 are not indicative of a release from this site.

Recommendations

- Based on the findings of the RFI, no further action is necessary; therefore, SWMU 8-29 does not require further investigation. A No Further Action proposal should be prepared.

5.40 SWMU 8-31, Building 20348, OWS Lines (ST-252)

5.40.1 Site Background and Environmental Setting

ST-252 is near the southeast corner of Building 20348, the 377th Transportation Squadron's tire shop. ST-252 is concrete and is 4.3 ft x 3.6 ft x 1.5 ft with metal grate covers. OWS ST-253 is 20 ft north of ST-252. ST-252 receives inflow from the wash rack area on the south side of the tire shop. Discharge is east 6 ft and then 30 ft north where it joins the discharge from OWS ST-253. The combined discharge runs 150 ft north to join sanitary sewer D (ST-281).

The lines serving ST-252 are in the urban/industrial zone. The nearest production wells to this site are KAFB-1, 2,100 ft west, and Eubank-1, 5,700 ft east.

5.40.2 Study Area Investigation

5.40.2.1 Previous Investigations

During the Stage 2B RFI, subsurface soil samples were collected from the perimeter of ST-252 and ST-253. Analytical results were not indicative of a release from these units. These results are presented in the Stage 2B RFI Report (USAF, 1995).

5.40.2.2 Data Gaps

Prior to the Stage 2B RFI, no data were available to confirm the presence or absence of contaminants in the subsurface soil surrounding this unit.

5.40.2.3 RFI Field Investigation

The objective of the investigation was to determine the presence or absence of contamination in soil adjacent to the wastelines. Because the discharge line length was less than 50 ft, no soil samples were collected at this site during this investigation. The soil samples collected during the Stage 2B RFI at ST-252 and ST-253 and the wasteline samples collected at adjacent OWS ST-253 during the Appendix III RFI (Section 5.41) were used to characterize this site.

5.40.3 Conclusions and Recommendations

Conclusions

- The analytical results from the Stage 2B RFI are not indicative of a release from this unit.
- The analytical results from the Appendix III RFI sampling at the adjacent ST-253 wasteline are not indicative of a release from this site.

Recommendations

- Based on the findings of the RFI, no further action is necessary; therefore, ST-252 does not require further investigation. A No Further Action proposal should be prepared.

5.41 SWMU 8-31, Building 20348, OWS Lines (ST-253)

5.41.1 Site Background and Environmental Setting

ST-253 is near the southeast corner of Building 20348, the 377th Transportation Squadron tire shop. The general location of the unit and its associated lines are shown on Figure 5-30. ST-253 is made of concrete and is 4.3 ft x 3.6 ft x 1.5 ft with metal grate covers. OWS ST-252 is 20 ft south of ST-253. Inflow to ST-253 consists of surface flow from the wash racks on the south side of the building. Discharge is 6 ft east where it is joined by the discharge from ST-252. The combined discharge then runs 150 ft north to join sanitary sewer D (ST-281).

The lines serving ST-253 are in the urban/industrial zone. The nearest production wells to this site are KAFB-1, 2,100 ft west, and Eubank-1, 5,700 ft east.

5.41.2 Study Area Investigation

5.41.2.1 Previous Investigations

During the Stage 2B RFI, subsurface soil samples were collected from the perimeter of OWS ST-252 and ST-253. Analytical results were not indicative of a release from these units. These results are presented in the Stage 2B RFI Report (USAF, 1995).

5.41.2.2 Data Gaps

Prior to the Stage 2B RFI, no data were available to confirm the presence or absence of contaminants in the subsurface soil surrounding this unit.

5.41.2.3 RFI Field Investigation

The objective of the investigations was to determine the presence or absence of contamination in soil adjacent to the wastelines. Line locations and sample borehole designations were completed prior to of the soil sampling effort. The soil investigation was limited to the shallow subsurface. Because of the close proximity of ST-252 and ST-253, the lines associated with these units were sampled together.

Analytical results from soil samples collected during the Stage 2B RFI were used to characterize the soil adjacent to the OWS inflow and outflow lines within a 50-ft length of ST-252 and ST-253. Based on engineering drawings, inflow is from wash rack runoff. The discharge lines from both units run 6 ft east, then turn north to combine and run 150 ft north to the sanitary sewer (sanitary sewer D). Subsurface line locations were determined using methods described in Section 3.0.

On January 6, 1995, two boreholes were sampled using a Geoprobe. The sample interval at each borehole location was driven from the depth of the line to 5 ft below the line. From this interval, two samples were collected from each borehole: one at a depth equal to the base of the line, the other from

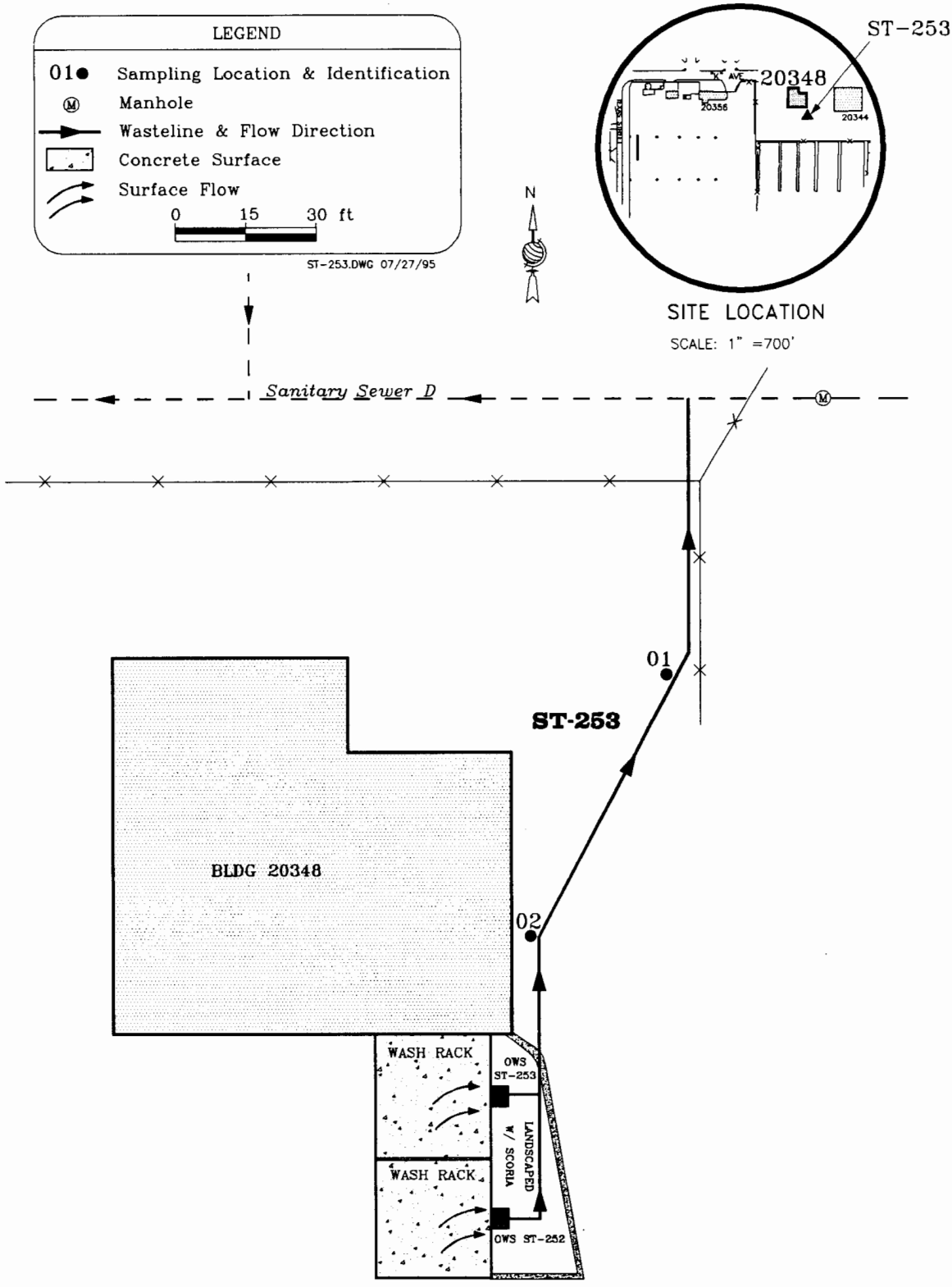


Figure 5-30. Soil Sampling Locations at SWMU 8-31, Building 20348, OWS Lines (ST-253)

3 ft below the base of the line. Both samples were field-screened with a FID organic vapor meter. Only the sample with the highest FID reading was submitted to the laboratory for analysis. If no elevated FID readings were detected, the sample collected at the depth closest to the base of the line was submitted for analysis. Along the discharge lines from ST-252 and ST-253, two soil samples were collected and submitted for laboratory analysis during the Appendix III RFI.

The analytical results from ST-252-01, collected during the Stage 2B RFI, were used as background concentration data for samples collected during the investigation of the wastelines at ST-252 and ST-253. Sample analyses for ST-252-01 included analyses for TPH, VOCs, SVOCs, metals, soil pH, and soil moisture.

Sampling operations and sample handling procedures are described in Section 3.0. Sample depths, borehole locations, and replicate samples collected during the Appendix III RFI are listed in Table 5-53. Soil boring logs for the boreholes drilled and sampled at ST-252 and ST-253 are in Appendix C.

Table 5-53. Boreholes and Samples Analyzed from SWMU 8-31, Building 20348, OWS Lines (ST-253)

Borehole	Borehole Location	Sample Depths (ft)
01	33 ft E and 16 ft N of NE corner of Building 20348	2-4
02	4 ft E and 39 ft S corner of Building 20348	2-4

5.41.2.4 Laboratory Analysis

Soil samples were analyzed for VOCs, SVOCs, TPH, metals, mercury (the potential contaminants associated with normal operations at this site), soil pH, and soil moisture. The four brass tubes in each 2-ft sample interval were field-screened for possible contamination using a beta-gamma meter and a FID. All field-screening instrument readings remained at background levels throughout drilling and sampling activities.

5.41.3 Site Characteristics

5.41.3.1 Geology

The Building 20348 area is underlain by unconsolidated alluvial sediment that is predominantly silty sand to fine-grained sand and very fine-grained sand. Two 7-ft boreholes were drilled at ST-252 and ST-253. No borehole penetrated into the Santa Fe Group sediments that presumably underlie this area. A discussion of the general geology at Kirtland AFB is presented in Section 2.4.

As a result of line installation, it is probable that backfill material is present adjacent to each of these lines to a depth at least equal to the total depth of each line. Borehole logs for this area are presented in Appendix C.

5.41.3.2 Hydrogeology

Groundwater beneath the Building 20348 area is found within the Upper Santa Fe sediments and is generally thought to be unconfined in the upper portion of the aquifer. This area is within the HR1 saturated zone setting as defined by SNL studies (Figure 2-9) (SNL, 1994). Hydrogeologic characterization in this portion of Kirtland AFB is complicated by the presence of numerous production wells (Figure 2-11). It is probable that uniform groundwater conditions do not exist in this region. Local cones of depression associated with groundwater withdrawal have altered the groundwater flow direction in the vicinity of the well fields (Figure 2-7).

The gradient is probably northwest at this site. Two cross-gradient production wells are located near the OWS and area drain: KAFB-1 is 2,100 ft west and Eubank-1 is 5700 ft east (Figures 2-7 and 2-11). Depth to groundwater is estimated to be approximately 350 ft below grade; however, shallower perched water zones may occur (Figure 2-10). Hydraulic conductivity within HR1 is estimated at 2 to 171 ft/day (SNL, 1994). A general discussion of the hydrogeology at Kirtland AFB is presented in Section 2.5.

5.41.4 Nature and Extent of Contamination

The following sections describe the nature and extent of contamination based on the analytical results for soil samples submitted for analysis at ST-252 and ST-253. Analytical results are summarized in Table 5-54, where only the reportable concentrations are listed. Full analytical results are presented in Appendix F and laboratory validation reports are presented in Appendix K.

Organic Compounds

Methylene chloride was the only VOC analyte detected in soil samples submitted for analysis at ST-253. It was detected at a concentration of 0.006 mg/kg in both samples and does not exceed the HHRB action level of 85 mg/kg (Table 5-54). Methylene chloride was also detected in associated QC samples and is believed to be the result of laboratory contamination as discussed in Section 3.5.1.

There were no SVOC analytes detected in either of the soil samples collected at ST-252 and ST-253.

Petroleum Hydrocarbons

Diesel range hydrocarbons were detected in one of the two samples at ST-252 and ST-253. The detected concentration of 5.8 mg/kg does not exceed the NMED action level of 100 mg/kg, and is similar to those measured in background samples collected during the Appendix III RFI. The TPH detection alone is not conclusive evidence of a release from this unit. Because no other release components (such as VOCs, SVOCs, or metals) are present, it is probable that a release has not occurred.

Table 5-54. Summary of Reportable Concentrations for Soil Analyses at SWMU 8-31, Building 20348, OWS Lines (ST-253)[1]
(Concentrations mg/kg)

Chemical Class	Analyte	HHRB Action Level[2]	PQL UTL	Borehole Number and Sample Depth Interval (ft)	
				ST253C-01	*ST253C-02*
				2–4	2–4
VOC	Methylene chloride	85.0	0.005	0.006	0.006
TPH	Diesel fraction	100	10.0	5.8	ND
METALS	Aluminum	78,000	14,700	5,620	5,860
	Arsenic	0.37	6.5	6.8	4.2
	Barium	5,500	735	678	520
	Calcium	N/A	121,000	71,100	111,000
	Chromium, total	390	21.6	5.9	4.3
	Cobalt	4,700	15.4	2.9	4.7
	Copper	2,900	223	8.2	6.5
	Iron	N/A	23,800	6,600	6,530
	Lead	400	17.5	3.0	2.9
	Magnesium	N/A	10,400	5,420	3,880
	Manganese	390	549	66.4	63.2
	Nickel	1,600	188	5.1	5.5
	Potassium	N/A	3,590	681	880
	Sodium	N/A	787	132	113
	Vanadium	550	55.3	27.1	20.9
	Zinc	23,000	114	13.0	12.6
OTHER	pH			8.3	8.4
	Moisture (%)			10.6	12.0

FOOTNOTES

1	Complete laboratory analytical results and method detection limits are presented in Appendix K.
2	Action level of RCRA Proposed Rule Subpart S (55 FR 30814, 7/27/90).
*	TPH action level is 100 mg/kg adopted from NMED UST regulations (NMED, 1990). SW-8015 analyzes volatile and semivolatile petroleum hydrocarbon fractions separately. The total concentration of the two fractions analyzed under SW-8015 will be used to assess compliance with stipulated action levels for the purpose of this RFI.
#	Denotes TCLP analysis, results in mg/l.
--	No Data.
FR	Field Replicate.
HHRB	Human health risk based.
J	Estimated value.
N/A	Not Applicable.
NA	Not Analyzed.
ND	Not detected above the method detection limit.
pCi/g	picocuries per gram.
PQL	Practical quantitation limits (defines VOC, SVOC, and TPH).
R	Reject NDs due to interference.
RAD	Radionuclides.
RE	Resample.
SVOC	Semivolatile organic compounds.
TPH	Total petroleum hydrocarbons.
U	Accept data (positive results may be influenced by lab contamination).
UJ	Estimated nondetect.
UTL	Upper tolerance limits (defines metals).
VOC	Volatile organic compounds.

5.41.4.3 Metals

Table 5-54 lists all reportable metal concentrations detected at ST-253 and the respective UTL and HHRB action level concentrations. Arsenic (6.8 and 4.2 mg/kg) was detected in both of the soil samples at concentrations above the HHRB action level of 0.37 mg/kg. The arsenic concentration detected in ST-253C-01 exceeded the UTL of 6.8 mg/kg. These concentrations of arsenic appear to be naturally occurring throughout Kirtland AFB as discussed in Section 4.2.2.

5.41.4.4 Soil pH and Moisture

Soil pH values were equal to 8.3 and 8.4 in these samples. Soil moisture values were 12.0 and 10.6 percent.

5.41.5 Conclusions and Recommendations

Conclusions

- One VOC was detected in the soil samples collected from this site. All concentrations were below HHRB action levels. No SVOCs were detected.
- No gasoline range hydrocarbons were detected. Diesel range hydrocarbons were detected in one sample collected at this site.
- Arsenic was the only metal detected at a concentration exceeding the HHRB action level; the concentration appears to be naturally occurring throughout Kirtland AFB.
- The analytical results at ST-253 are not indicative of a release from this site.

Recommendations

- Based on the findings of the RFI, no further action is necessary; therefore, ST-253/ST-252 do not require further investigation. A No Further Action proposal should be prepared.

5.42 SWMU 10-7, Building 20365, OWS Lines (ST-254)

5.42.1 Site Background and Environmental Setting

ST-254 is near the north side of Building 20365, a government vehicle car wash. The general location of the unit and its associated lines are shown on Figure 5-31. ST-254 is a concrete unit 9 ft x 6 ft x 6 ft. The unit has two compartments, a metal lid, and individual manholes for each compartment. According to engineering drawings, the unit receives inflow from both car wash bay area drains. An additional inflow line comes from the unused trench drain for the abandoned vehicle maintenance area 100 ft west of Building 20365. The OWS discharges north 50 ft to sanitary sewer D (ST-281).

The lines serving ST-254 are in the urban/industrial zone. The nearest production wells to this site are KAFB-1, 900 ft west; Sandia-6, 3,800 ft the east-southeast; and Eubank-1, 6,400 ft east.

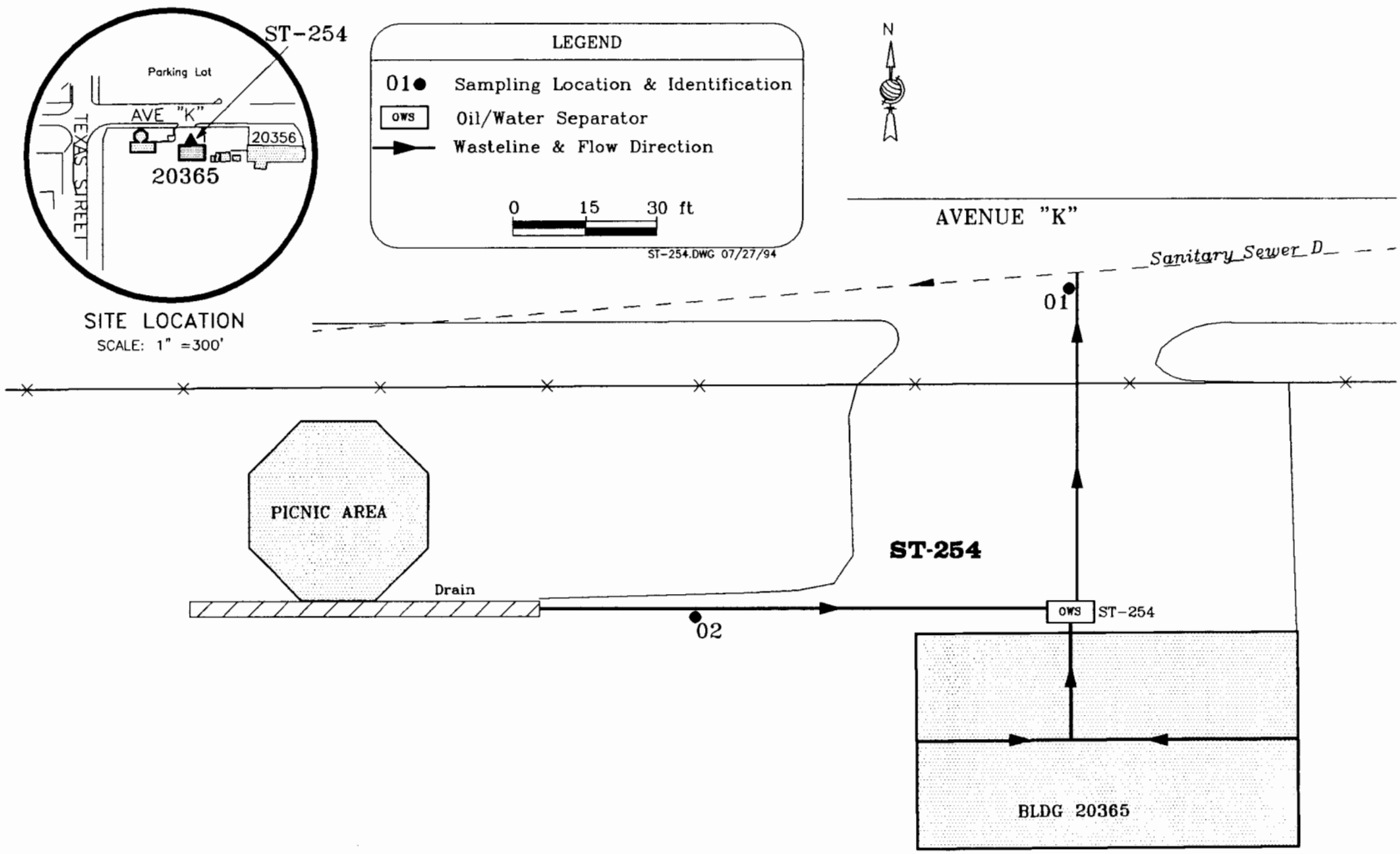


Figure 5-31. Soil Sampling Locations at SWMU 10-7, Building 20365, OWS Lines (ST-254)

5.42.2 Study Area Investigation

5.42.2.1 Previous Investigations

During the Stage 2B RFI, subsurface soil samples were collected from the perimeter of OWS ST-254. Analytical results for these soil samples were not indicative of a release from this unit. These results are presented in the Stage 2B RFI Report (USAF, 1995).

5.42.2.2 Data Gaps

Prior to the Appendix III RFI, no data were available to determine if a release occurred from the ST-254 wastelines.

5.42.2.3 RFI Field Investigation

The objective of the investigation was to determine the presence or absence of contaminants in soil adjacent to the wastelines. Line location and sample borehole designation were completed prior to soil sampling effort. The soil investigation was limited to the shallow subsurface.

Analytical results from soil samples collected during the Stage 2B RFI were used to characterize the soil adjacent to the OWS inflow and outflow lines within a 50-ft length of ST-254. Based on engineering drawings, the inflow lines run from the car wash bay area drains and an unused trench drain for a former vehicle maintenance area 100 ft west of the building. The discharge line runs north 50 ft to sanitary sewer D (ST-281). Subsurface line locations were confirmed using methods described in Section 3.0.

On January 11, 1995, two boreholes were sampled using a Geoprobe. The sample interval at each borehole location was driven from the depth of the line to 5 ft below the line. From this interval, two samples were collected from each borehole: one at a depth equal to the base of the line, the other from 3 ft below the base of the line. Both samples were field-screened with a FID organic vapor meter. Only the sample with the highest FID reading was submitted to the laboratory for analysis. If no elevated FID readings were detected, the sample collected at the depth closest to the base of the line was submitted for analysis. Two soil samples were collected from along the ST-254 wasteline and submitted for laboratory analysis during the Appendix III RFI.

The analytical results from ST-254-01, collected during the Stage 2B RFI, were used as background concentration data for the samples collected at the ST-254 during the Appendix III RFI.

Sampling operations and sample handling procedures are described in Section 3.0. Sample depths, borehole locations, and samples submitted for analysis during the Appendix III RFI are listed in Table 5-55. Corresponding soil boring logs for the boreholes drilled and sampled at ST-254 are in Appendix C.

Table 5-55. Boreholes and Samples Analyzed from SWMU 10-7, Building 20365, OWS Lines (ST-254)

Borehole	Borehole Location	Sample Depths (ft)
01	32 ft E and 72 ft N of NW corner of Building 20365	6-8
02	46 ft W and 2 ft N of NW corner of Building 20365	5-7

5.42.2.4 Laboratory Analysis

Soil samples were analyzed for VOCs, SVOCs, TPH, metals, mercury (the potential contaminants associated with normal operations at this site), soil pH, and soil moisture. The four brass tubes in each 2 ft sample interval were field-screened for possible contamination using a beta-gamma meter (per worker health and safety procedures) and a FID. All field-screening instrument readings remained at background levels throughout the ST-254 drilling and sampling activities.

ST-254-01, collected during the Stage 2B RFI, was used as a background sample during the investigation of the wastelines at ST-254. Sample analyses for ST-254-01 included analyses for TPH, VOCs, SVOCs, metals, soil pH, and soil moisture.

5.42.3 Site Characteristics

Geology

The Building 20365 area is underlain by unconsolidated alluvial sediment that is predominantly silty sand to very fine-grained sand and occasional clayey sand. One 11-ft borehole and one 7-ft borehole were drilled at ST-254. No boreholes penetrated into the Santa Fe Group sediments that presumably underlie this area. A discussion of the general geology at Kirtland AFB is presented in Section 2.4.

As a result of wasteline installation, it is possible that backfill material is present adjacent to each line to a depth equal to the total depth of each line. Borehole logs for this area are presented in Appendix C.

Hydrogeology

Groundwater beneath the Building 20365 area is found within the Upper Santa Fe sediments and is generally thought to be unconfined in the upper portion of the aquifer. This area is within the HR1 saturated zone setting as defined by SNL studies (Figure 2-9) (SNL, 1994). Hydrogeologic characterization in this portion of Kirtland AFB is complicated by the presence of numerous production wells (Figure 2-11). It is probable that uniform groundwater conditions do not exist in this region. Local cones of depression associated with groundwater withdrawal have altered the groundwater flow direction in the vicinity of the well fields (Figure 2-7).

The gradient probably is to the northwest at this site. Three production wells are located near ST-254: KAFB-1 is cross-gradient 900 ft west, Sandia-6 is upgradient 3,800 ft east-southeast, and Eubank-1 is cross-gradient 6,400 ft east (Figures 2-7 and 2-11). Depth to groundwater is estimated to be approximately 350 ft below grade; however, shallower perched water zones may occur (Figure 2-10). Hydraulic conductivity within HR1 is estimated at 2 to 171 ft/day (SNL, 1994). A general discussion of the hydrogeology at Kirtland AFB is presented in Section 2.5.

5.42.4 Nature and Extent of Contamination

The following sections describe the nature and extent of contamination based on the analytical results for soil samples submitted for analysis at ST-254. Analytical results are summarized in Table 5-56, where only the reportable concentrations are listed. Full analytical results are presented in Appendix F and laboratory validation reports are presented in Appendix K.

Organic Compounds

Methylene chloride was the only VOC analyte detected in soil samples submitted for analysis at ST-254. It was detected in both samples at concentrations of 0.007 and 0.008 mg/kg. The concentrations do not exceed the HHRB action level of 85 mg/kg. Methylene chloride was also detected in associated QC samples and is believed to be the result of laboratory contamination as discussed in Section 3.5.1.

There were no SVOC analytes detected in the soil samples collected at ST-254.

Petroleum Hydrocarbons

There were no petroleum hydrocarbons detected in either of the samples collected at ST-254.

Metals

Table 5-56 lists all reportable metal concentrations detected at ST-254 and the respective UTL and HHRB action level concentrations. Arsenic and beryllium were the only metals detected at concentrations above the HHRB action level. Arsenic (3.6 and 4 mg/kg) was detected in both soil samples at concentrations above the HHRB action level of 0.37 mg/kg but below the 6.5 mg/kg UTL. Beryllium (0.43 and 0.45 mg/kg) was detected in both soil samples at concentrations above the HHRB action level of 0.15 mg/kg, but below the 0.84 mg/kg UTL. These constituents appear to be naturally occurring throughout Kirtland AFB as discussed in Section 4.2.2.

Soil pH and Moisture

Soil pH values were 8.4 and 8.3 in these samples. Soil moisture values were equal to 7.2 and 10.4 percent (Table 5-56).

Table 5-56. Summary of Reportable Concentrations for Soil Analyses at SWMU 10-7, Building 20365, OWS Lines (ST-254)[1]
(Concentrations mg/kg)

Chemical Class	Analyte	HHRB Action Level[2]	PQL UTL	Borehole Number and Sample Depth Interval (ft)	
				ST254C-01	*ST254C-02*
				6–8	5–7
VOC	Methylene chloride	85.0	0.005	0.007	0.008
METALS	Aluminum	78,000	14,700	7,880	6,960
	Arsenic	0.37	6.5	3.6	4.0
	Barium	5,500	735	89.2	196
	Beryllium	0.15	0.84	0.43	0.45
	Cadmium	39.0	N/A	ND	0.67
	Calcium	N/A	121,000	56,700	47,300
	Chromium, total	390	21.6	6.0	6.9
	Cobalt	4,700	15.4	4.7	4.2
	Copper	2,900	223	16.1	11.0
	Iron	N/A	23,800	10,200	9,940
	Lead	400	17.5	4.4	4.2
	Magnesium	N/A	10,400	5,170	4,260
	Manganese	390	549	155	130
	Nickel	1,600	188	5.3	5.5
	Potassium	N/A	3,590	1,680	1,320
	Sodium	N/A	787	346	161
	Thallium	N/A	N/A	0.12	ND
	Vanadium	550	55.3	29.4	31.9
	Zinc	23,000	114	27.5	21.9
OTHER	pH			8.4	8.3
	Moisture (%)			7.2	10.4

FOOTNOTES

1	Complete laboratory analytical results and method detection limits are presented in Appendix K.
2	Action level of RCRA Proposed Rule Subpart S (55 FR 30814, 7/27/90).
*	TPH action level is 100 mg/kg adopted from NMED UST regulations (NMED, 1990). SW-8015 analyzes volatile and semivolatile petroleum hydrocarbon fractions separately. The total concentration of the two fractions analyzed under SW-8015 will be used to assess compliance with stipulated action levels for the purpose of this RFI.
#	Denotes TCLP analysis, results in mg/l.
--	No Data.
FR	Field Replicate.
HHRB	Human health risk based.
J	Estimated value.
N/A	Not Applicable.
NA	Not Analyzed.
ND	Not detected above the method detection limit.
pCi/g	picocuries per gram.
PQL	Practical quantitation limits (defines VOC, SVOC, and TPH).
R	Reject NDs due to interference.
RAD	Radionuclides.
RE	Resample.
SVOC	Semivolatile organic compounds.
TPH	Total petroleum hydrocarbons.
U	Accept data (positive results may be influenced by lab contamination).
UJ	Estimated nondetect.
UTL	Upper tolerance limits (defines metals).
VOC	Volatile organic compounds.

5.42.5 Conclusions and Recommendations

Conclusions

- One VOC was detected in the soil samples collected at this site. All concentrations were below HHRB action levels. No SVOCs were detected in samples collected at this site.
- No gasoline or diesel range hydrocarbons were detected in the samples collected at this site.
- Arsenic and beryllium were the only metals detected at concentrations exceeding the HHRB action level; these concentrations appear to be naturally occurring throughout Kirtland AFB.
- The analytical results at ST-254 are not indicative of a contaminant release from this site.

Recommendations

- Based on the findings of the RFI, no further action is necessary; therefore, ST-254 does not require further investigation. A No Further Action proposal should be prepared.

5.43 SWMU 10-7, Building 20375, OWS Lines (ST-255)

5.43.1 Site Background and Environmental Setting

ST-255 is in the east end of Building 20375, the auto hobby shop. Inflow to ST-255 is from a grate-covered channel along the north side of the east end of the building. It is concrete, has a solid metal cover, and is 5.5 ft x 2.5 ft x 3 ft. The channel receives surface drainage from the auto maintenance bays inside the building. The outflow line from the unit runs south 35 ft and then east to a lateral of sanitary sewer D (ST-281) 10 ft south of the building.

The line for this unit is in the urban/industrial zone. The nearest production wells are KAFB-1, 600 ft northwest, and KAFB-7, 4,500 ft southwest.

5.43.2 Study Area Investigation

5.43.2.1 Previous Investigations

During the Stage 2B RFI, subsurface soil samples were collected from the perimeter of OWS ST-255. Analytical results were not indicative of a release from this unit. These results are presented in the Stage 2B RFI Report (USAF, 1995).

5.43.2.2 Data Gaps

Prior to the Stage 2B RFI, no data were available to confirm the presence or absence of contaminants in the subsurface soil surrounding this unit.

5.43.2.3 RFI Field Investigation

Because of the close proximity of ST-255, ST-256, ST-257, and ST-258, the lines associated with these units were sampled together as ST-256. The soil samples collected during the Stage 2B RFI at ST-255, ST-256, ST-257, and ST-258 and the wasteline sample collected at adjacent OWS ST-256 during the Appendix III RFI (Section 5.44) were used to characterize this site.

5.43.3 Conclusions and Recommendations

Conclusions

- The analytical results from the Stage 2B RFI are not indicative of a release from this unit.
- The analytical results from the Appendix III RFI sampling at the adjacent ST-256 wasteline are not indicative of a release from this site.

Recommendations

- Based on the findings of the RFI, no further action is necessary; therefore, ST-255 does not require further investigation. A No Further Action proposal should be prepared.

5.44 SWMU 10-7, Building 20375, OWS Lines (ST-256)

5.44.1 Site Background and Environmental Setting

ST-256 is situated inside Building 20375, the auto hobby shop. The general location of the unit and its associated lines are shown on Figure 5-32. ST-256 is concrete, has solid metal covers, and is 5.7 ft x 2.5 ft x 3 ft. Inflow to ST-256 is from the eastern auto maintenance bay floor drain along the north end of Building 20375. The outflow line from the unit runs west 10 ft, combines with the discharge from ST-258 and ST-257 to run south for 60 ft, and then east to a lateral of sanitary sewer D (ST-281) 10 ft south of the building.

The line for this unit is in the urban/industrial zone. The nearest production wells are KAFB-1, 600 ft northwest, and KAFB-7, 4,500 ft southwest.

5.44.2 Study Area Investigation

5.44.2.1 Previous Investigations

During the Stage 2B RFI, subsurface soil samples were collected from the perimeter of OWS ST-256. Analytical results were not indicative of a release from these units. These results are presented in the Stage 2B RFI Report (USAF, 1995).

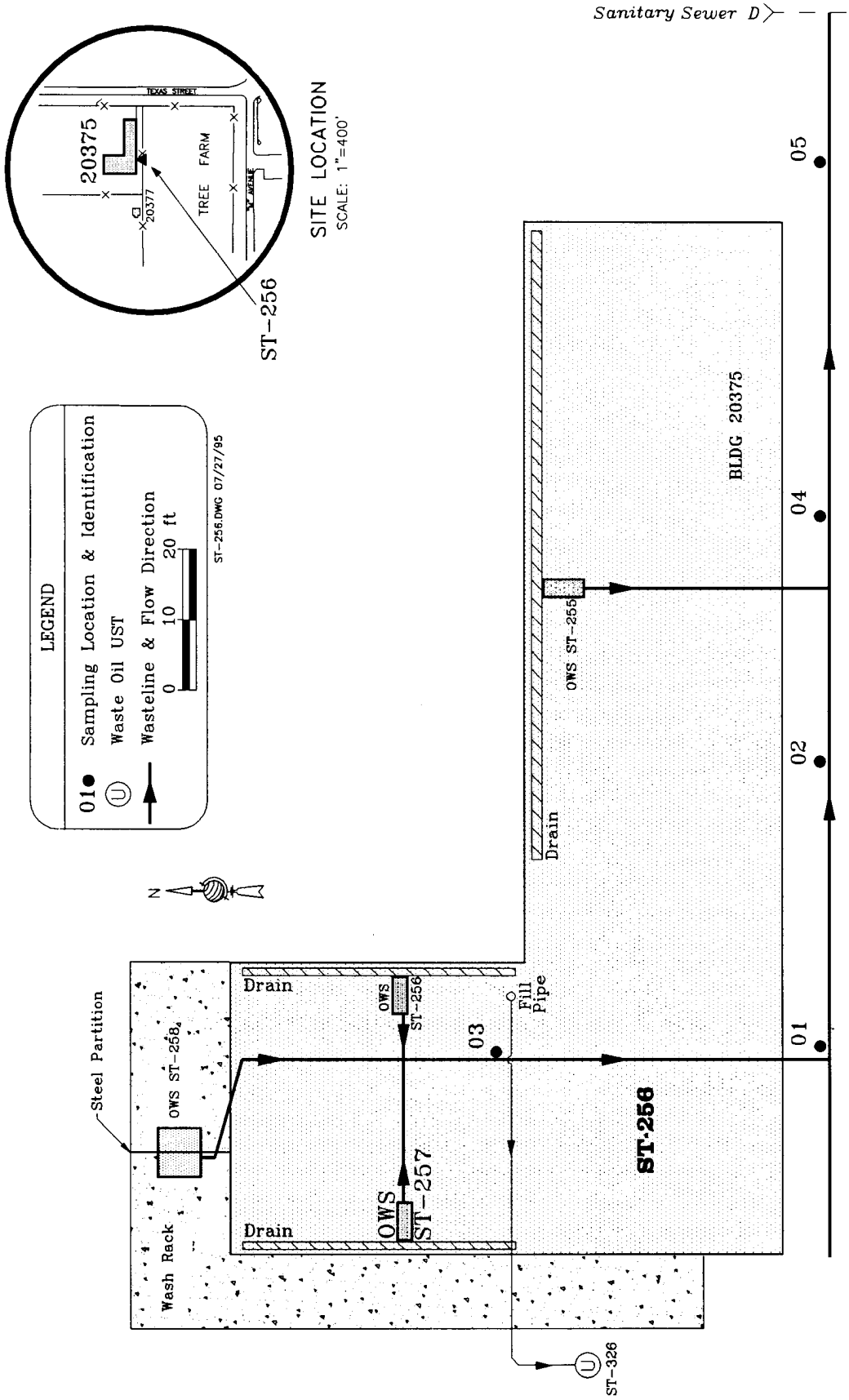


Figure 5-32. Soil Sampling Locations at SWMU 10-7, Building 20375, OWS Lines (ST-256)

5.44.2.2 Data Gaps

Prior to the Stage 2B RFI, no data were available to confirm the presence or absence of contaminants in the subsurface soil surrounding this unit.

5.44.2.3 RFI Field Investigation

Because of the close proximity of ST-255, ST-256, ST-257, and ST-258, the lines associated with these units were sampled together as ST-256. The objective of the investigation was to determine if contamination exists in the adjacent soil. Location of the wastelines and sample borehole designations were completed prior to the soil sampling effort. The soil investigation was limited to the shallow subsurface.

Analytical results from soil samples collected during the Stage 2B RFI were used to characterize the soil adjacent to the inflow and outflow lines within a 50-ft length of ST-256. Based on engineering drawings, the inflow lines are sources from the east and west service bays, as well as the wash rack outside the north end of the building. The discharge lines from these units run south to connect to the sanitary sewer (sanitary sewer D) that runs west along the south side of the building. Subsurface line locations were determined using methods described in Section 3.0.

On January 11, 1995, five boreholes were sampled using a Geoprobe. The sample interval at each borehole location was driven from the depth of the line to 5 ft below the line. From this interval, two samples were collected from each borehole: one at a depth equal to the base of the line, the other from 3 ft below the base of the line. Both samples were field-screened with a FID organic vapor meter. Only the sample with the highest FID reading was submitted to the laboratory for analysis. If no elevated FID readings were detected, the sample collected at the depth closest to the base of the line was submitted for analysis. Along the lines serving ST-256, five soil samples were collected and submitted for laboratory analysis during the Appendix III RFI.

The analytical results from ST-257-01, collected during the Stage 2B RFI, were used as background concentration data for the samples collected at ST-256 during the Appendix III RFI.

Sampling operations and sample handling procedures are described in Section 3.0. Sample depths, borehole locations, and samples collected during the Appendix III RFI are listed in Table 5-57. Corresponding soil boring logs for the boreholes drilled and sampled at ST-256 are in Appendix C.

5.44.2.4 Laboratory Analysis

Soil samples were analyzed for VOCs, SVOCs, TPH, metals, mercury (the potential contaminants associated with normal operations at this site), soil pH, and soil moisture. The four brass tubes in each 2-ft sample interval were field-screened for possible contamination using a beta-gamma meter and a FID. All field-screening instrument readings remained at background levels throughout drilling and sampling activities.

ST-257-01, collected during the Stage 2B RFI, was used as a background sample during the investigation of the inflow and outflow lines at ST-254. The soil sampling and analysis at the background hole included analyses for TPH, VOCs, SVOCs, metals, soil pH, and soil moisture.

Table 5-57. Boreholes and Samples Analyzed from SWMU 10-7, Building 20375, OWS Lines (ST-256)

Borehole	Borehole Location	Sample Depths (ft)
01	30 ft E and 6 ft N of the NW corner of Building 20375	3-5
02	70 ft E and 6 ft N of the NW corner of Building 20375	3-5
03	Inside, 19 ft E and 41 ft N of the NW corner of Building 20375	2-4
04	105 ft E and 6 ft N of the NW corner of Building 20375	7-9
05	9 ft E and 6 ft N of the NE corner of Building 20375	4-9

5.44.3 Site Characteristics

5.44.3.1 Geology

The Building 20375 area is underlain by unconsolidated alluvial sediment that is predominantly very fine-grained to fine-grained silty sand and sand; occasional clayey sand intervals are present. Five boreholes were drilled at Building 20375; a maximum depth of 9 ft below grade was attained in boreholes ST-256C-04 and ST-256C-05. No boreholes penetrated into the Santa Fe Group sediments that presumably underlie this area. A discussion of the general geology at Kirtland AFB is presented in Section 2.4.

As a result of line installation, it is probable that backfill material is present adjacent to each line to a depth at least equal to the each line's depth. Borehole logs for this area are presented in Appendix C.

5.44.3.2 Hydrogeology

Groundwater beneath the Building 20375 area is found within the Upper Santa Fe sediments and is generally thought to be unconfined in the upper portion of the aquifer. This area is within the HR1 saturated zone setting as defined by SNL studies (Figure 2-9) (SNL, 1994). Hydrogeologic characterization in this portion of Kirtland AFB is complicated by the presence of numerous production wells (Figure 2-11). It is probable that uniform groundwater conditions do not exist in this region. Local cones of depression associated with groundwater withdrawal have altered the groundwater flow direction in the vicinity of the well fields (Figure 2-7).

The gradient is probably northwest at this site. Two production wells are near this site: KAFB-1 is downgradient 600 ft northwest and KAFB-7 is upgradient 4,500 ft southwest (Figures 2-7 and 2-11).

Depth to groundwater is estimated to be about 350 ft below grade; however, shallower, perched water zones may occur (Figure 2-10). Hydraulic conductivity within HR1 is estimated at 2 to 171 ft/day (SNL, 1994). A general discussion of the hydrogeology at Kirtland AFB is presented in Section 2.5.

5.44.4 Nature and Extent of Contamination

The following sections describe the nature and extent of contamination based on the analytical results for soil samples submitted for analysis at ST-256. Analytical results for ST-256 are summarized in Table 5-58, where only the reportable concentrations are listed. Full analytical results are presented in Appendix F and laboratory validation reports are presented in Appendix K.

Organic Compounds

Methylene chloride was the only VOC analyte detected in the five soil samples submitted for analysis at ST-260. The detected concentrations of 0.006 to 0.011 mg/kg do not exceed the HHRB action level of 85 mg/kg (Table 5-58). Methylene chloride was also detected in associated QC samples and it believed to be the result of laboratory contamination as discussed in Section 3.5.1.

The SVOC analyte bis(2-ethylhexyl)phthalate (0.64 mg/kg), was detected in one of the five samples. The concentration is below the HHRB action level of 46 mg/kg (Table 5-58).

Petroleum Hydrocarbons

There were no petroleum hydrocarbons detected in the samples collected at ST-256.

Metals

Table 5-58 lists all reportable metal concentrations detected at ST-256 and the respective UTL and HHRB action level concentrations. Arsenic (1.9 to 5.5 mg/kg) was detected in all of the soil samples at concentrations above the HHRB action level of 0.37 mg/kg but below the 6.5 mg/kg UTL. Beryllium was detected in four of the five samples at concentrations ranging from 0.31 to 0.45 mg/kg. The concentrations exceed the 0.15 mg/kg HHRB action level, but are below the 0.84 mg/kg UTL. These concentrations of arsenic and beryllium appear to be naturally occurring throughout Kirtland AFB as discussed in Section 4.2.2.

5.44.4.4 Soil pH and Moisture

Soil pH values ranged from 8.2 to 8.5 in these samples. Soil moisture values ranged from 3.4 to 13.5 percent (Table 5-58).

Table 5-58. Summary of Reportable Concentrations for Soil Analyses at SWMU 10-7, Building 20375, OWS Lines (ST-256)[1]
(Concentrations mg/kg)

Chemical Class	Analyte	HHRB Action Level[2]	PQL UTL	Borehole Number and Sample Depth Interval (ft)				
				ST256C-01 3–5	*ST256C-02* 3–5	*ST256C-03* 2–4	*ST256C-04* 7–9	*ST256C-05* 4–6
VOC	Methylene chloride	85.0	0.005	0.009	0.011	0.015	0.006	0.007
SVOC	Bis(2-ethylhexyl)phthalate	46.0	0.70	ND	ND	0.64	ND	ND
METALS	Aluminum	78,000	14,700	5,360	6,620	7,820	6,130	10,400
	Antimony	31.0	N/A	ND	ND	ND	ND	0.62
	Arsenic	0.37	6.5	4.3	4.5	5.5	1.9	2.4
	Barium	5,500	735	591	947	206	103	200
	Beryllium	0.15	0.84	ND	0.32	0.33	0.31	0.45
	Cadmium	39.0	N/A	ND	ND	ND	ND	0.68
	Calcium	N/A	121,000	140,000	111,000	87,000	31,500	80,100
	Chromium, total	390	21.6	4.3	5.7	5.4	5.7	7.1
	Cobalt	4,700	15.4	2.9	3.9	3.8	6.2	5.2
	Copper	2,900	223	25.8	35.6	34.8	68.8	117
	Iron	N/A	23,800	4,800	7,140	9,430	12,100	10,700
	Lead	400	17.5	2.5	3.9	4.4	5.5	5.7
	Magnesium	N/A	10,400	8,540	5,170	4,000	4,120	4,030
	Manganese	390	549	42.2	74.4	114	284	136
	Nickel	1,600	188	4.6	4.9	7.4	7.0	7.2
	Potassium	N/A	3,590	599	871	1,080	1,470	1,990
	Sodium	N/A	787	129	171	129	301	70.8
	Thallium	N/A	N/A	ND	ND	ND	0.18	ND
	Vanadium	550	55.3	18.0	22.9	25.2	31.9	25.0
	Zinc	23,000	114	13.8	22.7	24.5	47.0	37.5
OTHER	pH			8.5	8.5	8.2	8.5	8.3
	Moisture (%)			13.5	7.6	8.0	3.4	11.2

FOOTNOTES

1	Complete laboratory analytical results and method detection limits are presented in Appendix K.
2	Action level of RCRA Proposed Rule Subpart S (55 FR 30814, 7/27/90).
*	TPH action level is 100 mg/kg adopted from NMED UST regulations (NMED, 1990). SW-8015 analyzes volatile and semivolatile petroleum hydrocarbon fractions separately. The total concentration of the two fractions analyzed under SW-8015 will be used to assess compliance with stipulated action levels for the purpose of this RFI.
#	Denotes TCLP analysis, results in mg/l.
--	No Data.
FR	Field Replicate.
HHRB	Human health risk based.
J	Estimated value.
N/A	Not Applicable.
NA	Not Analyzed.
ND	Not detected above the method detection limit.
pCi/g	picocuries per gram.
PQL	Practical quantitation limits (defines VOC, SVOC, and TPH).
R	Reject NDs due to interference.
RAD	Radionuclides.
RE	Resample.
SVOC	Semivolatile organic compounds.
TPH	Total petroleum hydrocarbons.
U	Accept data (positive results may be influenced by lab contamination).
UJ	Estimated nondetect.
UTL	Upper tolerance limits (defines metals).
VOC	Volatile organic compounds.

5.44.5 Conclusions and Recommendations

Conclusions

- One VOC and one SVOC were detected in the soil samples collected from this site. All concentrations were below HHRB action levels.
- No gasoline or diesel range hydrocarbons were detected in the samples collected at this site.
- Arsenic and beryllium were the only metals detected at concentrations exceeding the HHRB action level; these concentrations appear to be naturally occurring throughout Kirtland AFB.
- The analytical results at ST-256 are not indicative of a release from this site.

Recommendations

- Based on the findings of the RFI, no further action is necessary; therefore, ST-256 does not require further investigation. A No Further Action proposal should be prepared.

5.45 SWMU 10-7, Building 20375, OWS Lines (ST-257)

5.45.1 Site Background and Environmental Setting

ST-257 is inside Building 20375, the auto hobby shop. It is concrete, has solid metal covers, and is 5.7 ft x 2.5 ft x 3 ft. ST-257 is on the east side of Building 20375 (Figure 5-32) and receives runoff from the eastern bay floor drain. The outflow line runs east for 20 ft where it combines with the discharge from ST-258 and ST-256 to run south for 60 ft and then east to a lateral of sanitary sewer D (ST-281) 10 ft south.

The line for this unit is in the urban/industrial zone. The nearest production wells are KAFB-1, 600 ft northwest, and KAFB-7, 4,500 ft southwest.

5.45.2 Study Area Investigation

5.45.2.1 Previous Investigations

During the Stage 2B RFI, subsurface soil samples were collected from the perimeter of OWS ST-257. Analytical results were not indicative of a release from these units. These results are presented in the Stage 2B RFI Report (USAF, 1995).

5.45.2.2 Data Gaps

Prior to the Stage 2B RFI, no data were available to confirm the presence or absence of contaminants in the subsurface soil surrounding this unit.

5.45.2.3 RFI Field Investigation

Because of the close proximity of ST-255, ST-256, ST-257, and ST-258, the lines associated with these units were sampled together as ST-256. The soil samples collected during the Stage 2B RFI at ST-255, ST-256, ST-257, ST-258 and the wasteline sample collected at adjacent OWS ST-256 during the Appendix III RFI (Section 5.44) were used to characterize this site.

5.45.3 Conclusions and Recommendations

Conclusions

- The analytical results from the Stage 2B RFI are not indicative of a release from this unit.
- The analytical results from the Appendix III RFI sampling at the adjacent ST-256 wasteline are not indicative of a release from this site.

Recommendations

- Based on the findings of the RFI, no further action is necessary; therefore, ST-257 does not require further investigation. A No Further Action proposal should be prepared.

5.46 SWMU 10-7, Building 20375, OWS Lines (ST-258)

5.46.1 Site Background and Environmental Setting

ST-258 is associated with a vehicle wash rack at the north end of Building 20375, the auto hobby shop (Figure 5-32). The wash rack is covered by a metal roof the same height as the building and is open along the north side. A metal partition beginning 1 ft above the floor and ending at a height of 7 ft separates the wash rack into two portions. ST-258 is concrete and is 5.8 ft x 4.4 ft x 3 ft. The eastern half of the OWS is covered by a metal grate and is still operated as a car wash. The western half is covered by a solid metal lid and is no longer in use. Inflow to ST-258 is from the wash rack outside the building at the north end. The outflow line runs east-southeast for 15 ft and then south for 25 ft where it combines with the discharge from ST-258 and ST-256. It continues south for 60 ft and then east to sanitary sewer D (ST-281) 10 ft south of the building.

The line for this unit is in the urban/industrial zone. The nearest production wells are KAFB-1, 600 ft northwest, and KAFB-7, 4,500 ft southwest.

5.46.2 Study Area Investigation

5.46.2.1 Previous Investigations

During the Stage 2B RFI, subsurface soil samples were collected from the perimeter of OWS ST-256. Analytical results for these soil samples were not indicative of a release from this unit. These results are presented in the Stage 2B RFI Report (USAF, 1995).

5.46.2.2 Data Gaps

Prior to the Appendix III RFI, no data were available to confirm the presence or absence of contaminants in the subsurface soil surrounding this unit.

5.46.2.3 RFI Field Investigation

Because of the close proximity of ST-255, ST-256, ST-257, and ST-258, the lines associated with these units were sampled together as ST-256. The soil samples collected during the Stage 2B RFI at ST-255, ST-256, ST-257, and ST-258 and the wasteline sample collected at adjacent OWS ST-256 during the Appendix III RFI (Section 5.44) were used to characterize this site.

5.46.3 Conclusions and Recommendations

Conclusions

- The analytical results from the Stage 2B RFI are not indicative of a release from this unit.
- The analytical results from the Appendix III RFI sampling at the adjacent ST-256 wasteline are not indicative of a release from this site.

Recommendations

- Based on the findings of the RFI, no further action is necessary; therefore, ST-258 does not require further investigation. A NFA proposal should be prepared.

5.47 SWMU 10-7, Building 20422, OWS Lines (ST-260)

5.47.1 Site Background and Environmental Setting

ST-260 is outside at a heavy equipment wash rack just east of Building 20422 in the eastern portion of Kirtland AFB. The wash rack is a concrete slab with 18-in. wide, inward sloping edges. Area drain ST-259 is in the middle of the wash rack and ST-260 is on the southwest corner. Building 20422 is a metal shed used to store the sprayers and hoses used for equipment cleaning. The above-ground storage tank south of the wash rack was formerly used to store and dispense heavy oil/asphalt used for road maintenance and is no longer in use. ST-259 and ST-260 were cleaned and repaired in November 1994. The walls of the area drain and separator were sandblasted and coated with an epoxy. The piping

between the area drain and separator was sleeved with a 3-in. diameter pipe that was anchored inside the existing 4-in. pipe. These units are scheduled for replacement in 1996.

ST-259 receives washdown fluids from the wash rack and discharges southwest to ST-260. The OWS is concrete and is 9.5 ft x 3.5 ft x 5 ft with two compartments, each with a solid metal cover. The OWS is surrounded on three sides by a curb about 9 in. high. ST-260 discharges to a sanitary sewer lateral 25 ft east of Building 20422.

The lines serving ST-260 are in the urban/industrial zone. The nearest production wells to this site are KAFB-1, 2,550 ft northwest, and Sandia-6, 3,000 ft east-southeast.

5.47.2 Study Area Investigation

5.47.2.1 Previous Investigations

During the Stage 2B RFI, subsurface soil samples were collected from the perimeter of OWS ST-260. Analytical results indicated a possible release near the outflow of the OWS. These results are presented in the Stage 2B RFI Report (USAF, 1995).

5.47.2.2 Data Gaps

Prior to the Appendix III RFI, no data were available to confirm the presence or absence of contaminants in the subsurface soil surrounding the lines of this unit.

5.47.2.3 RFI Field Investigation

Based on engineering drawings, the inflow sources to ST-260 include the wash rack drains 11 ft to the northeast. The outflow is to the sanitary sewer 25 east of the unit. Because the discharge length was less than 50 ft, no soil samples were collected at this site during this investigation. The soil samples collected during the Stage 2B RFI at ST-260 were used to characterize this site.

5.47.3 Conclusions and Recommendations

Conclusions

- The analytical results from the Stage 2B RFI indicate a possible release near the discharge point of the OWS. Additional sampling will be conducted to define the nature and extent of the release.

Recommendations

- Further investigation has been proposed at ST-260. Additional soil samples will be collected in an attempt to determine the lateral and vertical extent of the subsurface contamination at the unit.

5.48 SWMU 8-47, Building 20423, OWS Lines (ST-261)

5.48.1 Site Background and Environmental Setting

SWMU 8-47 is inside a service bay at the southeast corner of Building 20423, a heavy equipment maintenance shop in the eastern portion of Kirtland AFB. The general location of the unit and its associated lines are shown on Figure 5-33. SWMU 8-47 is a concrete unit 7.3 ft x 3 ft x 2.5 ft. The unit has a metal grate on the south end and a solid metal cover on the north end. The separator receives inflow from a small wash rack and from area drains in the bay floor. Discharge is 65 ft to the west and then north to sanitary sewer D (ST-281). This unit is scheduled for either replacement or closure in 1996.

The lines serving SWMU 8-47 are in the urban/industrial zone. The nearest production wells to this site are KAFB-1, 2,500 ft northwest, and Sandia-6, 3,050 ft east-southeast.

5.48.2 Study Area Investigation

5.48.2.1 Previous Investigations

During the Stage 2B RFI, subsurface soil samples were collected from the perimeter of SWMU 8-47. Analytical results for these soil samples were not indicative of a release from these units. The results are presented in the Stage 2B RFI Report (USAF, 1995).

5.48.2.2 Data Gaps

Prior to the Appendix III RFI, no data were available to confirm the presence or absence of contaminants in the subsurface soil surrounding this unit.

5.48.2.3 RFI Field Investigation

The objective of the investigation was to determine the presence or absence of contamination in soil adjacent to the wastelines. Line location of the wastelines and sample borehole designations were completed prior to soil sampling effort. The soil investigation was limited to the shallow subsurface.

Analytical results from soil samples collected during the Stage 2B RFI were used to characterize the soil adjacent to the inflow and outflow lines within a 50-ft length of SWMU 8-47. Based on engineering drawings, inflow line sources include area drains within the building and a wash rack. Outflow is north to the sanitary sewer D (ST-281) 65 ft west. Subsurface line locations were determined using methods described in Section 3.0.

On January 26, 1995, two boreholes were sampled using a Geoprobe. The sample interval at each borehole location was driven from the depth of the line to 5 ft below the line. From this interval, two samples were collected from each borehole: one at a depth equal to the base of the line, the other from

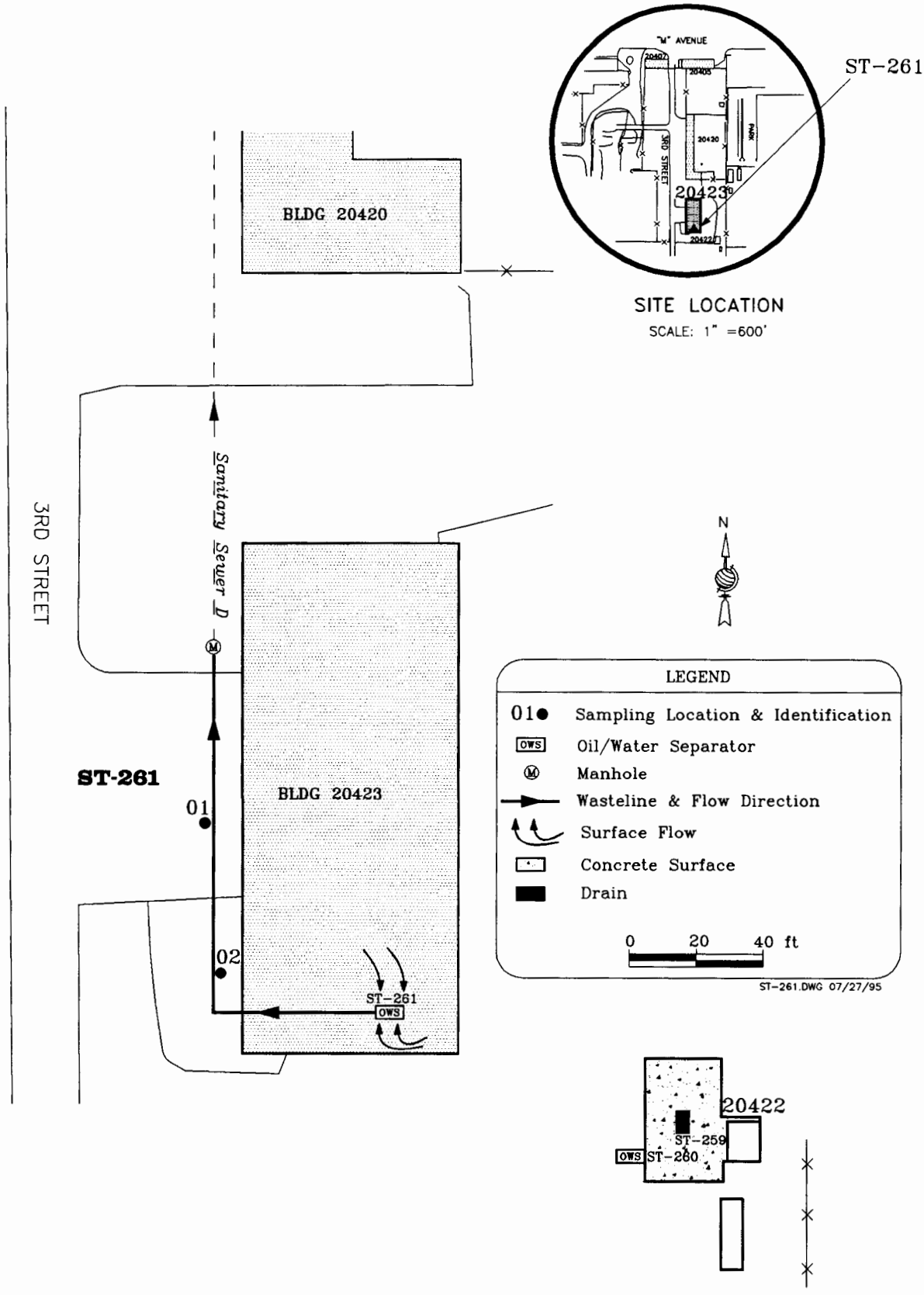


Figure 5-33. Soil Sampling Locations at SWMU 8-47, Building 20423, OWS Lines (ST-261)

3 ft below the base of the line. Both samples were field-screened with a FID organic vapor meter and only the sample with the highest FID reading was submitted to the laboratory for analysis. If no elevated FID readings were detected, the sample collected at the depth closest to the base of the line was submitted for analysis. Along the lines serving SWMU 8-47, two soil samples were collected and submitted for laboratory analysis during the Appendix III RFI.

The analytical results from sample ST-259-01, collected during the Stage 2B RFI were used as background concentration data for the samples collected at SWMU 8-47 during the Appendix III RFI.

Sampling operations and sample handling procedures are described in Section 3.0. Sample depths, borehole locations, and samples collected during the Appendix III RFI are listed in Table 5-59. Corresponding soil boring logs for the boreholes drilled and sampled at SWMU 8-47 are in Appendix C.

Table 5-59. Boreholes and Samples Analyzed from SWMU 8-47, Building 20423, OWS Lines (ST-261)

Borehole	Borehole Location	Sample Depths (ft)
01	9 ft W and 71 N of the SW corner of Building 20423	4-6
02	2 ft W and 22 ft N of the SW corner of Building 20423	3-5

5.48.2.4 Laboratory Analysis

Soil samples were analyzed for VOCs, SVOCs, TPH, metals, mercury (the potential contaminants associated with normal operations at this site), soil pH, and soil moisture. The four brass tubes in each 2-ft sample interval were field-screened for possible contamination using a beta-gamma meter and a FID. All field-screening instrument readings remained at background levels throughout Appendix III RFI drilling and sampling activities.

ST-259-01, collected during the Stage 2B RFI, was used as a background sample during the investigation of the inflow and outflow lines at SWMU 8-47. The soil sampling and analysis at the background hole included analyses for TPH, VOCs, SVOCs, metals, soil pH, and soil moisture.

5.48.3 Site Characteristics

5.48.3.1 Geology

The Building 20423 area is underlain by unconsolidated alluvial sediment that is predominantly silty sand to very fine-grained sand. Two boreholes were drilled at Building 20423. A maximum depth of 9 ft below grade was attained in borehole ST-261C-01. No borehole penetrated into the Santa Fe Group sediments that presumably underlie this area. A discussion of the general geology at Kirtland AFB is presented in Section 2.4.

As a result of line installation, it is probable that backfill material is present adjacent to each line to a depth equal to the total depth of each line. Borehole logs for this area are in Appendix C.

5.48.3.2 Hydrogeology

Groundwater beneath the Building 20423 area is found within the Upper Santa Fe sediments and is generally thought to be unconfined in the upper portion of the aquifer. This area is within the HR1 saturated zone setting as defined by SNL studies (Figure 2-9) (SNL, 1994). Hydrogeologic characterization in this portion of Kirtland AFB is complicated by the presence of numerous production wells. It is probable that uniform groundwater conditions do not exist in this region (Figure 2-11). Local cones of depression associated with groundwater withdrawal have altered the groundwater flow direction in the vicinity of the well fields (Figure 2-7).

The gradient is probably to the northwest. Two production wells are located near SWMU 8-47: KAFB-1 is downgradient 2,500 ft northwest and Sandia-6 is upgradient 3,050 ft east-southeast (Figures 2-7 and 2-11). Depth to groundwater is estimated to be approximately 350 ft below grade; however, shallower perched water zones may occur (Figure 2-10). Hydraulic conductivity within HR1 is estimated at 2 to 171 ft/day (SNL, 1994). A general discussion of the hydrogeology at Kirtland AFB is presented in Section 2.5.

5.48.4 Nature and Extent of Contamination

The following sections describe the nature and extent of contamination based on the analytical results for soil samples submitted for analysis at SWMU 8-47. Analytical results for SWMU 8-47 are summarized in Table 5-60, where only the reportable concentrations are listed. Full analytical results are presented in Appendix F and laboratory validation reports are presented in Appendix K.

Organic Compounds

Methylene chloride was the only VOC analyte detected in the soil samples submitted for analysis at SWMU 8-47. The detected concentration of 0.006 mg/kg does not exceed the HHRB action level of 85 mg/kg. Methylene chloride was also detected in associated QC samples and is believed to be the result of laboratory contamination as discussed in Section 3.5.1.

The SVOC analytes benzyl butyl phthalate and di-n-butylphthalate were detected in both samples. Benzyl butyl phthalate was detected at concentrations of 0.74 and 0.94 mg/kg. Di-n-butylphthalate was detected at concentrations of 2.9 and 4.8 mg/kg. Both analytes were detected at concentrations below respective HHRB action levels.

Petroleum Hydrocarbons

Gasoline range hydrocarbons were detected in one sample at a concentration of 0.60 mg/kg. This concentration does not exceed the NMED action level of 100 mg/kg. Gasoline range hydrocarbons were also detected in associated QC samples and are believed to be the result of laboratory contamination as discussed in Section 3.5.

Table 5-60. Summary of Reportable Concentrations for Soil Analyses at SWMU 8-47, Building 20423, OWS Lines (ST-261)[1]
(Concentrations mg/kg)

Chemical Class	Analyte	HHRB Action Level[2]	PQL UTL	Borehole Number and Sample Depth Interval (ft)	
				ST261C-01	*ST261C-02*
				4–6	3–5
VOC	Methylene chloride	85.0	0.005	0.006	0.006
SVOC	Benzyl butyl phthalate	16,000	1.3	0.94	0.74
	Di-n-butylphthalate	7,800	0.70	2.9	4.8
TPH	Gasoline fraction	100	1.0	0.60	ND
METALS	Aluminum	78,000	14,700	9,300	11,200
	Arsenic	0.37	6.5	8.1	9.0
	Barium	5,500	735	182	362
	Beryllium	0.15	0.84	0.34	0.46
	Cadmium	39.0	N/A	0.92	ND
	Calcium	N/A	121,000	91,900	70,500
	Chromium, total	390	21.6	8.5	8.8
	Cobalt	4,700	15.4	6.2	7.4
	Copper	2,900	223	19.9	19.5
	Iron	N/A	23,800	10,900	14,000
	Lead	400	17.5	5.9	6.8
	Magnesium	N/A	10,400	7,770	7,950
	Manganese	390	549	189	241
	Nickel	1,600	188	7.9	10.4
	Potassium	N/A	3,590	1,390	1,800
	Sodium	N/A	787	158	167
	Thallium	N/A	N/A	0.11	0.16
	Vanadium	550	55.3	52.7	61.6
	Zinc	23,000	114	31.1	37.7
OTHER	pH			8.6	8.2
	Moisture (%)			12.6	12.7

FOOTNOTES

1	Complete laboratory analytical results and method detection limits are presented in Appendix K.
2	Action level of RCRA Proposed Rule Subpart S (55 FR 30814, 7/27/90).
*	TPH action level is 100 mg/kg adopted from NMED UST regulations (NMED, 1990). SW-8015 analyzes volatile and semivolatile petroleum hydrocarbon fractions separately. The total concentration of the two fractions analyzed under SW-8015 will be used to assess compliance with stipulated action levels for the purpose of this RFI.
#	Denotes TCLP analysis, results in mg/l.
--	No Data.
FR	Field Replicate.
HHRB	Human health risk based.
J	Estimated value.
N/A	Not Applicable.
NA	Not Analyzed.
ND	Not detected above the method detection limit.
pCi/g	picocuries per gram.
PQL	Practical quantitation limits (defines VOC, SVOC, and TPH).
R	Reject NDs due to interference.
RAD	Radionuclides.
RE	Resample.
SVOC	Semivolatile organic compounds.
TPH	Total petroleum hydrocarbons.
U	Accept data (positive results may be influenced by lab contamination).
UJ	Estimated nondetect.
UTL	Upper tolerance limits (defines metals).
VOC	Volatile organic compounds.

Metals

Table 5-60 lists all reportable metal concentrations detected at SWMU 8-47 and the respective UTL and HHRB action level concentrations. Arsenic (8.1 and 9.0 mg/kg) was detected in both of the soil samples at concentrations above the HHRB action level of 0.37 mg/kg and above the UTL of 6.5 mg/kg. Beryllium was detected in both of the samples at concentrations of 0.34 and 0.46 mg/kg, but below the 0.84 mg/kg UTL. These concentrations of arsenic and beryllium appear to be naturally occurring at Kirtland AFB as discussed in Section 4.2.2.

Soil pH and Moisture

Soil pH values were 8.6 and 8.2 in these samples. Soil moisture values were equal to 12.6 and 12.7 percent.

5.48.5 Conclusions and Recommendations

Conclusions

- One VOC and two SVOCs were detected in the soil samples collected from this site; all concentrations were below HHRB action levels.
- Gasoline range hydrocarbons were detected in one sample at a concentration below the NMED action level of 100 mg/kg. Because gasoline range hydrocarbons were also detected in associated QC samples, the SWMU 8-47 detection is believed to be the result of laboratory contamination.
- Arsenic and beryllium were the only metals detected at concentrations exceeding the HHRB action level; these concentrations appear to be naturally occurring throughout Kirtland AFB.
- The analytical results at SWMU 8-47 are not indicative of a release from this site.

Recommendations

- Based on the findings of the RFI, no further action is necessary; therefore, SWMU 8-47 does not require further investigation. A No Further Action proposal should be prepared.

5.49 SWMU 8-55, Building 20698, OWS Lines (ST-262)

5.49.1 Site Background and Environmental Setting

SWMU 8-55 is in the wash rack on the west side of Building 20698, the Civil Engineers vehicle wash rack area. The base entomology shop also washes equipment at this site. The general location of the unit and its associated lines are shown on Figure 5-34. The inflow lines to SWMU 8-55 carry flow from a wash rack and area drains in the building; discharge is west to sanitary sewer D (ST-281).

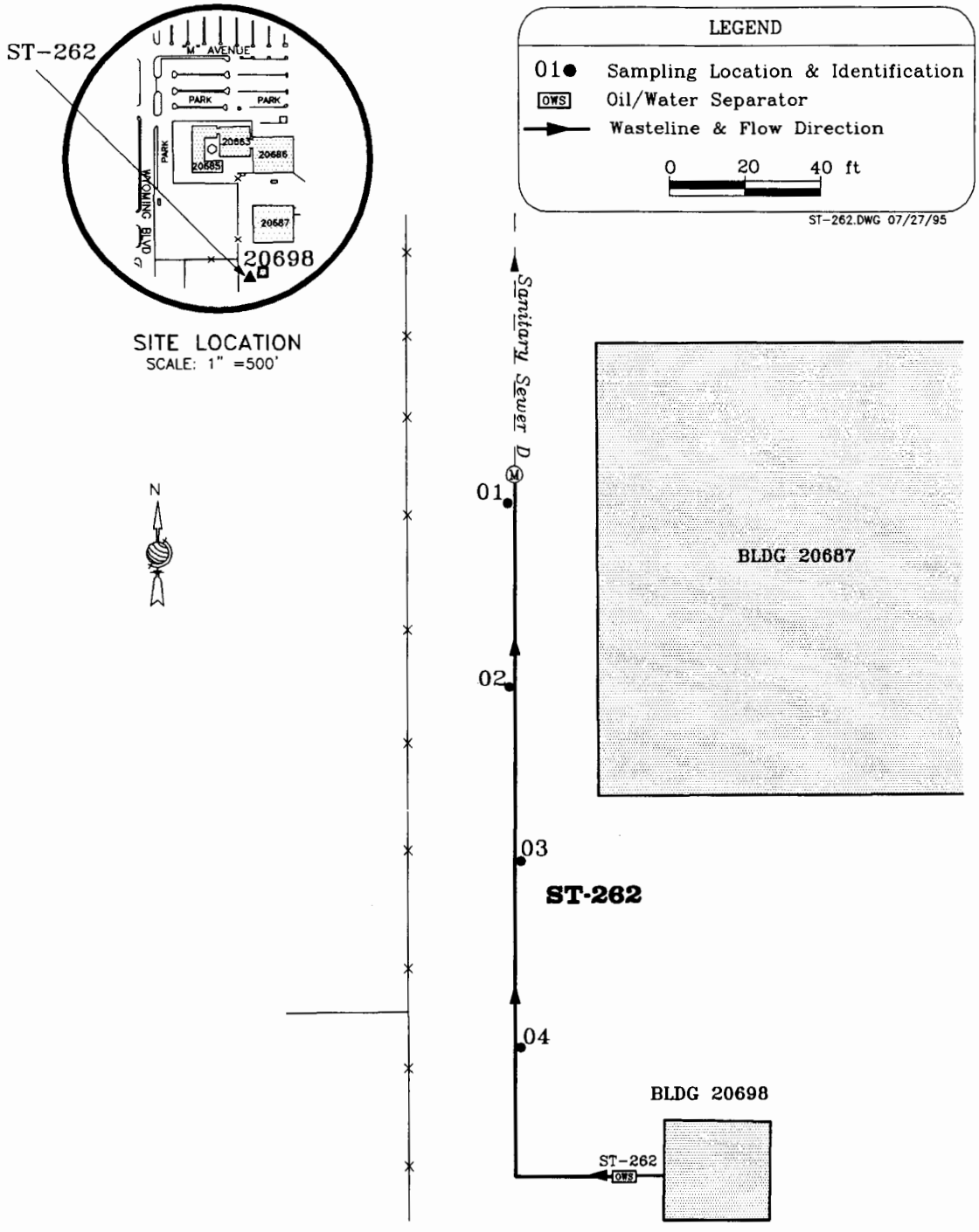


Figure 5-34. Soil Sampling Locations at SWMU 8-55, Building 20698, OWS Lines (ST-262)

The lines serving SWMU 8-55 are in the urban/industrial zone. The nearest production wells to this site are KAFB-1, 3,250 ft west-northwest, and Sandia-6, 2,100 ft east-southeast.

5.49.2 Study Area Investigation

5.49.2.1 Previous Investigations

During the Stage 2B RFI, subsurface soil samples were collected from the perimeter of OWS SWMU 8-55. Analytical results from the Stage 2B RFI did not indicate that contaminants had been released.

5.49.2.2 Data Gaps

Prior to the Appendix III RFI, no data were available that indicated a release occurred from the SWMU 8-55 wastelines.

5.49.2.3 RFI Field Investigation

The objective of the investigation was to determine if contamination exists in the adjacent soil. Location of wastelines and sample borehole designation were completed prior to the startup of the soil sampling effort. Subsurface line locations were confirmed using methods described in Section 3.0. The soil investigation was limited to the shallow subsurface.

Analytical results from samples collected during Stage 2B RFI were used to characterize the soil adjacent to the inflow and outflow lines within a 50-ft radius of SWMU 8-55. Based on engineering drawings, inflow line sources include area drains within the building and a wash rack. Outflow is 30 ft west, then 180 ft north to a sanitary sewer D (ST-281).

On February 6, 1995, four boreholes were sampled using a Geoprobe. The sample interval at each borehole location extended from the depth of the line to 5 ft below the line. From this interval, two samples were collected from each borehole: one at a depth equal to the base of the line, the other from 3 ft below the base of the line. Both samples were field-screened with a FID organic vapor meter and only the sample with the highest FID reading was submitted to the laboratory for analysis. If no FID readings were detected, the sample collected at the depth closest to the base of the line was submitted for analysis. Along the lines serving SWMU 8-55, four soil samples were collected and submitted for laboratory analysis during the Appendix III RFI.

The analytical results from ST-262-01, collected during the Stage 2B RFI, were used as background concentration data for the samples collected at SWMU 8-55 during the Appendix III RFI.

Sampling operations and sample handling procedures are described in Section 3.0. Sample depths, sample locations, and samples collected during the Appendix III RFI are listed in Table 5-61. The corresponding soil boring logs for the boreholes drilled and sampled at SWMU 8-55 are in Appendix C.

Table 5-61. Boreholes and Samples Analyzed from SWMU 8-55, Building 20698, OWS Lines (ST-262)

Borehole	Borehole Location	Sample Depths (ft)
01	14 ft W and 79 ft N of the SW corner of Building 20698	5-7
02	15 ft W and 29 ft N of the SW corner of Building 20698	4-6
03	15 ft W and 17 ft S of the SW corner of Building 20698	3-5
04	15 ft W and 68 ft S of the SW corner of Building 20698	2-4

5.49.2.4 Laboratory Analysis

The soil samples were analyzed for VOCs, SVOCs, TPH, metals, mercury (the potential contaminants associated with normal operations at this site), soil pH, and soil moisture. The four brass tubes in each 2-ft sample interval were field-screened for possible contamination using a beta-gamma meter and a FID. All field-screening instrument readings remained at background levels throughout Appendix III RFI sampling activities at SWMU 8-55.

ST-262-01, collected during Stage 2B RFI work, was used as a background sample during the investigation of the inflow and outflow lines at SWMU 8-55. The soil sampling and analysis at the background hole included analyses for TPH, VOCs, SVOCs, metals, soil pH, and soil moisture.

5.49.3 Site Characteristics

5.49.3.1 Geology

The Building 20698 area is underlain by unconsolidated alluvial sediment that is predominantly very fine-grained sand to silty sand and gravely sand. No borehole penetrated into the Santa Fe Group sediments that presumably underlie this area. A discussion of the general geology at Kirtland AFB is presented in Section 2.5.

As a result of line installation, it is probable that backfill material is present adjacent to each line to a depth equal to each line's total depth. Borehole logs for this area are presented in Appendix C.

5.49.3.2 Hydrogeology

Groundwater beneath SWMU 8-55 is found within the Upper Santa Fe sediments and is generally thought to be unconfined in the upper portion of the aquifer. This area is within the HR1 saturated zone

setting as defined by SNL studies (Figure 2-9) (SNL, 1994). Hydrogeologic characterization in this portion of Kirtland AFB is complicated by the presence of numerous production wells (Figure 2-11). It is probable that uniform groundwater conditions do not exist in this region. Local cones of depression associated with groundwater withdrawal have altered the groundwater flow direction in the vicinity of the well fields (Figure 2-7).

The gradient is probably to the northwest at this site. Two production wells are located near SWMU 8-55: KAFB-1 is cross-gradient 3,250 ft west-northwest and Sandia-6 is upgradient 2,100 ft east-southeast (Figures 2-7 and 2-11). Depth to groundwater is estimated to be approximately 350 ft below grade; however, shallower perched water zones may occur (Figure 2-10). Hydraulic conductivity in the vicinity of HR1 is estimated at 2 to 171 ft/day (SNL, 1994). A more detailed discussion of the hydrogeology at Kirtland AFB is presented in Section 2.5.

5.49.4 Nature and Extent of Contamination

The following sections describe the nature and extent of contamination based on the analytical results. Analytical results for SWMU 8-55 are presented in Table 5-62, where only the reportable concentrations are listed. Full analytical results are presented in Appendix F and laboratory validation reports are presented in Appendix K.

Organic Compounds

There were no VOC or SVOC analytes detected in the soil samples collected at SWMU 8-55.

Petroleum Hydrocarbons

There were no petroleum hydrocarbons detected in the soil samples at SWMU 8-55.

Metals

Table 5-62 lists all reportable metal concentrations detected at SWMU 8-55 and the respective UTL and HHRB action level concentrations. Arsenic (2.2 to 5.0 mg/kg) was detected in all of the soil samples at concentrations above the HHRB action level of 0.37 mg/kg but below the 6.5 mg/kg UTL. Beryllium was detected in two of the four samples with concentrations (0.33 and 0.34 mg/kg) above the HHRB level of 0.15 mg/kg but below the 0.84 mg/kg UTL. These concentrations of arsenic and beryllium appear to be naturally occurring at Kirtland AFB as discussed in Section 4.2.2.

Soil pH and Moisture

Soil pH values ranged from 7.7 to 8.5 in these samples. Soil moisture values ranged from 9.2 to 14.3 percent.

Table 5-62. Summary of Reportable Concentrations for Soil Analyses at SWMU 8-55, Building 20698, OWS Lines (ST-262)[1] (Concentrations mg/kg)

Chemical Class	Analyte	HHRB Action Level[2]	PQL UTL	Borehole Number and Sample Depth Interval (ft)			
				ST262C-01 5–7	*ST262C-02* 4–6	*ST262C-03* 3–5	*ST262C-04* 2–4
METALS	Aluminum	78,000	14,700	8,440	8,190	9,890	5,960
	Arsenic	0.37	6.5	3.1	5.0	2.2	5.5
	Barium	5,500	735	166	456	167	413
	Beryllium	0.15	0.84	0.33	ND	0.34	ND
	Cadmium	39.0	N/A	ND	0.58	ND	ND
	Calcium	N/A	121,000	48,800	144,000	40,900	166,000
	Chromium, total	390	21.6	6.9	5.8	7.1	4.8
	Cobalt	4,700	15.4	6.1	5.7	6.8	4.7
	Copper	2,900	223	24.2	13.9	28.8	23.0
	Iron	N/A	23,800	12,000	8,710	14,200	6,800
	Lead	400	17.5	5.2	3.8	6.2	3.5
	Magnesium	N/A	10,400	5,320	10,400	6,110	9,590
	Manganese	390	549	195	145	237	100
	Mercury	23.0	N/A	ND	0.11	ND	ND
	Nickel	1,600	188	6.6	7.8	7.5	5.3
	Potassium	N/A	3,590	1,750	1,160	1,830	817
	Sodium	N/A	787	156	138	175	139
	Thallium	N/A	N/A	0.14	ND	0.15	0.13
	Vanadium	550	55.3	41.2	45.3	30.8	40.6
	Zinc	23,000	114	32.6	24.2	35.5	21.4
OTHER	pH			7.7	8.3	8.3	8.5
	Moisture (%)			9.2	14.3	12.2	12.9

FOOTNOTES

1	Complete laboratory analytical results and method detection limits are presented in Appendix K.
2	Action level of RCRA Proposed Rule Subpart S (55 FR 30814, 7/27/90).
*	TPH action level is 100 mg/kg adopted from NMED UST regulations (NMED, 1990). SW-8015 analyzes volatile and semivolatile petroleum hydrocarbon fractions separately. The total concentration of the two fractions analyzed under SW-8015 will be used to assess compliance with stipulated action levels for the purpose of this RFI.
#	Denotes TCLP analysis, results in mg/l.
--	No Data.
FR	Field Replicate.
HHRB	Human health risk based.
J	Estimated value.
N/A	Not Applicable.
NA	Not Analyzed.
ND	Not detected above the method detection limit.
pCi/g	picocuries per gram.
PQL	Practical quantitation limits (defines VOC, SVOC, and TPH).
R	Reject NDs due to interference.
RAD	Radionuclides.
RE	Resample.
SVOC	Semivolatile organic compounds.
TPH	Total petroleum hydrocarbons.
U	Accept data (positive results may be influenced by lab contamination).
UJ	Estimated nondetect.
UTL	Upper tolerance limits (defines metals).
VOC	Volatile organic compounds.

5.49.5 Conclusions and Recommendations

Conclusions

- No VOCs or SVOCs were detected in the soil samples collected from this site.
- No gasoline or diesel range hydrocarbons were detected in the soil samples collected from this site.
- Arsenic and beryllium were the only metals detected at concentrations exceeding the HHRB action level; these concentrations appear to be naturally occurring throughout Kirtland AFB.
- The analytical results at SWMU 8-55 are not indicative of a release from this site.

Recommendations

- Based on the findings of the RFI, no further action is necessary; therefore, SWMU 8-55 does not require further investigation. A No Further Action proposal should be prepared.

5.50 SWMU 10-7, Building 23226, OWS Lines (ST-263)

5.50.1 Site Background and Environmental Setting

ST-263 is comprised of two units associated with a wash rack northwest of Building 23226, within a housing complex in the northwestern portion of Kirtland AFB. The general location of the units and associated lines are shown on Figure 5-35. Inflow to ST-263 consists of surface drainage from the concrete wash rack. The discharge line is presumed to run 100 ft west to join an unmapped stormwater sewer system lateral that flows north.

The line serving ST-263 is in the urban/industrial zone. The nearest production wells to this site are KAFB-3, 3,000 ft northwest, and KAFB-1, 4,300 ft southwest.

5.50.2 Study Area Investigation

5.50.2.1 Previous Investigations

During the Stage 2B RFI, subsurface soil samples were collected from the perimeter of ST-263. Analytical results from the Stage 2B RFI did not indicate that contamination had been released at the site.

5.50.2.2 Data Gaps

Prior to the Appendix III RFI, no data were available that indicated a release occurred from the ST-263 wastelines.

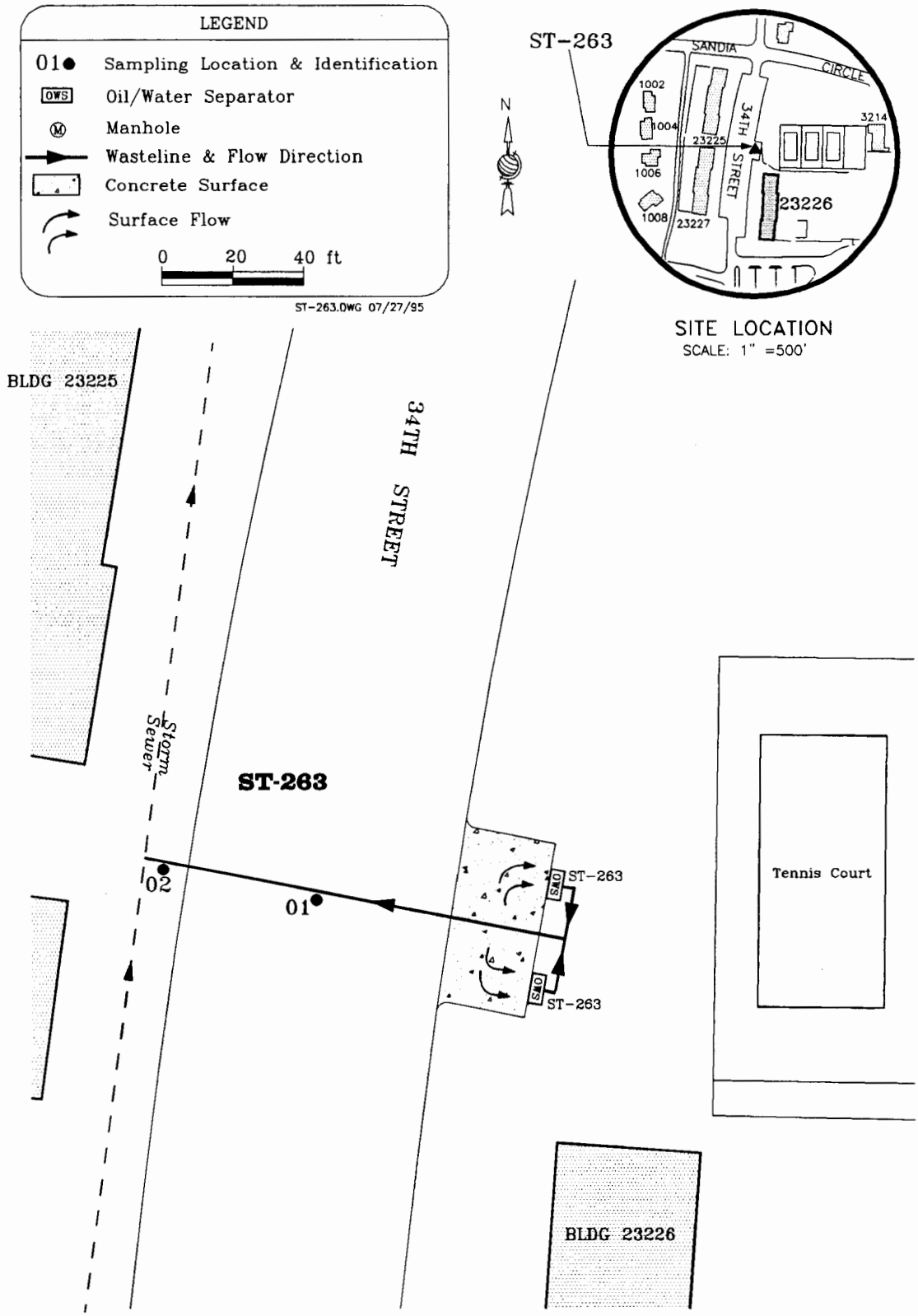


Figure 5-35. Soil Sampling Locations at SWMU 10-7, Building 23226, OWS Lines (ST-263)

5.50.2.3 RFI Field Investigation

The objective of the investigation was to determine if contamination exists in the adjacent soil. Location of wastelines and sample borehole designation were completed prior to startup of the soil sampling effort. The soil investigation was limited to the shallow subsurface.

Analytical results from samples collected during Stage 2B activities were used to characterize the soil adjacent to the inflow and outflow lines within a 50-ft radius of ST-263. Based on engineering drawings, inflow line sources include surface drainage from a concrete wash rack. Discharge is presumably to a storm sewer lateral approximately 100 ft west. Subsurface line locations were confirmed using methods described in Section 3.0.

On December 16, 1994, two boreholes were sampled using a Geoprobe. The sample interval at each borehole location extended from the depth of the line to 5 ft below the line. From this interval, two samples were collected from each borehole: one at a depth equal to the base of the line, the other from 3 ft below the base of the line. Both samples were field-screened with a FID organic vapor meter and only the sample with the highest FID reading was submitted to the laboratory for analysis. If no FID readings were detected, the sample collected at the depth closest to the base of the line was submitted for analysis. Along the lines serving ST-263, two soil samples were collected and submitted for laboratory analysis during the Appendix III RFI.

The analytical results from background sample ST-263-01, collected during the Stage 2B RFI were used as background concentration data for the samples collected at ST-263 during Appendix III RFI.

Sampling operations and sample handling procedures are described in Section 3.0. Sample depths, sample locations, and samples collected during the Appendix III RFI are listed in Table 5-63. The corresponding soil boring logs for the boreholes drilled and sampled at ST-263 are in Appendix C.

Table 5-63. Boreholes and Samples Analyzed from SWMU 10-7, Building 23226, OWS Lines (ST-263)

Borehole	Borehole Location	Sample Depths (ft)
01	55 ft E of borehole 02	3-5
02	28 ft E and 16 ft N of the NE corner of Building 23227	4-6

5.50.2.4 Laboratory Analysis

The soil samples were analyzed for VOCs, SVOCs, TPH, metals, mercury (the potential contaminants associated with normal operations at this site), soil pH, and soil moisture. The four brass tubes in each 2-ft sample interval were field-screened for possible contamination using a beta-gamma meter and a FID. All field-screening instrument readings remained at background levels throughout Appendix III RFI sampling activities at ST-263.

ST-263-01, collected during Stage 2B RFI work, was used as a background sample during the investigation of the inflow and outflow lines at ST-263. The soil sampling and analysis at the background hole included analyses for TPH, VOCs, SVOCs, metals, soil pH, and soil moisture.

5.50.3 Site Characteristics

5.50.3.1 Geology

The ST-263 area is underlain by unconsolidated alluvial sediment that is predominantly silty sand to very fine-grained sand with intermittent sandy gravel. No borehole penetrated into the Santa Fe Group sediments that presumably underlie this area. A discussion of the general geology at Kirtland AFB is presented in Section 2.4.

As a result of wasteline installation, it is probable that backfill material is present adjacent to each line to a depth equal to the total depth of each line. Borehole logs for this area are presented in Appendix C.

5.50.3.2 Hydrogeology

Groundwater beneath ST-263 is found within the Upper Santa Fe sediments and is generally thought to be unconfined in the upper portion of the aquifer. This area is within the HR1 saturated zone setting as defined by SNL studies (Figure 2-9) (SNL, 1994). Hydrogeologic characterization in this portion of Kirtland AFB is complicated by the presence of numerous production wells (Figure 2-11). Uniform groundwater conditions in this region probably do not exist. Local cones of depression associated with groundwater withdrawal have altered the groundwater flow direction in the vicinity of the well fields (Figure 2-7).

The gradient is probably to the northwest at this site. Two production wells are located near ST-263: KAFB-3 is downgradient 3,000 ft northwest and KAFB-1 is cross-gradient 4,300 ft southwest (Figures 2-7 and 2-11). Depth to groundwater is estimated to be approximately 350 ft below grade; however, shallower perched water zones may occur (Figure 2-10). Hydraulic conductivity within HR1 is estimated at 2 to 171 ft/day (SNL, 1994). A general discussion of the hydrogeology at Kirtland AFB is presented in Section 2.5.

5.50.4 Nature and Extent of Contamination

The following sections describe the nature and extent of contamination based on the analytical results. Analytical results for ST-263 are presented in Table 5-64, where only the reportable concentrations are listed. Full analytical results are presented in Appendix F and laboratory validation reports are presented in Appendix K.

Organic Compounds

There were no VOC or SVOC analytes detected in the soil samples collected at ST-263.

Table 5-64. Summary of Reportable Concentrations for Soil Analyses at SWMU 10-7, Building 23226, OWS Lines (ST-263)[1]
(Concentrations mg/kg)

Chemical Class	Analyte	HHRB Action Level[2]	PQL UTL	Borehole Number and Sample Depth Interval (ft)	
				ST263C-01	*ST263C-02*
				3–5	4–6
METALS	Aluminum	78,000	14,700	5,080	4,520
	Arsenic	0.37	6.5	2.0	0.59
	Barium	5,500	735	76.8	54.6
	Cadmium	39.0	N/A	0.52	0.93
	Calcium	N/A	121,000	38,900	28,000
	Chromium, total	390	21.6	6.1	4.0
	Cobalt	4,700	15.4	5.7	6.4
	Copper	2,900	223	27.7	193
	Iron	N/A	23,800	10,300	14,100
	Lead	400	17.5	4.5	3.5
	Magnesium	N/A	10,400	3,320	3,150
	Manganese	390	549	232	228
	Nickel	1,600	188	6.2	4.0
	Potassium	N/A	3,590	1,200	1,420
	Sodium	N/A	787	93.0	214
	Thallium	N/A	N/A	0.11	ND
	Vanadium	550	55.3	21.3	27.2
	Zinc	23,000	114	26.4	84.6
OTHER	pH			8.8	9.0
	Moisture (%)			4.3	2.8

FOOTNOTES

1	Complete laboratory analytical results and method detection limits are presented in Appendix K.
2	Action level of RCRA Proposed Rule Subpart S (55 FR 30814, 7/27/90).
*	TPH action level is 100 mg/kg adopted from NMED UST regulations (NMED, 1990). SW-8015 analyzes volatile and semivolatile petroleum hydrocarbon fractions separately. The total concentration of the two fractions analyzed under SW-8015 will be used to assess compliance with stipulated action levels for the purpose of this RFI.
#	Denotes TCLP analysis, results in mg/l.
--	No Data.
FR	Field Replicate.
HHRB	Human health risk based.
J	Estimated value.
N/A	Not Applicable.
NA	Not Analyzed.
ND	Not detected above the method detection limit.
pCi/g	picocuries per gram.
PQL	Practical quantitation limits (defines VOC, SVOC, and TPH).
R	Reject NDs due to interference.
RAD	Radionuclides.
RE	Resample.
SVOC	Semivolatile organic compounds.
TPH	Total petroleum hydrocarbons.
U	Accept data (positive results may be influenced by lab contamination).
UJ	Estimated nondetect.
UTL	Upper tolerance limits (defines metals).
VOC	Volatile organic compounds.

Petroleum Hydrocarbons

There were no petroleum hydrocarbons detected in the samples collected at ST-263.

5.50.4.3 Metals

Table 5-64 lists all reportable metal concentrations detected at ST-263 and the respective UTL and HHRB action level concentrations. Arsenic (2.0 and 0.59 mg/kg) was detected in both of the soil samples at concentrations above the HHRB action level of 0.37 mg/kg, but below the UTL of 6.5 mg/kg. The arsenic concentrations may be naturally occurring at Kirtland AFB as discussed in section 4.2.2.

Soil pH and Moisture

Soil pH values were equal to 8.8 and 9.0 in these samples. Soil moisture values were equal to 4.3 and 2.8 percent (Table 5-64).

5.50.5 Conclusions and Recommendations

Conclusions

- No VOC or SVOC analytes were detected in the soil samples collected from this site.
- No gasoline or diesel range hydrocarbons were detected in the soil samples collected from this site.
- Arsenic was the only metal detected at a concentration exceeding the HHRB action level; the concentration appears to be naturally occurring throughout Kirtland AFB.
- The analytical results at ST-263 are not indicative of a release from this site.

Recommendations

- Based on the findings of the RFI, no further action is necessary; therefore, ST-263 does not require further investigation. A No Further Action proposal should be prepared.

5.51 SWMU 10-7, Building 30142, OWS Lines (ST-264)

5.51.1 Site Background and Environmental Setting

ST-264 is below the tool crib floor in the north-central part of Building 30142, a vehicle maintenance shop in the DOE Central Training Area, which is located within the MWSA. The general location of the unit is shown on Figure 5-36. Inflow lines to ST-264 carry flow from area drains inside Building 30142. Discharge is approximately 50 ft northwest to the Manzano sanitary sewer.

This site is isolated from the urban/industrial zone and is located at the foot of the Manzano Mountains on the east boundary of the Albuquerque-Belen Basin. No production wells are near this site.

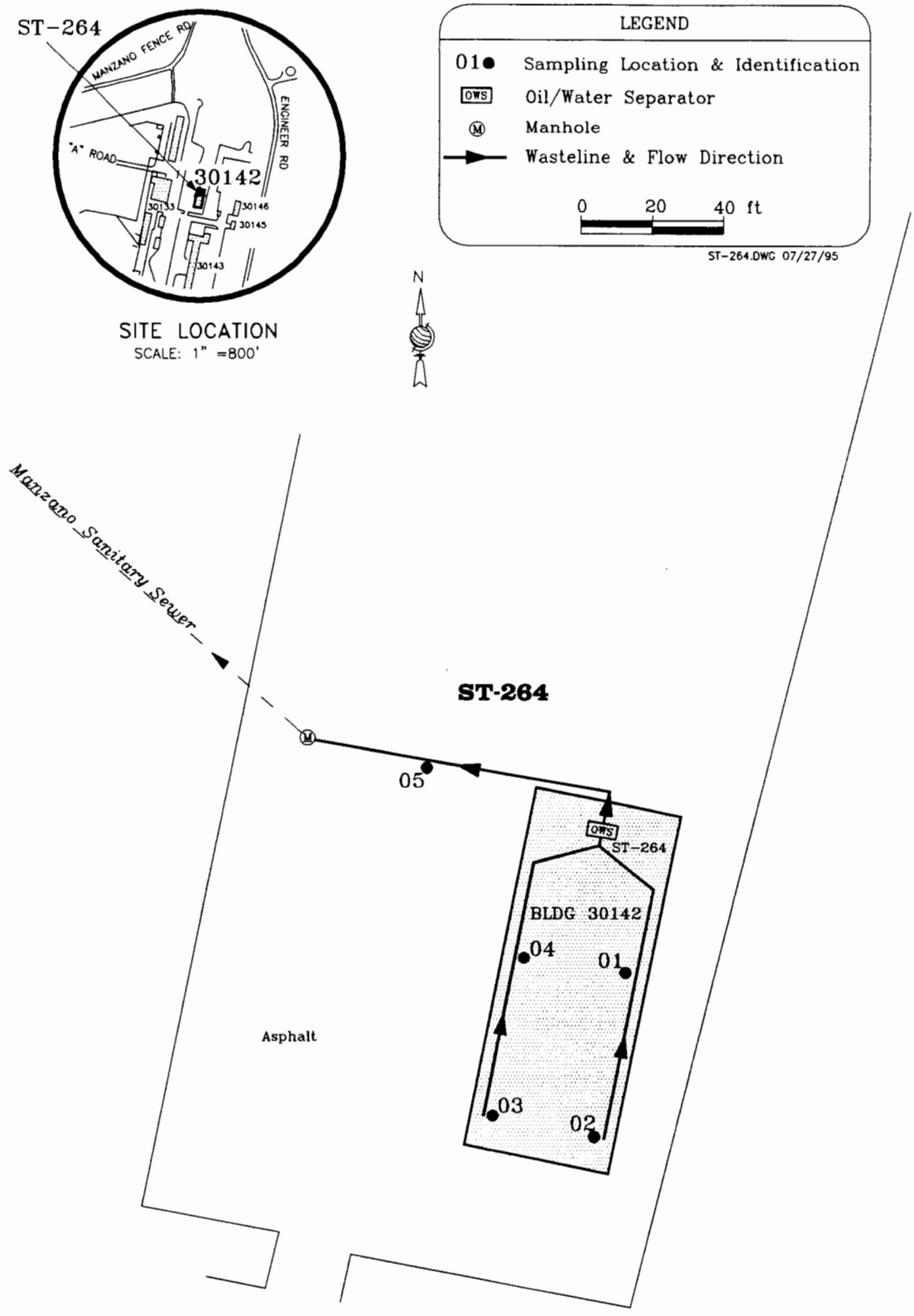


Figure 5-36. Soil Sampling Locations at SWMU 10-7, Building 30142, OWS Lines (ST-264)

5.51.2 Study Area Investigation

5.51.2.1 Previous Investigations

During the Stage 2B RFI, subsurface soil samples were collected from the perimeter of OWS ST-264. Previous investigations sampled source materials as described below. Analytical results from the Stage 2B RFI did not indicate that contaminants had been released.

5.51.2.2 Data Gaps

Prior to the Appendix III RFI, no data were available that indicated a release occurred from the wastelines of ST-264.

5.51.2.3 RFI Field Investigation

The objective of the investigation was to determine if contamination exists in the adjacent soil. Location of wastelines and sample borehole designation were completed prior to the startup of the soil sampling effort. The soil investigation was limited to the shallow subsurface.

Analytical results from samples collected during Stage 2B activities were used to characterize the soil adjacent to the inflow and outflow lines within a 50-ft radius of ST-264. Based on engineering drawings, inflow lines to ST-264 run from the area drains inside Building 30142; discharge lines run 85 ft west to the sanitary sewer. Subsurface line locations were confirmed using methods described in Section 3.0.

On February 1, 1995, five boreholes were sampled using a Geoprobe. The sample interval at each borehole location extended from the depth of the line to 5 ft below the line. From this interval, two samples were collected from each borehole: one at a depth equal to the base of the line, the other from 3 ft below the base of the line. Both samples were field-screened with a FID organic vapor meter and only the sample with the highest FID reading was submitted to the laboratory for analysis. If no FID readings were detected, the sample collected at the depth closest to the base of the line was submitted for analysis. Five soil samples were collected from along the lines serving ST-264 and submitted for laboratory analysis during the Appendix III RFI.

The analytical results from ST-264-01, collected during the Stage 2B RFI, were used as background concentration data for the samples collected at ST-264 during Appendix III RFI.

Sampling operations and sample handling procedures are described in Section 3.0. Sample depths, sample locations, and replicate samples collected during the Appendix III RFI are listed in Table 5-65. Soil boring logs for the boreholes drilled and sampled at ST-264 are in Appendix C.

Table 5-65. Boreholes and Samples Analyzed from SWMU 10-7, Building 30142, OWS Lines (ST-264)

Borehole	Borehole Location	Sample Depths (ft)
01	Inside, 35 ft E and 54 ft N of SW corner of Building 30142	2-4
02	Inside, 35 ft E and 10.5 ft N of SW corner of Building 30142	1-3
03	Inside, 4.5 ft E and 9.5 ft N of SW corner of Building 30142	1-3
04	Inside, 4.5 ft E and 55.5 ft N of SW corner of Building 30142	2-4
05	29 ft W and 7 ft N of NW corner of Building 30142	4-6

5.51.2.4 Laboratory Analysis

The soil samples were analyzed for VOCs, SVOCs, TPH, metals, mercury (the potential contaminants associated with normal operations at this site), soil pH, and soil moisture. The four brass tubes in each 2-ft sample interval were field-screened for possible contamination using a beta-gamma meter and a FID. All field-screening instrument readings remained at background levels throughout Appendix III RFI sampling activities at ST-264.

ST-264-01, collected during Stage 2B RFI work, was used as a background sample during the investigation of the inflow and outflow lines at ST-264. The soil sampling and analysis at the background hole included analyses for TPH, VOCs, SVOCs, metals, soil pH, and soil moisture.

5.51.3 Site Characteristics

5.51.3.1 Geology

The Manzano portion of Kirtland AFB is a built-up facilities area isolated from the main urban/ industrial part of Kirtland AFB. It is located at the base of a subgroup of the Manzano Mountains, known locally as the Four Hills, on the east boundary of the Albuquerque-Belen Basin. The Santa Fe Group in this area is thin or absent. Auger holes drilled by the USGS about 1,000 ft west (toward the Albuquerque-Belen Basin) penetrated weathered granite at about 100 ft. Granite may be shallower in the area. The alluvium contains course-grained granite wash but, near the mountain front, it may be poorly sorted. Thus, permeability may be low regardless of the course-grained material. Surface soil is gravelly.

The Building 30142 area is underlain by unconsolidated alluvial sediment and weathered granite that is predominantly silty sand to fine-grained sand. Five boreholes ranging from 6 to 9 ft deep were drilled at ST-264. A discussion of the general geology at Kirtland AFB is presented in Section 2.4.

As a result of installation of the lines it is probable that the backfill material is present adjacent to each line to a depth equal to the total depth of each line. Borehole logs for this area are presented in Appendix C.

5.51.3.2 Hydrogeology

This site is in the HR2 saturated zone setting as defined by SNL studies (Figure 2-9) (SNL, 1994). This zone straddles the Tijeras/Hubbell Springs/Sandia Fault complex. The saturated zone hydrology is characterized by the juxtaposition of higher permeability Santa Fe Group sediments against low-permeability Paleozoic and Precambrian bedrock (Thorn *et al.*, 1993). Santa Fe Group sediments are faulted down to the west across the faults. Very little is known about groundwater flow in this region except that a steep gradient exists across the fault zone. East of the fault zone, the static water elevation is estimated at 5,710 ft amsl except at Sandia Technical Area III, where the static water elevation drops to 4,920-4,935 ft amsl at Sandia Technical Area III (Figure 2-7).

Groundwater beneath ST-264 is estimated to be approximately 320 ft below the surface (Figure 2-10). This area may serve as a recharge area for the Albuquerque basin aquifer with groundwater movement west across the fault (SNL, 1994). A general discussion of the hydrogeology at Kirtland AFB is presented in Section 2.5.

5.51.4 Nature and Extent of Contamination

The following sections describe the nature and extent of contamination based on the analytical results. Analytical results for ST-264 are presented in Table 5-66, where only the reportable concentrations are listed. Full analytical results are presented in Appendix F and laboratory validation reports are presented in Appendix K.

Organic Compounds

Methylene chloride (0.006 to 0.007 mg/kg) was the only VOC analyte detected in the soil samples collected at ST-264. The concentrations were below the HHRB action level of 85.0 mg/kg. Methylene chloride was also detected in associated QC samples and is believed to be the result of laboratory contamination as discussed in Section 3.5.1.

Di-n-butylphthalate was the only SVOC analyte detected in the soil samples collected at ST-264. The concentrations, ranging from 1.4 to 2.1 mg/kg, are below the HHRB action level of 7,800 mg/kg.

Petroleum Hydrocarbons

There were no petroleum hydrocarbons detected in any of the soil samples collected at ST-264.

Table 5-66. Summary of Reportable Concentrations for Soil Analyses at SWMU 10-7, Building 30142, OWS Lines (ST-264)[1]
(Concentrations mg/kg)

Chemical Class	Analyte	HHRB Action Level[2]	PQL UTL	Borehole Number and Sample Depth Interval (ft)				
				ST264C-01 2–4	*ST264C-02* 1–3	*ST264C-03* 1–3	*ST264C-04* 2–4	*ST264C-05* 4–6
VOC	Methylene chloride	85.0	0.005	0.006	0.006	ND	0.007	0.006
SVOC	Di-n-butylphthalate	7,800	0.70	1.4	1.4	1.8	2.0	2.1
METALS	Aluminum	78,000	14,700	9,400	9,630	11,900	11,300	8,300
	Arsenic	0.37	6.5	ND	ND	1.1	1.4	0.40
	Barium	5,500	735	83.1	71.9	77.1	128	68.6
	Beryllium	0.15	0.84	0.31	0.31	0.32	0.44	0.31
	Cadmium	39.0	N/A	ND	ND	ND	ND	0.63
	Calcium	N/A	121,000	8,930	17,000	31,800	25,000	7,780
	Chromium, total	390	21.6	8.0	9.4	8.6	9.8	4.3
	Cobalt	4,700	15.4	11.7	10.7	11.3	11.5	9.8
	Copper	2,900	223	129	155	43.4	34.4	41.6
	Iron	N/A	23,800	18,200	16,500	15,500	17,800	15,200
	Lead	400	17.5	5.0	5.0	4.7	6.0	4.0
	Magnesium	N/A	10,400	7,190	6,500	6,260	8,620	5,880
	Manganese	390	549	395	346	301	350	399
	Nickel	1,600	188	11.0	8.7	9.0	11.5	5.5
	Potassium	N/A	3,590	2,610	2,240	2,550	2,780	2,440
	Sodium	N/A	787	190	152	269	182	73.8
	Thallium	N/A	N/A	0.12	0.13	0.12	0.14	0.11
	Vanadium	550	55.3	33.0	32.6	29.1	41.4	25.0
	Zinc	23,000	114	123	84.2	50.4	49.2	55.7
OTHER	pH			9.6	9.2	9.0	9.2	8.8
	Moisture (%)			3.1	3.4	5.5	8.6	4.1

FOOTNOTES

1	Complete laboratory analytical results and method detection limits are presented in Appendix K.
2	Action level of RCRA Proposed Rule Subpart S (55 FR 30814, 7/27/90).
*	TPH action level is 100 mg/kg adopted from NMED UST regulations (NMED, 1990). SW-8015 analyzes volatile and semivolatile petroleum hydrocarbon fractions separately. The total concentration of the two fractions analyzed under SW-8015 will be used to assess compliance with stipulated action levels for the purpose of this RFI.
#	Denotes TCLP analysis, results in mg/l.
--	No Data.
FR	Field Replicate.
HHRB	Human health risk based.
J	Estimated value.
N/A	Not Applicable.
NA	Not Analyzed.
ND	Not detected above the method detection limit.
pCi/g	picocuries per gram.
PQL	Practical quantitation limits (defines VOC, SVOC, and TPH).
R	Reject NDs due to interference.
RAD	Radionuclides.
RE	Resample.
SVOC	Semivolatile organic compounds.
TPH	Total petroleum hydrocarbons.
U	Accept data (positive results may be influenced by lab contamination).
UJ	Estimated nondetect.
UTL	Upper tolerance limits (defines metals).
VOC	Volatile organic compounds.

Metals

Table 5-66 lists all reportable metal concentrations detected at ST-264 and the respective UTL and HHRB action level concentrations. Arsenic (0.4 to 1.4 mg/kg) was detected in three samples at concentrations exceeding the HHRB action level of 0.37 mg/kg but below the 6.5 mg/kg UTL. Beryllium was detected in all five samples at concentrations ranging from 0.31 to 0.44 mg/kg, exceeding the HHRB action level of 0.15 mg/kg but below the 0.84 mg/kg UTL. Manganese (301 to 399 mg/kg) was detected in two samples at concentrations exceeding the 390 HHRB action level but below the 549 mg/kg UTL. The arsenic, beryllium, and manganese concentrations may be naturally occurring at Kirtland AFB as discussed in Section 4.2.2.

Soil pH and Moisture

Soil pH values ranged from 8.8 to 9.6 in these samples. Soil moisture values ranged from 3.1 to 8.6 percent.

5.51.5 Conclusions and Recommendations

Conclusions

- One VOC and one SVOC were detected in the soil samples collected from this site; all concentrations were below HHRB action levels.
- No gasoline or diesel range hydrocarbons were detected in soil samples collected from this site.
- Arsenic, beryllium, and manganese were the only metals detected at concentrations exceeding the HHRB action level; these concentrations appear to be naturally occurring throughout Kirtland AFB.
- The analytical results at ST-264 are not indicative of a release from this site.

Recommendations

- Based on the findings of the RFI, no further action is necessary; therefore, ST-264 does not require further investigation. A No Further Action proposal should be prepared.

5.52 SWMU 10-7, Building 30146, OWS Lines (ST-265)

5.52.1 Site Background and Environmental Setting

ST-265 is inside the service bay near the east side of Building 30146 that is in the DOE Central Training Area which is located within the MWSA. Inflow sources to ST-265 carry flow from two area drains inside the building. Inflow lines are 15 and 30 ft in length; discharge is 10 ft east to the Manzano Base sanitary sewer.

This site is isolated from the urban/industrial zone at the foot of the Manzano Mountains on the east boundary of the Albuquerque-Belen Basin. No production wells are near this site.

5.52.2 Study Area Investigation

5.52.2.1 Previous Investigations

During the Stage 2B RFI, subsurface soil samples were collected from the perimeter of OWS ST-265. Analytical results indicate that contaminants had been released at the OWS.

5.52.2.2 Data Gaps

Prior to the Appendix III RFI, no data were available that indicated a release occurred from the wastelines of ST-265.

5.52.2.3 RFI Field Investigation

Based on engineering drawings, the inflow and outflow lines to ST-265 are less than 50 ft in length. Line location activities were performed as described in Section 3.0. The samples collected for the OWS unit during Stage 2B RFI were used to characterize the soil adjacent to line lengths within 50 ft from the unit. In this instance, samples collected during Stage 2B RFI adequately characterized soil conditions surrounding inflow and outflow lines.

5.52.3 Conclusions and Recommendations

Conclusions

- The analytical results from Stage 2B RFI indicated that a release has occurred from this unit.

Recommendations

- Further investigation has been proposed at ST-265. Additional soil samples will be collected in an attempt to determine both the lateral and vertical extent of the subsurface contamination at the unit.

5.53 SWMU 10-7, Building 57007, OWS Lines (ST-267)

5.53.1 Site Background and Environmental Setting

OWS ST-267 is near the middle of a wash rack west of the north corner of Building 57007, part of the Civil Engineering Research Facility in the south-central portion of Kirtland AFB. The general location of the unit and its associated lines are shown on Figure 5-37. OWS ST-267 does not have any inflow lines; it receives surface flow from the wash rack. Discharge is 150 ft southwest to an open drainage channel.

Building 57007 is located on the Hubbell Bench, on the east boundary of the Albuquerque-Belen Basin (USAF, 1993c). The nearest production well to the site is KAFB-10 (Figure 2-11), 18,000 ft northwest, which is controlled and operated by DOE and SNL.

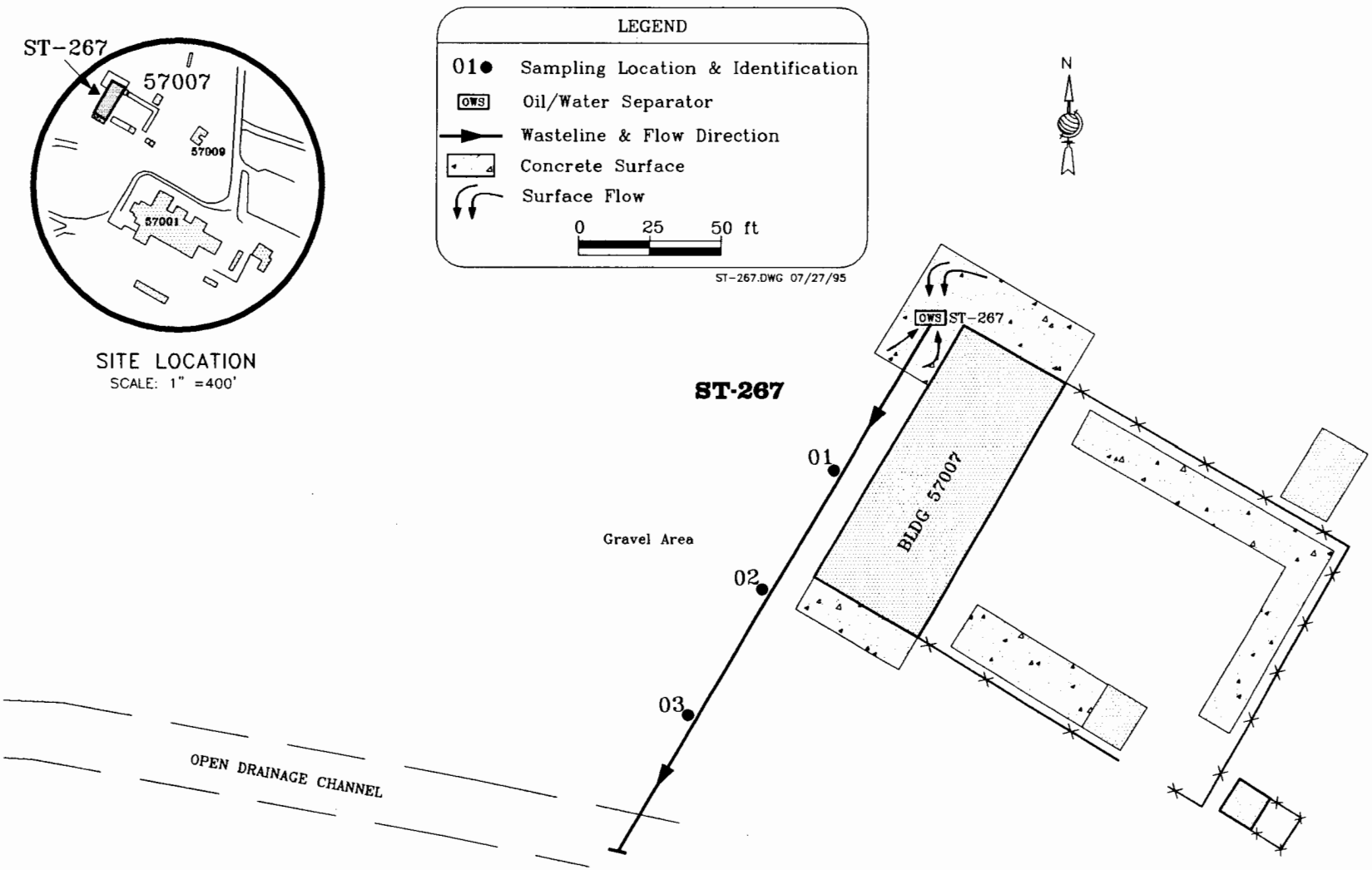


Figure 5-37. Soil Sampling Locations at SWMU 10-7, Building 57007, OWS Lines (ST-267)

5.53.2 Study Area Investigation

5.53.2.1 Previous Investigations

During the Stage 2B RFI, subsurface soil samples were collected from the perimeter of OWS ST-267. Analytical results from the Stage 2B RFI did not indicate that contaminants had been released at the site.

5.53.2.2 Data Gaps

Prior to the Stage 2B RFI, no data were available to confirm the presence or absence of contaminants in the subsurface soil surrounding this unit. Prior to the Appendix III RFI, no data were available that indicated a release occurred from the wastelines of ST-267.

5.53.2.3 RFI Field Investigation

The objective of the investigation was to determine if contamination exists in the adjacent soil. Line locations and sample borehole designations were completed prior to the soil sampling effort. The soil investigation was limited to the shallow subsurface.

Analytical results from samples collected during Stage 2B RFI were used to characterize the soil adjacent to the inflow and outflow lines within a 50-ft radius of ST-267. Subsurface line locations were confirmed using methods described in Section 3.0.

On January 30, 1995, three boreholes were sampled using a Geoprobe. The sample interval at each borehole location extended from the depth of the line to 5 ft below the line. From this interval, two samples were collected from each borehole: one at a depth equal to the base of the line, the other from 3 ft below the base of the line. Both samples were field-screened with a FID organic vapor meter and only the sample with the highest FID reading was submitted to the laboratory for analysis. If no FID readings were detected, the sample collected at the depth closest to the base of the line was submitted for analysis. Along the lines of ST-267, three samples were collected and submitted for laboratory analysis during the Appendix III RFI.

The analytical results from ST-266-01, collected during the Stage 2B RFI, were used as background concentration data for the samples collected at ST-267 during Appendix III RFI.

Sampling operations and sample handling procedures are described in Section 3.0. Sample depths, sample locations, and samples collected during the Appendix III RFI are listed in Table 5-67. The corresponding soil boring logs for the boreholes drilled and sampled at ST-267 are in Appendix C.

Table 5-67. Boreholes and Samples Analyzed from SWMU 10-7, Building 57007, OWS Lines (ST-267)

Borehole	Borehole Location	Sample Depths (ft)
01	11 ft W and 67.5 ft S of the NW corner of Building 57007	1-3
02	10.5 ft W and 106.5 ft S of the NW corner of Building 57007	5-7
03	10.5 ft W and 157.5 ft S of the NW corner of Building 57007	3-5

5.53.2.4 Laboratory Analysis

The soil samples were analyzed for VOCs, SVOCs, TPH, metals, mercury (the potential contaminants associated with normal operations at this site), soil pH, and soil moisture. The four brass tubes in each 2-ft sample interval were field-screened for possible contamination using a beta-gamma meter and a FID. All field-screening instrument readings remained at background levels throughout Appendix III RFI sampling activities at ST-267.

ST-266-01, collected during Stage 2B RFI work, was used as a background sample during the investigation of the inflow and outflow lines at ST-267. The soil sampling and analysis at the background hole included analyses for TPH, VOCs, SVOCs, metals, soil pH, and soil moisture.

5.53.3 Site Characteristics

5.53.3.1 Geology

This facility is located on the Hubbell Bench, on the east boundary of the Albuquerque-Belen Basin. The Santa Fe Group at the location of ST-267 could be as much as 300 ft thick. The alluvium and Santa Fe Group contain course grained material that, near the mountain front, may be poorly sorted. Thus permeability may be low regardless of the course-grained material.

The Building 57007 area is underlain by unconsolidated alluvial sediment and weathered granite. The sediment is predominantly fine-grained sand and very fine-grained to fine-grained silty sand. A maximum depth of 8 ft was attained with a Geoprobe; no borehole penetrated into the Santa Fe Group sediments that presumably underlie this area. A discussion of the general geology at Kirtland AFB is presented in Section 2.4.

As a result of ST-267 line installation, it is probable that backfill material is present adjacent to the line to a depth equal to the total depth of the line. Borehole logs for this site are presented in Appendix C.

5.53.3.2 Hydrogeology

This site is on the western edge of the HR3 saturated zone setting as defined by SNL studies (Figure 2-9). Bedrock in this area is inferred to be Permian- and Pennsylvanian-aged sedimentary rock. Near the mountains, bedrock is inferred to be Precambrian granite and metamorphic rock. Bedrock is covered by alluvial material; the thickness of this cover presumably increases west away from the mountains. Depth to groundwater is estimated at 90 to 100 ft below grade (Figure 2-10) (SNL, 1994). Groundwater flow is west-northwest (Figure 2-7). The nearest production well is KAFB-10, 4 mi northwest downgradient of the site (Figures 2-7 and 2-11). Hydraulic conductivity values based on testing range from 6.52 to 114.5 ft/day. A more detailed discussion of the hydrogeology at Kirtland AFB is presented in Section 2.5.

There is a 2 percent land surface slope. There are no arroyos nearby and surface water flows only in intense storms. The chemical quality of stream flow is unknown and surface water is not used. Stream flow is not known to ever reach the Rio Grande; however, because of the topography, it would be possible in an extreme storm event. Because of the unlikelihood of surface water ever reaching a perennial stream, surface water-borne contaminants would disperse to soil and might eventually migrate toward groundwater by way of surface flows that infiltrate the normally dry channel bottoms. Erosion of surface soil is moderated by the coarseness of the soil, and erosion in the immediate vicinity of Building 57007 is controlled.

5.53.4 Nature and Extent of Contamination

The following sections describe the nature and extent of contamination based on the analytical results. Analytical results for ST-267 are presented in Table 5-68, where only the reportable concentrations are listed. Full analytical results are presented in Appendix F and laboratory validation reports are presented in Appendix K.

Organic Compounds

The VOC analyte methylene chloride (0.006 to 0.007 mg/kg) was detected in the soil samples collected at ST-256. The concentrations were below the HHRB action level of 85.0 mg/kg. Methylene chloride was also detected in associated QC samples and is believed to be the result of laboratory contamination as discussed in Section 3.5.1.

There were no SVOC analytes detected in the soil samples collected at ST-267.

Petroleum Hydrocarbons

Diesel range hydrocarbons were detected in two of the three samples at ST-267 at concentrations of 12.0 and 6.5 mg/kg; both detected concentrations do not exceed the NMED action level of 100 mg/kg. TPH concentrations measured in the two samples were similar to those measured in background samples collected during the Appendix III RFI. The TPH detections alone are not conclusive evidence of a release from this unit. Because no other release components (such as VOCs, SVOCs, or metals) are present, it is probable that a release has not occurred.

Table 5-68. Summary of Reportable Concentrations for Soil Analyses at SWMU 10-7, Building 57007, OWS Lines (ST-267)[1]
(Concentrations mg/kg)

Chemical Class	Analyte	HHRB Action Level[2]	PQL UTL	Borehole Number and Sample Depth Interval (ft)		
				ST267C-01	*ST267C-02*	*ST267C-03*
				1–3	5–7	3–5
VOC	Methylene chloride	85.0	0.005	0.007	0.007	0.006
TPH	Diesel fraction	100	10.0	12.0	6.5	ND
METALS	Aluminum	78,000	14,700	9,990	10,300	4,500
	Arsenic	0.37	6.5	3.4	2.6	2.0
	Barium	5,500	735	115	98.7	179
	Beryllium	0.15	0.84	0.35	ND	ND
	Cadmium	39.0	N/A	ND	ND	0.64
	Calcium	N/A	121,000	49,100	35,000	97,600
	Chromium, total	390	21.6	6.3	5.3	3.8
	Cobalt	4,700	15.4	3.7	4.0	3.2
	Copper	2,900	223	15.4	23.7	15.5
	Iron	N/A	23,800	7,700	7,360	6,060
	Lead	400	17.5	7.9	8.5	6.0
	Magnesium	N/A	10,400	2,670	3,010	4,910
	Manganese	390	549	123	138	195
	Mercury	23.0	N/A	0.10	0.09	ND
	Nickel	1,600	188	9.4	3.3	5.6
	Potassium	N/A	3,590	1,270	778	686
	Sodium	N/A	787	86.1	691	88.0
	Vanadium	550	55.3	16.6	12.5	11.9
	Zinc	23,000	114	22.1	27.4	22.0
OTHER	pH			8.0	8.0	8.3
	Moisture (%)			13.1	7.4	6.4

FOOTNOTES

1	Complete laboratory analytical results and method detection limits are presented in Appendix K.
2	Action level of RCRA Proposed Rule Subpart S (55 FR 30814, 7/27/90).
*	TPH action level is 100 mg/kg adopted from NMED UST regulations (NMED, 1990). SW-8015 analyzes volatile and semivolatile petroleum hydrocarbon fractions separately. The total concentration of the two fractions analyzed under SW-8015 will be used to assess compliance with stipulated action levels for the purpose of this RFI.
#	Denotes TCLP analysis, results in mg/l.
--	No Data.
FR	Field Replicate.
HHRB	Human health risk based.
J	Estimated value.
N/A	Not Applicable.
NA	Not Analyzed.
ND	Not detected above the method detection limit.
pCi/g	picocuries per gram.
PQL	Practical quantitation limits (defines VOC, SVOC, and TPH).
R	Reject NDs due to interference.
RAD	Radionuclides.
RE	Resample.
SVOC	Semivolatile organic compounds.
TPH	Total petroleum hydrocarbons.
U	Accept data (positive results may be influenced by lab contamination).
UJ	Estimated nondetect.
UTL	Upper tolerance limits (defines metals).
VOC	Volatile organic compounds.

Metals

Table 5-68 lists all reportable metal concentrations detected at ST-267 and the respective UTL and HHRB action level concentrations. Arsenic (2.0 to 3.4 mg/kg) was detected in all three of the soil samples at concentrations above the HHRB action level of 0.37 mg/kg, but below the 6.5 mg/kg UTL. Beryllium (0.35 mg/kg) was detected in one of the three samples at a concentration above the 0.15 mg/kg HHRB, but below the 0.84 mg/kg UTL. These concentrations of arsenic and beryllium appear to be naturally occurring as discussed in Section 4.2.2.

Soil pH and Moisture

Soil pH values ranged from 8.0 to 8.3 in these samples. Soil moisture values ranged from 6.4 to 13.1 percent.

5.53.5 Conclusions and Recommendations

Conclusions

- One VOC was detected in the soil samples collected from this site. All concentrations were below HHRB action levels. No SVOCs were detected in soil samples collected from this site.
- No gasoline or diesel range hydrocarbons were detected in soil samples collected from this site.
- Arsenic and beryllium were the only metals detected at concentrations exceeding the HHRB action level; these concentrations appear to be naturally occurring throughout Kirtland AFB.
- The analytical results at ST-267 are not indicative of a release from this site.

Recommendations

- Based on the findings of the RFI, no further action is necessary; therefore, ST-267 does not require further investigation. A No Further Action proposal should be prepared.

6.0 Drain Lines

This section of the RFI addresses the lines serving 10 drains at Kirtland AFB. Most of the drain lines discharge to OWSs, but some discharge directly to the sanitary sewer or storm sewer. These drain lines have been identified as potential sources of soil contamination if line leaks are present.

The lines serving the 10 drains are located throughout Kirtland AFB and are summarized in Table 6-1. The buildings with drain lines of importance in this RFI include shops, aircraft and jet engine maintenance facilities, and photographic development facilities. Potential contaminants which may have entered the drains include JP-4 fuel, motor oil, cleaning solvents, hydraulic fluid, photographic chemicals, and pesticides.

The drains, with the exception of WP-38, were addressed in the Stage 2B RFI Report (USAF, 1995). The Stage 2B RFI consisted of soil borings and soil samples in the immediate vicinity of the area or floor drains. As described in this section, the results of the Stage 2B RFI Report were used to characterize drain lines less than 50 ft long.

The Appendix III RFI investigative procedures were based on the length of the drain lines. Figure 6-1 presents the investigative plan for the drain lines. If the lines were less than 50 ft long, the results of the Stage 2B RFI were used to characterize the site. However, if the lines were longer than 50 ft, soil samples were collected during the Appendix III RFI. If little or no contamination was detected during the Appendix III RFI field sampling or no contamination was detected during the Stage 2B RFI field sampling, no further action (NFA) is proposed for the inflow and/or outflow lines. The results of all sampling associated with the Appendix III RFI (and applicable Stage 2B RFI) sampling and analysis are presented in this RFI Report.

6.1 SWMU WP-38, Building 20687, Entomology Shop Drain and Outflow Line (WP-38)

6.1.1 Site Background and Environmental Setting

Drain WP-38, the entomology shop drain and outflow line, is inside the southeast area of Building 20687. The site includes the drain as well as the discharge line. The general location of the unit is shown on Figure 6-2. The drain outflow runs 70 ft west and 40 ft north and discharges into sanitary sewer D (ST-281). SWMU WP-38 was investigated on May 9, 1995.

Building 20687 is located in the urban/industrial zone, which is discussed in Section 2.0. The nearest production well to this site is KAFB-1 is 3,200 ft northwest (Figure 2-11).

6.1.2 Study Area Investigation

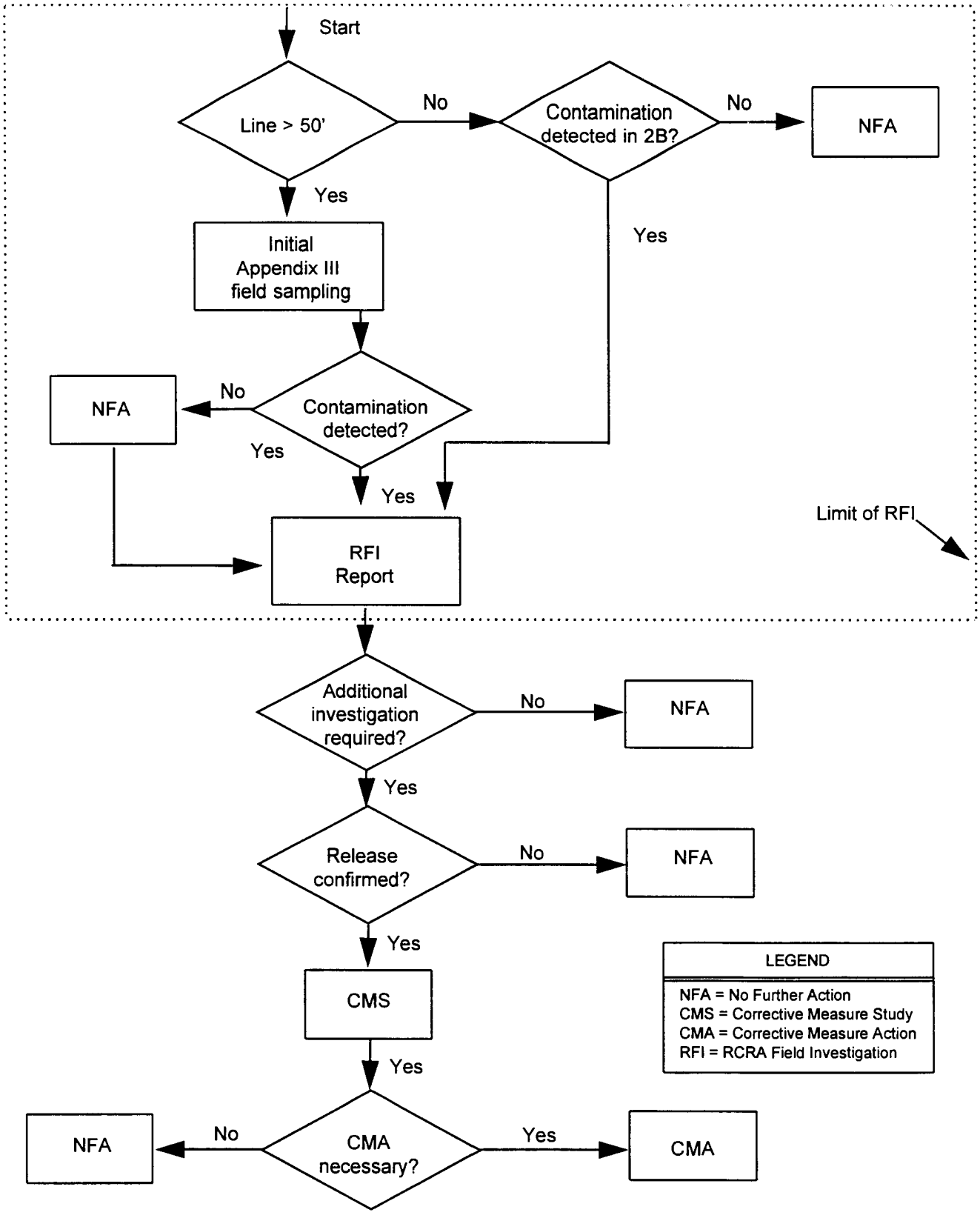
6.1.2.1 Previous Investigations

No previous investigations have been performed at this site.

Table 6-1. Drain Line Summary

SWMU No.	Kirtland AFB No.	Location	Use	Active/ Inactive	Approximate Outflow Line Length (ft)
WP-38	WP-38	Area drain and outflow line in the SW part of Building 20687	Inactive unit receiving runoff from the entomology shop discharging to sanitary sewer D	Inactive	110
8-6	WP-47	Silver recovery unit and drain line in rooms 128, 116, and 132 in the N part of Building 1000	Active unit receiving excess water from the recovery unit and discharging to sanitary sewer A	Inactive	180, total
10-7	ST-213	Area drain line, outside near the SE corner of Building 381	Active unit receives flow from the wash rack area discharges to OWS ST-211	Active	13
10-2BC	ST-220	Floor drains and lines in the S hangar bays of Building 1001	Active units receiving flow from the hangar floor and formerly from trench and area drains to the W; unit formerly discharged to the storm sewer to the E, now is routed to sanitary sewer to the N	Active	250
10-7	ST-224	Area drain lines outside between Building 1031 and an aircraft engine test cell	Active unit receiving flow from both buildings and discharging to OWS ST-222	Active	25
10-7	ST-228	Area drain lines are 40 ft S of Building 1040	Active unit receives flow from an asphalt parking lot and driveway area that discharges to OWS ST-234	Active	110
10-2	ST-233	Area drain lines 60 ft W of the NW corner of Building 1046	Active unit receives runoff from the roof of Building 1046, parking lot W of Building 1046, and lawn area surrounding the drain that discharges to a drainage ditch to the W	Active	36
10-7	ST-237	Area drain line between Buildings 1051, 1060, and 1061	Active unit that receives flow from the asphalt driveway and discharges to OWS ST-234	Active	40
10-7	ST-259	Area drain line in the middle of a wash rack W of Building 20422	Active unit receives flow from the wash rack area and discharges to OWS ST-260.	Active	18
10-2	ST-266	Area drain line is NE of Building 57001	Receives flow from the asphalt driveway and discharges N to a stormwater culvert	Active	70

Figure 6-1.
Investigative Plan for Drain Line



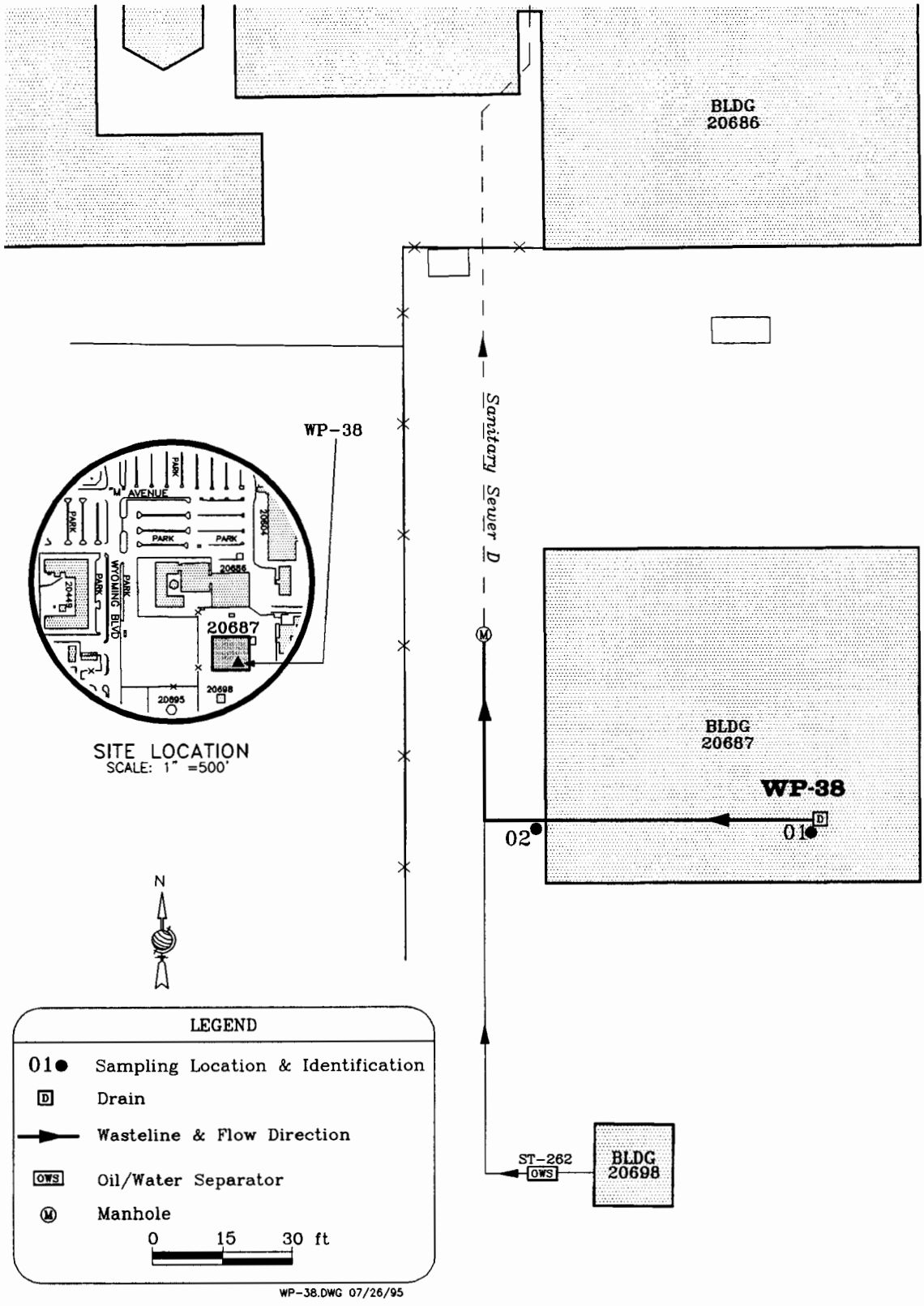


Figure 6-2. Soil Sampling Locations at WP-38, Building 20687, Entomology Shop Drain and Outflow Line (WP-38)

6.1.2.2 Data Gaps

Prior to the Appendix III RFI, no data were available to determine if a release occurred from the WP-38 drain and outflow line.

6.1.2.3 RFI Field Investigation

The objective of the WP-38 drain line investigation was to determine the presence or absence of contamination in soil adjacent to the floor drain and discharge line. The soil investigation was limited to the shallow subsurface.

On May 9, 1995, two boreholes were drilled and sampled using a Geoprobe. WP-38C-01 was drilled adjacent to the drain and was used to characterize the soil within a 50-ft radius. The bottom of the drain was determined to be 1 ft below grade. The upper and lower 2-ft sections of the 5-ft interval below the base of the drain were collected (i.e., 1 to 3 ft and 4 to 6 ft). WP-38C-02 was drilled adjacent to the outflow line, and the depth of the outflow line was determined to be 4 ft below grade. The upper and lower 2-ft sections of the 5-ft interval below the base of the drain line were collected (i.e., 4 to 6 ft and 7 to 9 ft).

The analytical results from sample ST-262-01, south of Building 20687, collected during the Stage 2B RFI were used for background concentration data for the samples collected at WP-38 during the Appendix III RFI.

Sample depths, borehole locations, and replicate samples submitted for analysis during the Appendix III RFI are listed in Table 6-2. Soil boring logs for WP-38 are in Appendix C.

Table 6-2. Boreholes and Samples Analyzed from SWMU WP-38, Building 20687, Entomology Shop Drain and Outflow Line (WP-38)

Borehole	Borehole Location	Sample Depths (ft)
01	Adjacent to drain	1-6[a]
02	Adjacent to outflow line	4-9[b]

a. Both 2-ft sections of the 5-ft interval were used due to the collection of a replicate sample.

b. Both 2-ft sections of the 5-ft interval were used due to the collection of a MS/MSD sample.

6.1.2.4 Laboratory Analysis

Two soil samples and one replicate sample were analyzed for VOCs, SVOCs, TPH, pesticides, herbicides, metals, mercury (the expected contaminants associated with normal operations at this site), soil pH, and soil moisture. The four brass tubes in each 2-ft sample interval were field-screened for possible contamination using a beta-gamma meter and a FID. No elevated readings were measured with these instruments.

ST-262-01, collected during the Stage 2B RFI, was used as a background sample during the WP-38 investigation. The soil sampling and analysis at the background hole included analyses for TPH, VOCs, SVOCs, pesticides, herbicides, metals, soil pH, and soil moisture.

6.1.3 Site Characteristics

6.1.3.1 Geology

The Building 20687 area is underlain by unconsolidated alluvial sediment that is predominantly very fine-grained to very coarse, well-graded sand. Two boreholes, one 6-ft and one 9-ft deep, were drilled at WP-38. No boreholes penetrated into the Santa Fe Group sediment that presumably underlies this area. A discussion of the general geology at Kirtland AFB is presented in Section 2.4.

As a result of installation, it is probable that backfill material is present adjacent to this line to a depth at least equal to the line's total depth. Borehole logs for this area are presented in Appendix C.

6.1.3.2 Hydrogeology

Groundwater beneath the Building 20687 area is found within the Upper Santa Fe sediment and is generally thought to be unconfined in the upper portion of the aquifer. This area is within the HR1 saturated zone setting as defined by SNL (Figure 2-9) (SNL, 1994). Hydrogeologic characterization in this portion of Kirtland AFB is complicated by the presence of numerous production wells (Figure 2-11). It is probable that uniform groundwater conditions do not exist in this region. Local cones of depression associated with groundwater withdrawal have altered the groundwater flow direction in the vicinity of the well fields (Figure 2-7).

The gradient is probably north at this site. The nearest production well to this site is KAFB-1, 3,200 ft cross-gradient northwest (Figures 2-7 and 2-11). Depth to groundwater is estimated to be 350 ft below grade; however, shallower perched water zones may occur (Figure 2-10). Hydraulic conductivity within HR1 is estimated to range from 2 to 171 ft/day (SNL, 1994). A general discussion of the hydrogeology at Kirtland AFB is presented in Section 2.5.

6.1.4 Nature and Extent of Contamination

The following sections describe the nature and extent of contamination based on the analytical results for soil samples submitted for analysis at WP-38. Analytical results for WP-38 are summarized in Table 6-3, where only the reportable concentrations are listed. Full analytical results are presented in Appendix F. Laboratory validation reports are presented in Appendix K.

Organic Compounds

There were no VOC or SVOC analytes detected in any of the soil samples collected at SWMU WP-38.

Petroleum Hydrocarbons

No gasoline or diesel range hydrocarbons were detected in any of the boreholes at SWMU WP-38.

Table 6-3. Summary of Reportable Concentrations for Soil Analyses at SWMU WP-38, Building 20687, Entomology Shop Drain and Outflow Line (WP-38)[1] (Concentrations mg/kg)

Chemical Class	Analyte	HHRB Action Level[2]	UTL	Borehole Number and Sample Depth Interval (ft)		
				WP38C-01	WP38C-02	
				1–6	4–9 FR	4–9
METALS	Aluminum	78,000	14,700	6,710	4,190	4,210
	Arsenic	0.37	6.5	1.8	0.63	0.95
	Barium	5,500	735	131	39.1	63.2
	Cadmium	39.0	N/A	0.62	ND	ND
	Calcium	N/A	121,000	39,600	13,400	15,000
	Chromium, total	390	21.6	9.1	4.6	5.8
	Cobalt	4,700	15.4	6.8	5.8	6.8
	Copper	2,900	223	74.7	206	181
	Iron	N/A	23,800	15,200	9,340	12,400
	Lead	400	17.5	5.8	3.2	3.8
	Magnesium	N/A	10,400	4,640	3,060	3,050
	Manganese	390	549	251	193	213
	Nickel	1,600	188	14.2	5.5	2.9
	Potassium	N/A	3,590	1,040	1,090	1,280
	Sodium	N/A	787	275	288	273
	Vanadium	550	55.3	28.3	15.8	21.9
	Zinc	23,000	114	55.5	87.2	79.8
OTHER	pH			12.0	8.8	9.1
	Moisture (%)			3.1	2.7	2.8

FOOTNOTES

1	Complete laboratory analytical results and method detection limits are presented in Appendix K.
2	Action level of RCRA Proposed Rule Subpart S (55 *FR* 30814, 7/27/90).
*	TPH action level is 100 mg/kg adopted from NMED UST regulations (NMED, 1990). SW-8015 analyzes volatile and semivolatile petroleum hydrocarbon fractions separately. The total concentration of the two fractions analyzed under SW-8015 will be used to assess compliance with stipulated action levels for the purpose of this RFI.
#	Denotes TCLP analysis, results in mg/l.
--	No Data.
FR	Field Replicate.
HHRB	Human health risk based.
J	Estimated value.
N/A	Not Applicable.
NA	Not Analyzed.
ND	Not detected above the method detection limit.
pCi/g	picocuries per gram.
PQL	Practical quantitation limits (defines VOC, SVOC, and TPH).
R	Reject NDs due to interference.
RAD	Radionuclides.
RE	Resample.
SVOC	Semivolatile organic compounds.
TPH	Total petroleum hydrocarbons.
U	Accept data (positive results may be influenced by lab contamination).
UJ	Estimated nondetect.
UTL	Upper tolerance limits (defines metals).
VOC	Volatile organic compounds.

Metals

Arsenic (0.63 to 1.8 mg/kg) was the only metal detected in the two soil samples and one field replicate at concentrations above the HHRB action level of 0.37 mg/kg, but below the 6.5 mg/kg UTL (Table 6-3). The arsenic concentrations appear to be naturally occurring throughout Kirtland AFB as discussed in Section 4.2.2.

Soil pH and Moisture

Soil pH ranged from 8.8 to 12.0 in these samples. Soil moisture values ranged from 2.7 to 3.1 percent (Table 6-3).

6.1.5 Conclusions and Recommendations

Conclusions

- No VOCs or SVOCs were detected in the soil samples collected from this site.
- No gasoline or diesel range hydrocarbons were detected in the soil samples collected at this site.
- Arsenic was the only metal detected at a concentration exceeding the HHRB action level; these concentrations appear to be naturally occurring throughout Kirtland AFB.
- The analytical results at WP-38 are not indicative of a release from this site.

Recommendations

- Based on the findings of the RFI, no further action is necessary; therefore, WP-38 does not require further investigation. A No Further Action proposal should be prepared.

6.2 SWMU 8-6, Building 1000, Silver Recovery Unit Drains and Lines (WP-47)

6.2.1 Site Background and Environmental Setting

The silver recovery unit discharged into four floor drains in the former Kirtland AFB Photographic Laboratory in the northern section of Building 1000 (Figure 6-3). One drain is in room 128, two drains are in room 116, and one drain is in room 132. Wastewater from the recovery unit discharged into the adjacent floor drain lines and flowed to sanitary sewer A (ST-278) on the north side of the building (Figure 6-3). If the silver recovery unit malfunctioned or operated inefficiently, silver-laden solution could be discharged. Discharge from this unit was regulated by a pretreatment agreement with the City of Albuquerque, governing discharge to the city sanitary sewer. The silver recovery unit drain lines were investigated on December 27, 1994.

The silver recovery unit electrolytically recovered silver, using a special cartridge, from spent fixer, a solution used in the photographic development process. The spent fixer was stored in plastic containers until it was processed, and the cartridge was periodically replaced. Processed fixer fluids included

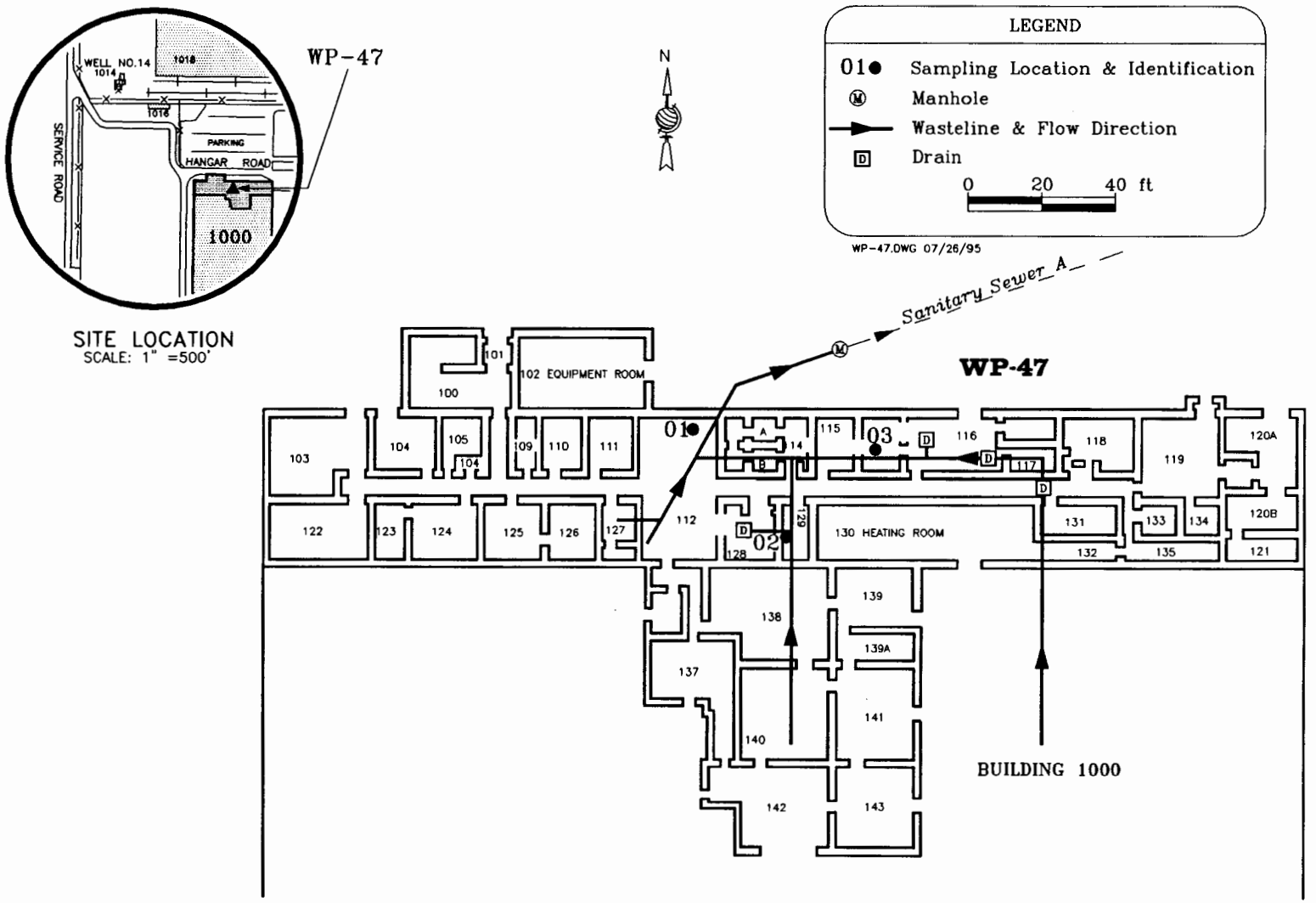


Figure 6-3. Soil Sampling Locations at SWMU 8-6, Building 1000, Silver Recovery Unit Drains and Lines (WP-47)

10 gallons per month from base units, about 10 gallons per year from the Air National Guard Photographic Laboratory, Building 1055, and 10 gallons per month from the Naval Weapons Evaluation Facility Photographic Laboratory, Building 1002.

The drain in room 132 had been inactive for several years. The silver recovery units had been active intermittently at the other three locations. No drains were receiving wastewater at the time of the Stage 2B RFI sampling effort. The portable silver recovery unit was moved when the Kirtland AFB Photographic Laboratory relocated from Building 1000 to Building 20140.

Building 1000 is located in the urban/industrial zone. Two production wells are located near SWMU 8-6: KAFB-14 is 450 ft northwest and KAFB-2 is 4,500 ft southeast (Figure 2-11).

6.2.2 Study Area Investigation

6.2.2.1 Previous Investigations

During the Stage 2B RFI, sediment samples were collected from each of the four floor drains. Aqueous fractions from three of the traps were also collected. The analytical results from the investigation indicated the presence of silver above HHRB action levels in the sediment and aqueous samples found inside the floor drains.

6.2.2.2 Data Gaps

Prior to the Appendix III RFI, no data were available to determine if a release occurred from the wastelines at SWMU 8-6.

6.2.2.3 RFI Field Investigation

The objective of the investigation was to determine the presence or absence of contamination in the soil adjacent to the drain lines. The soil investigation was limited to the shallow subsurface.

On December 27, 1994, three boreholes were drilled and sampled using a manual probe system. WP-47C-01, WP-47C-02, and WP-47C-03 were drilled adjacent to the drain line and used to characterize the soil within a 50-ft radius. The bottom of the drain was determined to be 1 ft below grade. The upper and lower 2-ft sections of the 5-ft interval below the base of the drain line were collected (i.e., 1 to 3 ft and 4 to 6 ft).

The analytical results from ST-221-01, east of Buildings 1000 and 1001, collected during the Stage 2B RFI, were used for background concentration data to compare to the samples collected at SWMU 8-6 during the Appendix III RFI.

Sampling operations and sampling handling procedures are described in Section 3.0. Borehole locations and sample depths that were submitted for analysis are listed in Table 6-4. Borehole logs are in Appendix C.

Table 6-4. Boreholes and Samples Analyzed from SWMU 8-6, Building 1000, Silver Recovery Unit Drains and Lines (WP-47)

Borehole	Borehole Location	Sample Depths (ft)
01	Adjacent to drain line	1-3
02	Adjacent to drain line	1-3
03	Adjacent to drain line	1-3

6.2.2.4 Laboratory Analysis

Soil samples were analyzed for VOCs, SVOCs, TPH, metals, mercury (the expected contaminants associated with normal operations at this site), soil pH, and soil moisture. The four brass tubes in each 2-ft sample interval were field-screened for possible contamination using a beta-gamma meter and a FID. All field-screening instrument readings remained at background levels throughout the SWMU 8-6 drilling and sampling activities.

ST-221-01, collected during the Stage 2B RFI, was used as a background sample during the wasteline investigation at SWMU 8-6. Sample analysis for ST-221-01 included analyses for TPH, VOCs, SVOCs, metals, soil pH, and soil moisture.

6.2.3 Site Characteristics

6.2.3.1 Geology

The Building 1000 area is underlain by unconsolidated alluvial sediment that is predominantly fine-grained sand. Three 6-ft boreholes were drilled at SWMU 8-6. No boreholes penetrated into the Santa Fe Group sediment that presumably underlies this area. A discussion of the general geology at Kirtland AFB is presented in Section 2.4.

As a result of installation, it is probable that backfill material is present adjacent to this line to a depth at least equal to the line's total depth. Borehole logs for this area are presented in Appendix C.

6.2.3.2 Hydrogeology

Groundwater beneath this area is found within the Upper Santa Fe Group sediment and is generally thought to be unconfined in the upper portion of the aquifer. This area is within the HR1 saturated zone setting as defined by SNL (Figure 2-9) (SNL, 1994). Hydrogeologic characterization in this portion of Kirtland AFB is complicated by the presence of numerous production wells (Figure 2-11). It is probable that this region does not have uniform groundwater conditions. Local cones of depression associated with groundwater withdrawal have altered the groundwater flow direction in the vicinity of the well fields (Figure 2-7).

The gradient is probably north-northeast at this site. Two production wells are located near SWMU 8-6: KAFB-14 is upgradient 450 ft northeast and KAFB-2 is cross-gradient 4,500 ft southeast (Figures 2-7 and 2-11). Depth to groundwater is estimated to be 350 ft below grade (Figure 2-10); however, shallower perched water zones may occur. Hydraulic conductivity within HR1 is estimated at 2 to

171 ft/day (SNL, 1994). A general discussion of the hydrogeology at Kirtland AFB is presented in Section 2.5.

6.2.4 Nature and Extent of Contamination

The following sections describe the nature and extent of contamination based on the analytical results for soil samples submitted for analysis at SWMU 8-6. Analytical results are summarized in Table 6-5, where only the reportable concentrations are listed. Full analytical results are presented in Appendix F. Laboratory validation reports are presented in Appendix K.

Organic Compounds

Methylene chloride (0.007 to 0.008 mg/kg) was the only VOC analyte detected in the three soil samples collected at SWMU 8-6. These concentrations did not exceed the HHRB action level of 85 mg/kg for methylene chloride (Table 6-5). Methylene chloride was also detected in associated QC samples and is believed to be the result of laboratory contamination as discussed in Section 3.5.1.

Di-n-butylphthalate (0.55 to 0.71 mg/kg) was the only SVOC analyte detected in all samples; the concentrations were below the HHRB action level of 7,800 mg/kg.

Petroleum Hydrocarbons

No gasoline range hydrocarbons were detected in any of the three samples.

Diesel range hydrocarbons (13 to 14 mg/kg) were detected in the three samples collected and submitted for analysis at concentrations below the NMED action level of 100 mg/kg.

Metals

Arsenic and beryllium were the only metals detected at concentrations above the HHRB action levels in soil samples from SWMU 8-6 (Table 6-5). Arsenic (2.4 to 3.6 mg/kg) was detected in all samples at concentrations above the HHRB action level of 0.37 mg/kg, but below the 6.5 mg/kg UTL. Beryllium (0.32 and 0.34 mg/kg) was detected in two of the three samples collected at SWMU 8-6 above the HHRB action level of 0.15 mg/kg, but below the 0.84 mg/kg UTL. These concentrations of arsenic and beryllium appear to be naturally occurring throughout Kirtland AFB as discussed in Section 4.2.2.

Soil pH and Moisture

Soil pH ranged from 8.0 to 8.5 in these samples. Soil moisture values ranged from 7.3 to 13.2 percent (Table 6-5).

Table 6-5. Summary of Reportable Concentrations for Soil Analyses at SWMU 8-6, Building 1000, Silver Recovery Unit Drains and Lines (WP-47)[1] (Concentrations mg/kg)

Chemical Class	Analyte	HHRB Action Level[2]	PQL UTL	Borehole Number and Sample Depth Interval (ft)		
				WP47C-01 1–3	*WP47C-02* 1–3	*WP47C-03* 1–3
VOC	Methylene chloride	85.0	0.005	0.007	0.008	0.008
SVOC	Di-n-butylphthalate	7,800	0.70	0.64	0.55	0.71
TPH	Diesel fraction	100	10.0	13.0	14.0	13.0
METALS	Aluminum	78,000	14,700	5,170	6,180	8,670
	Arsenic	0.37	6.5	3.6	3.3	2.4
	Barium	5,500	735	124	94.4	86.5
	Beryllium	0.15	0.84	ND	0.34	0.32
	Calcium	N/A	121,000	131,000	79,500	25,800
	Chromium, total	390	21.6	5.0	5.1	6.0
	Cobalt	4,700	15.4	2.9	4.1	4.2
	Copper	2,900	223	20.5	15.5	15.0
	Iron	N/A	23,800	4,860	6,730	9,870
	Lead	400	17.5	2.6	2.7	42.9
	Magnesium	N/A	10,400	3,520	2,490	2,830
	Manganese	390	549	56.5	79.4	153
	Mercury	23.0	N/A	ND	0.40	ND
	Nickel	1,600	188	5.2	5.9	4.6
	Potassium	N/A	3,590	676	983	1,750
	Sodium	N/A	787	178	148	113
	Vanadium	550	55.3	15.2	16.9	21.8
	Zinc	23,000	114	16.7	17.2	24.5
OTHER	pH			8.0	8.4	8.5
	Moisture (%)			13.2	10.7	7.3

FOOTNOTES

1	Complete laboratory analytical results and method detection limits are presented in Appendix K.
2	Action level of RCRA Proposed Rule Subpart S (55 *FR* 30814, 7/27/90).
*	TPH action level is 100 mg/kg adopted from NMED UST regulations (NMED, 1990). SW-8015 analyzes volatile and semivolatile petroleum hydrocarbon fractions separately. The total concentration of the two fractions analyzed under SW-8015 will be used to assess compliance with stipulated action levels for the purpose of this RFI.
#	Denotes TCLP analysis, results in mg/l.
–	No Data.
FR	Field Replicate.
HHRB	Human health risk based.
J	Estimated value.
N/A	Not Applicable.
NA	Not Analyzed.
ND	Not detected above the method detection limit.
pCi/g	picocuries per gram.
PQL	Practical quantitation limits (defines VOC, SVOC, and TPH).
R	Reject NDs due to interference.
RAD	Radionuclides.
RE	Resample.
SVOC	Semivolatile organic compounds.
TPH	Total petroleum hydrocarbons.
U	Accept data (positive results may be influenced by lab contamination).
UJ	Estimated nondetect.
UTL	Upper tolerance limits (defines metals).
VOC	Volatile organic compounds.

6.2.5 Conclusions and Recommendations

Conclusions

- One VOC and one SVOC were detected in the soil samples collected from this site. Concentrations were below the HHRB action levels.

- No gasoline range hydrocarbons were detected. Diesel range hydrocarbons were detected in all of the samples at this site. The concentrations did not exceed the NMED action level of 100 mg/kg and the detections were not indicative of a release from this site. The detected concentrations were similar to those measured in background samples collected during the Appendix III RFI. The TPH detections alone are not conclusive evidence of a release from this unit. Because no other release indicators (such as VOCs, SVOCs, or metals) are present, it is probable that a release has not occurred.

- Arsenic and beryllium were the only metals detected at concentrations exceeding HHRB action levels; these concentrations appear to be naturally occurring throughout Kirtland AFB.

- The analytical results at SWMU 8-6 are not indicative of a release from this site.

Recommendations

- Based on the findings of the RFI, no further action is necessary; therefore, SWMU 8-6 does not require further investigation. A No Further Action proposal should be prepared.

6.3 SWMU 10-7, Building 381, Area Drain Line (ST-213)

6.3.1 Site Background and Environmental Setting

ST-213 is near the outside southeast corner of Building 381 in the western portion of Kirtland AFB (Figure 5-8). Building 381 is the AGE shop, used for the maintenance of flightline support equipment. ST-213, a concrete unit with a metal grate cover, is 26 ft x 1 ft x 1 ft. It receives inflow from the wash rack area and discharges to OWS ST-211 via a 13-ft outflow line.

In accordance with the Kirtland AFB RCRA Part B Permit (as an interim measure), OWS ST-211 was removed in October 1994 and replaced with a new unit. This new unit is a fiberglass-coated, double-walled steel OWS equipped with interstitial monitoring and high-level oil alarm systems. A 6-in. sanitary sewer line was installed to connect the new OWS to the existing sanitary sewer. The new unit was installed below ground about 20 to 30 ft east of the original OWS location. Area drain ST-213, which emptied into OWS ST-211, was redirected to empty into an existing 6-in. storm sewer line.

Building 381 is in the urban/industrial environmental zone. Two production wells are located near ST-213: KAFB-14 is 2,100 ft east and KAFB-12 is 2,800 ft north (Figure 2-11).

6.3.2 Study Area Investigation

6.3.2.1 Previous Investigations

During the Stage 2B RFI, subsurface soil samples were collected from the perimeter of the drain ST-213. Analytical results indicated that no release had occurred at this site.

6.3.2.2 Data Gaps

Prior to the Appendix III RFI, no data were available to confirm the presence or absence of contaminants in the subsurface soil surrounding the lines serving drain ST-213.

6.3.2.3 RFI Field Investigation

The objective of the ST-213 line investigation was to determine the presence or absence of contaminants in soil adjacent to the wastelines.

Since the Stage 2B RFI indicated no contamination and the drain line is less than 50 ft, no subsurface soil investigation was conducted adjacent to the drain lines. The sampling from the Stage 2B RFI was used to characterize this site.

6.3.2.4 Laboratory Analysis

No laboratory analyses were performed.

6.3.3 Site Characteristics

6.3.3.1 Geology

The Building 381 area is underlain by unconsolidated alluvial sediment. The sediment is predominantly fine-grained sand and very fine-grained to fine-grained silty sand. A discussion of the general geology at Kirtland AFB is presented in Section 2.4.

As a result of area drain installation, it is probable that backfill material is present adjacent to these units to a depth equal to the unit's depth.

6.3.3.2 Hydrogeology

Groundwater beneath ST-213 is found within the Upper Santa Fe sediments and is generally thought to be unconfined in the upper portion of the aquifer. This area is within the HR1 saturated zone setting as defined by SNL (Figure 2-9) (SNL, 1994). Hydrogeologic characterization in this portion of Kirtland AFB is complicated by the presence of numerous production wells (Figure 2-11). It is probable that uniform groundwater conditions do not exist in this region. Local cones of depression associated with groundwater withdrawal have altered the groundwater flow direction in the vicinity of the well fields (Figure 2-7).

It is probable that the gradient is to the northeast. Two production wells are located near ST-213: KAFB-14 is 2,100 ft downgradient east of Building 381 and KAFB-12 is 2,800 ft cross-gradient north (Figures 2-7 and 2-11). Depth to groundwater is estimated to be 350 ft below grade (Figure 2-10); however, shallower perched water zones may occur. Hydraulic conductivity within HR1 is estimated at 2 to 171 ft/day (SNL, 1994). A general discussion of the hydrogeology at Kirtland AFB is presented in Section 2.5.

6.3.4 Nature and Extent of Contamination

Analytical results from the Stage 2B RFI did not indicate a release had occurred at this site.

6.3.5 Conclusions and Recommendations

- Based on the findings of the RFI, no further action is necessary; therefore, ST-213 does not require further investigation. A No Further Action proposal should be prepared.

6.4 SWMU 10-2BC, Building 1001, Floor Drains and Lines (ST-220)

6.4.1 Site Background and Environmental Setting

The floor drains and lines comprising SWMU 10-2BC are in the center of the floor inside the south hangar bays of Building 1001, which is located in the western portion of Kirtland AFB (Figure 6-4). The south hangar bays of Building 1001 are used for aircraft maintenance. The SWMU 10-2BC drain is made of concrete with a metal grate cover and is 11.2 ft long, 2.5 ft wide (outside dimensions), and 4 ft deep. Just prior to the Stage 2B RFI field effort, this unit was replaced and construction workers onsite stated the former lines leading to and from SWMU 10-2BC had been permanently sealed off and new lines had been rerouted. SWMU 10-2BC was investigated on December 20, 1994.

In the past, SWMU 10-2BC received discharge from a series of floor drains and a trench drain by the hangar located along the west side of Building 1001. The unit also received runoff generated from aircraft maintenance activities. The unit discharged east through a buried outflow line to a storm sewer running lateral along the east side of Building 1001. The new rerouted outflow line now discharges to a new OWS that in turn discharges to a sanitary sewer on the west side of the hangar.

In the 1950s and 1960s, aircraft used for taking post-nuclear detonation measurements over the Nevada Test Site may have been washed down at SWMU 10-2BC. A radiological survey of the site was conducted by Kirtland AFB Bioenvironmental Division on October 26, 1992 (USAF, 1992). No radiological activity was indicated above background levels (USAF, 1993c).

Building 1001 is located in the urban/industrial environmental zone. This environmental setting is discussed in Section 2.0. Three production wells are located near SWMU 10-2BC: KAFB-14 is 750 ft northwest, KAFB-12 is 4,000 ft northwest, and KAFB-2 is 4,300 ft southeast (Figure 2-11).

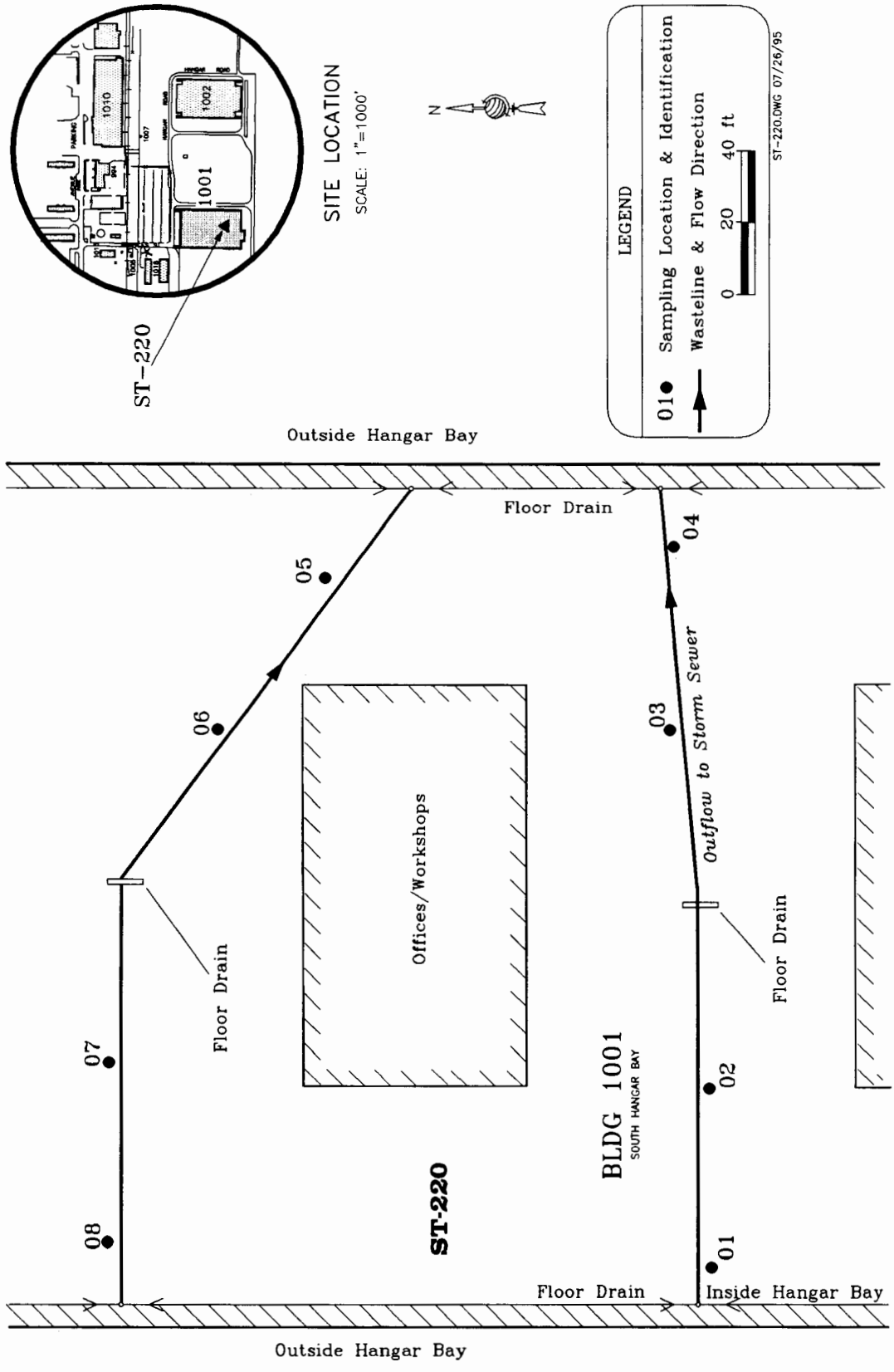


Figure 6-4. Soil Sampling Locations at SWMU 10-2BC, Building 1001, Floor Drains and Lines (ST-220)

6.4.2 Study Area Investigation

6.4.2.1 Previous Investigations

During the Stage 2B RFI, subsurface soil samples were collected from the perimeter of SWMU 10-2BC. The analytical results from the investigation did not indicate a release at this site.

6.4.2.2 Data Gaps

Prior to the Appendix III RFI, no data were available to determine if a release occurred to the subsurface soil from the inflow or outflow lines from SWMU 10-2BC.

6.4.2.3 RFI Field Investigation

The objective of the investigation of the drain lines serving SWMU 10-2BC was to determine the presence or absence of contaminants in soil adjacent to the wastelines. The soil investigation was limited to the shallow subsurface.

Analytical results from samples collected during Stage 2B RFI were used to characterize the soil adjacent to the inflow and outflow lines within a 50-ft radius of the floor drains at SWMU 10-2BC. Based on engineering drawings and observed site conditions, the inflow line to these floor drains comes from an area drain to the west at the perimeter of Building 1001. Discharge is east to another area drain at the perimeter on the east side of Building 1001.

On December 20, 1994, eight boreholes were drilled and sampled using a Geoprobe. All boreholes were drilled adjacent to the drain lines and were used to characterize the soil within a 50-ft radius. Based on engineering drawings and observed field conditions, the depth of the drain line was determined to be 1 ft below grade. The upper and lower 2-ft sections of the 5-ft interval below the base of the drain line were to be collected (i.e., 1 to 3 ft and 4 to 6 ft), but because of concrete coring and varying concrete depths, the 5-ft interval varied from one borehole to the next.

The analytical results from ST-221-01, east of Building 1001, collected during the Stage 2B RFI, was used for background concentration data to compare to the samples collected at SWMU 10-2BC during Appendix III RFI.

Sampling operations and sampling handling procedures are described in Section 3.0. Borehole locations and sample depths submitted for analysis are listed in Table 6-6. Borehole logs are in Appendix C.

Table 6-6. Boreholes and Samples Analyzed from SWMU 10-2BC, Building 1001, Floor Drains and Lines (ST-220)

Borehole	Borehole Location	Sample Depths (ft)
01	Adjacent to drain line	2-4
02	Adjacent to drain line	2-4
03	Adjacent to drain line	3-5
04	Adjacent to drain line	3-5
05	Adjacent to drain line	3-5
06	Adjacent to drain line	5-7[a]
07	Adjacent to drain line	2-7[b]
08	Adjacent to drain line	2-7[c]

a. The lower 2-ft section of the 5-ft interval was used due to poor sample collection at the upper 2-ft section.

b. Both 2-ft sections of the 5-ft interval were used due to the collection of a MS/MSD sample.

c. Both 2-ft sections of the 5-ft interval were used due to the collection of a replicate sample.

6.4.2.4 Laboratory Analysis

Nine soil samples, including one replicate, were analyzed for VOCs, SVOCs, TPH, metals, mercury (the expected contaminants associated with normal operations at this site), soil pH, and soil moisture. The four brass tubes in each 2-ft sample interval were field-screened for possible contamination using a beta-gamma meter and a FID. No elevated readings were measured with these instruments.

ST-221-01, collected during the Stage 2B RFI field investigation, was used as a background sample during the investigation of outflow lines at SWMU 10-2BC. The soil sampling and analysis at the background hole included analyses for TPH, VOCs, SVOCs, metals, gross alpha and beta, soil pH, and soil moisture.

6.4.3 Site Characteristics

6.4.3.1 Geology

The area surrounding SWMU 10-2BC is underlain by unconsolidated alluvial sediment that is predominantly fine-grained sand and very fine-grained to fine-grained silty sand. Five 7-ft and three 8-ft boreholes were drilled at SWMU 10-2BC. No boreholes penetrated into the Santa Fe Group sediments that presumably underlie this area. A discussion of the general geology at Kirtland AFB is presented in Section 2.4.

As a result of floor drain installation, it is probable that backfill material is present. Borehole logs for this site are presented in Appendix C.

6.4.3.2 Hydrogeology

Groundwater beneath the SWMU 10-2BC area is found within the Upper Santa Fe sediment and is generally thought to be unconfined in the upper portion of the aquifer. This area is within the HR1 saturated zone setting as defined by SNL (Figure 2-9) (SNL, 1994). Hydrogeologic characterization in

this portion of Kirtland AFB is complicated by the presence of numerous production wells (Figure 2-11). It is probable that uniform groundwater conditions do not exist in this region. Local cones of depression associated with groundwater withdrawal have altered the groundwater flow direction in the vicinity of the well fields (Figure 2-7).

The gradient is probably north-northeast at this site. Three production wells are located near SWMU 10-2BC: KAFB-14 is 750 ft downgradient northwest, KAFB-12 is 4,000 ft cross-gradient northwest, and KAFB-2 is 4,300 ft upgradient southeast (Figures 2-7 and 2-11). Depth to groundwater is estimated to be 350 ft below grade (Figure 2-10); however, shallower perched water zones may occur. Hydraulic conductivity within HR1 is estimated at 2 to 171 ft/day (SNL, 1994). A general discussion of the hydrogeology at Kirtland AFB is presented in Section 2.5.

6.4.4 Nature and Extent of Contamination

The following sections describe the nature and extent of contamination based on the analytical results for soil samples submitted for analysis at SWMU 10-2BC. Analytical results are summarized in Table 6-7, where only the reportable concentrations are listed. Full analytical results are presented in Appendix F. Laboratory validation reports are presented in Appendix K.

Organic Compounds

No VOC analytes were detected in any of the soil samples at SWMU 10-2BC.

Di-n-butylphthalate (0.51 to 0.90 mg/kg) was the only SVOC analyte detected in all boreholes. These concentrations were below the HHRB action level of 7,800 mg/kg.

Petroleum Hydrocarbons

No gasoline range hydrocarbons were detected in any of the soil samples at SWMU 10-2BC.

Diesel range hydrocarbons (4.3 to 8.1 mg/kg) were detected in five of the nine samples. The concentrations detected were below the NMED action level of 100 mg/kg and were similar to those measured in background samples collected during the Appendix III RFI. The TPH detections alone are not conclusive evidence of a release from this unit. Because no other release components (such as VOCs, SVOCs, or metals) are present, it is probable that a release has not occurred.

Metals

Arsenic and beryllium were the only metals detected at concentrations above the HHRB action levels in soil samples from SWMU 10-2BC (Table 6-7). Arsenic (1.4 to 4.5 mg/kg) was detected in all samples collected at concentrations above the HHRB of 0.37 mg/kg, but below the 6.5 mg/kg UTL. Beryllium (0.31 and 0.54 mg/kg) was detected in eight of the nine samples collected at SWMU 10-2BC above the HHRB action level of 0.15 mg/kg, but below the 0.84 mg/kg UTL. These concentrations appear to be naturally occurring throughout Kirtland AFB as discussed in Section 4.2.2.

Table 6-7. Summary of Reportable Concentrations for Soil Analyses at SWMU 10-2BC, Building 1001, Floor Drains and Lines (ST-220)[1]
(Concentrations mg/kg)

Chemical Class	Analyte	HHRB Action Level[2]	PQL UTL	Borehole Number and Sample Depth Interval (ft)			
				ST220C-01 2–4	*ST220C-02* 2–4	*ST220C-03* 3–5	*ST220C-04* 3–5
SVOC	Di-n-butylphthalate	7,800	0.70	0.67	0.52	0.56	0.70
TPH	Diesel fraction	100	10.0	ND	8.0	7.7	8.1
METALS	Aluminum	78,000	14,700	7,480	6,320	5,410	5,000
	Arsenic	0.37	6.5	1.4	3.3	2.9	4.5
	Barium	5,500	735	107	109	126	761
	Beryllium	0.15	0.84	0.43	0.32	0.31	ND
	Cadmium	39.0	N/A	ND	ND	ND	ND
	Calcium	N/A	121,000	43,100	68,500	123,000	132,000
	Chromium, total	390	21.6	8.5	5.9	7.3	6.9
	Cobalt	4,700	15.4	4.1	3.4	2.7	3.4
	Copper	2,900	223	41.7	24.0	14.4	29.5
	Iron	N/A	23,800	9,380	7,560	6,090	5,290
	Lead	400	17.5	4.1	4.0	3.7	3.4
	Magnesium	N/A	10,400	3,020	2,790	3,440	4,120
	Manganese	390	549	129	96.4	71.0	78.2
	Nickel	1,600	188	6.5	5.1	4.9	3.2
	Potassium	N/A	3,590	1,370	1,090	726	657
	Sodium	N/A	787	87.8	92.7	149	164
	Thallium	N/A	N/A	ND	ND	ND	ND
	Vanadium	550	55.3	19.7	16.5	19.3	23.1
	Zinc	23,000	114	29.6	20.2	16.0	20.7
OTHER	pH			7.9	8.1	8.7	8.7
	Moisture (%)			6.0	6.1	3.6	6.5

Table 6-7. Summary of Reportable Concentrations for Soil Analyses at SWMU 10-2BC, Building 1001, Floor Drains and Lines (ST-220)[1] (Concentrations mg/kg) (Continued)

Chemical Class	Analyte	HHRB Action Level[2]	PQL UTL	Borehole Number and Sample Depth Interval (ft)				
				ST220C-05	*ST220C-06*	*ST220C-07*	*ST220C-08*	
				3–5	5–7	2–7	2–7 FR	2–7
SVOC	Di-n-butylphthalate	7,800	0.70	0.90	0.74	0.51	0.61	0.62
TPH	Diesel fraction	100	10.0	6.1	4.3	ND	ND	ND
METALS	Aluminum	78,000	14,700	6,600	7,480	10,500	10,100	6,280
	Arsenic	0.37	6.5	2.8	3.4	2.1	2.3	2.6
	Barium	5,500	735	113	542	114	102	398
	Beryllium	0.15	0.84	0.33	0.43	0.43	0.54	0.32
	Cadmium	39.0	N/A	ND	ND	ND	ND	0.64
	Calcium	N/A	121,000	93,500	81,600	43,100	32,200	152,000
	Chromium, total	390	21.6	7.1	8.6	8.6	9.5	8.5
	Cobalt	4,700	15.4	4.2	3.0	4.4	5.7	3.7
	Copper	2,900	223	34.9	27.7	10.7	11.3	36.3
	Iron	N/A	23,800	7,460	8,400	11,800	12,100	7,280
	Lead	400	17.5	4.6	4.7	7.2	5.7	2.9
	Magnesium	N/A	10,400	3,020	5,200	3,620	3,380	4,540
	Manganese	390	549	90.5	118	165	168	122
	Nickel	1,600	188	4.7	6.0	7.9	7.6	5.0
	Potassium	N/A	3,590	1,120	1,040	2,130	2,090	982
	Sodium	N/A	787	120	242	88.6	71.1	146
	Thallium	N/A	N/A	ND	ND	ND	ND	0.11
	Vanadium	550	55.3	18.4	27.8	24.0	22.9	23.4
	Zinc	23,000	114	24.4	23.8	24.7	25.9	25.3
OTHER	pH			8.4	8.6	8.3	8.1	8.3
	Moisture (%)			7.7	6.2	7.8	6.9	5.9

FOOTNOTES

1	Complete laboratory analytical results and method detection limits are presented in Appendix K.
2	Action level of RCRA Proposed Rule Subpart S (55 *FR* 30814, 7/27/90).
*	TPH action level is 100 mg/kg adopted from NMED UST regulations (NMED, 1990). SW-8015 analyzes volatile and semivolatile petroleum hydrocarbon fractions separately. The total concentration of the two fractions analyzed under SW-8015 will be used to assess compliance with stipulated action levels for the purpose of this RFI.
#	Denotes TCLP analysis, results in mg/l.
--	No Data.
FR	Field Replicate.
HHRB	Human health risk based.
J	Estimated value.
N/A	Not Applicable.
NA	Not Analyzed.
ND	Not detected above the method detection limit.
pCi/g	picocuries per gram.
PQL	Practical quantitation limits (defines VOC, SVOC, and TPH).
R	Reject NDs due to interference.
RAD	Radionuclides.
RE	Resample.
SVOC	Semivolatile organic compounds.
TPH	Total petroleum hydrocarbons.
U	Accept data (positive results may be influenced by lab contamination).
UJ	Estimated nondetect.
UTL	Upper tolerance limits (defines metals).
VOC	Volatile organic compounds.

Soil pH and Moisture

Soil pH ranged from 7.9 to 8.7 in these samples. Soil moisture values ranged from 3.6 to 7.8 percent (Table 6-7).

6.4.5 Conclusions and Recommendations

Conclusions

- No VOCs were detected in any of the soil samples collected at SWMU 10-2BC.
- One SVOC was detected in the soil samples collected from this site; all concentrations were below the HHRB action levels.
- No gasoline range hydrocarbons were detected. Diesel range hydrocarbons was detected in five samples at the site. The concentrations detected did not exceed the NMED action level of 100 mg/kg and the detections were not indicative of a contaminant release from this site.
- Arsenic and beryllium were the only metals detected at concentrations exceeding HHRB action levels; these concentrations appear to be naturally occurring throughout Kirtland AFB.
- The analytical results at SWMU 10-2BC are not indicative of a release from this site.

Recommendations

- Based on the findings of the RFI, no further action is necessary; therefore, SWMU 10-2BC does not require further investigation. A No Further Action proposal should be prepared.

6.5 SWMU 10-7, Building 1031, Area Drain Lines (ST-224)

6.5.1 Site Background and Environmental Setting

The area drain lines comprising ST-224 are in the western portion of Kirtland AFB located outside between Building 1031 and an aircraft engine test cell used for testing and maintaining jet engines (Figure 6-5). ST-224 measures 2.5 ft in diameter and 2 ft in depth. ST-224 receives inflow from area drains inside the aircraft engine test cell and Building 1031 and discharges south to the OWS ST-222. ST-224 was investigated on February 2, 1995.

Building 1031 is in the urban/industrial zone. Three production wells are near ST-224: KAFB-2 is 3,500 ft southeast, KAFB-1 is 4,800 ft east-northeast, and KAFB-7 is 2,400 ft southeast (Figure 2-11).

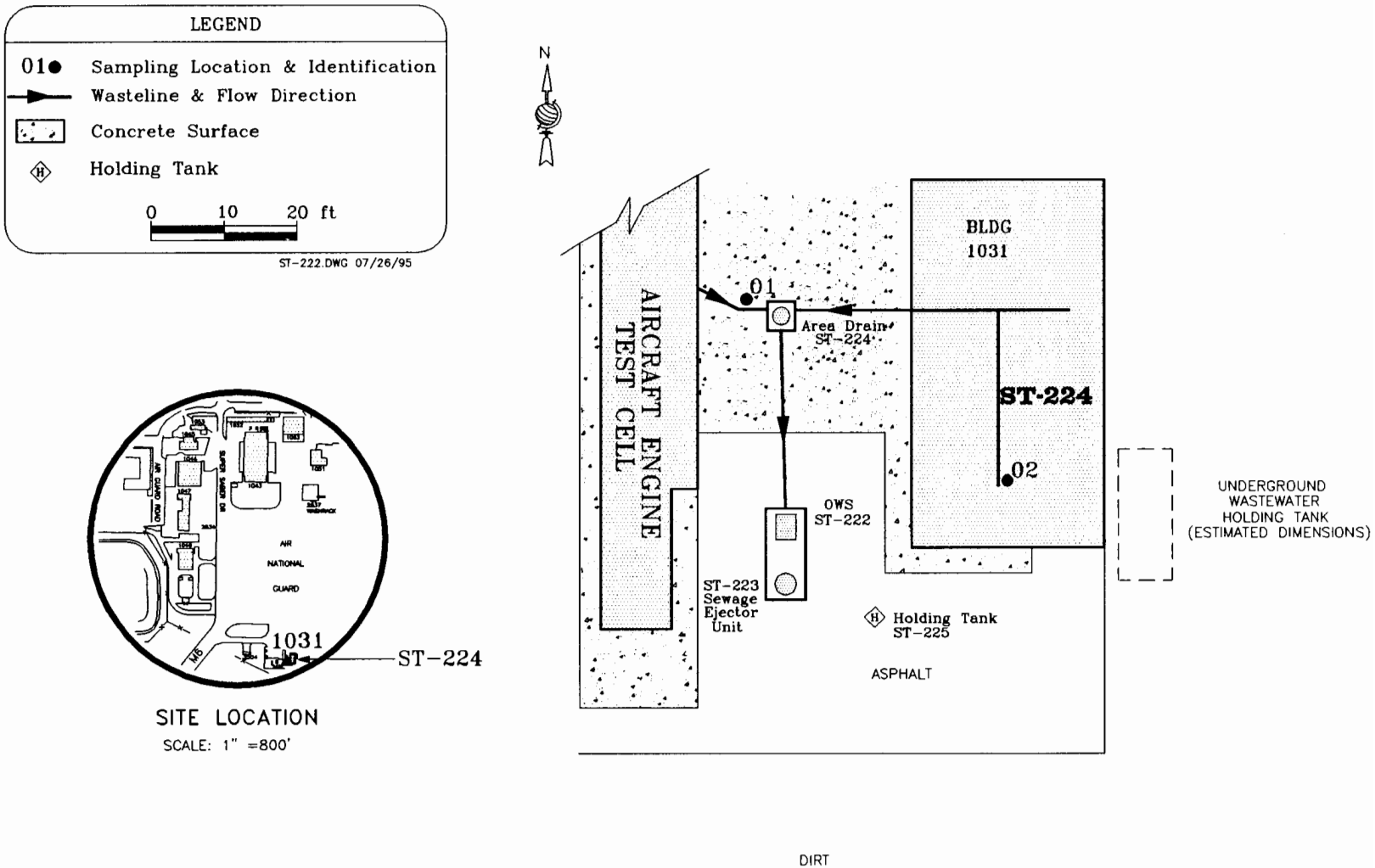


Figure 6-5. Soil Sampling Locations at SWMU 10-7, Building 1031, Area Drain Lines (ST-224)

6.5.2 Study Area Investigation

6.5.2.1 Previous Investigations

During the Stage 2B RFI, subsurface soil samples were collected from the perimeter of the area drain at ST-224. The analytical results from the investigation did not indicate a release from the unit. These results are presented in the Stage 2B RFI Report (USAF, 1995).

6.5.2.2 Data Gaps

Prior to the Appendix III RFI, no data were available to confirm the presence or absence of contaminants in subsurface soil from the wastelines of ST-224.

6.5.2.3 RFI Field Investigation

The objective of the investigation of the drain lines serving ST-224 was to determine if contamination exists in the subsurface soil adjacent to the lines. The soil investigation was limited to the shallow subsurface.

Analytical results from samples collected during the Stage 2B RFI were used to characterize the soil adjacent to the inflow lines within a 50-ft radius of the area drain at ST-224. Based on engineering drawings and observed site conditions, the inflow line to this area drain comes from a floor drain to the west, inside the aircraft engine test cell and a drain inside Building 1031. Discharge is south to the OWS.

On February 2, 1995, two boreholes were drilled and sampled using a Geoprobe. All boreholes were drilled adjacent to the drain lines and used to characterize the soil within a 50-ft radius. Based on engineering drawings and observed field conditions, the depth of the drain line was determined to be 1 ft below grade. The upper and lower 2-ft sections of the 5-ft interval below the base of the drain line were collected (i.e., 1 to 3 ft and 4 to 6 ft).

The analytical results from ST-222-01, south of Building 1031, collected during the Stage 2B RFI, were used for background concentration data to compare to the samples collected at ST-224 during the Appendix III RFI.

Sampling operations and sampling handling procedures are described in Section 3.0. Sample depths and borehole locations for samples submitted for analysis during the Appendix III RFI are listed in Table 6-8. Borehole logs are in Appendix C.

Table 6-8. Boreholes and Samples Analyzed from SWMU 10-7, Building 1031, Area Drain Lines (ST-224)

Borehole	Borehole Location	Sample Depths (ft)
01	Adjacent to the drain line	1-3
02	Adjacent to the drain line	1-3

6.5.2.4 Laboratory Analysis

Two soil samples were analyzed for VOCs, SVOCs, TPH, metals, mercury (the expected contaminants associated with normal operations at this site), soil pH, and soil moisture. The four brass tubes in each 2-ft sample interval were field-screened for possible contamination using a beta-gamma meter and a FID. No elevated readings were measured with these instruments.

ST-222-01, collected during the Stage 2B RFI, was used as a background sample during the investigation of wastelines at ST-224. Soil analysis for ST-222-01 included analyses for TPH, VOCs, SVOCs, metals, soil pH, and soil moisture.

6.5.3 Site Characteristics

6.5.3.1 Geology

The area surrounding ST-224 is underlain by unconsolidated alluvial sediment that is predominantly fine-grained sand. Two 6-ft-deep boreholes were drilled at ST-224. No boreholes penetrated into the Santa Fe Group sediment that presumably underlies this area. A discussion of the general geology at Kirtland AFB is presented in Section 2.4.

As a result of floor drain installation, it is probable that backfill material is present adjacent to each line to a depth at least equal to each line's total depth. Borehole logs for this site are presented in Appendix C.

6.5.3.2 Hydrogeology

Groundwater beneath the area surrounding ST-224 is found within the Upper Santa Fe sediment and is generally thought to be unconfined in the upper portion of the aquifer. This area is within the HR1 saturated zone setting as defined by SNL (Figure 2-9) (SNL, 1994). Hydrogeologic characterization in this portion of Kirtland AFB is complicated by the presence of numerous production wells (Figure 2-11). It is probable that uniform groundwater conditions do not exist in this region. Local cones of depression associated with groundwater withdrawal have altered the groundwater flow direction in the vicinity of the well fields (Figure 2-7).

The gradient is probably north-northeast at this site. Three production wells are located near ST-224: KAFB-2 is 3,500 ft cross-gradient southeast, KAFB-1 is 4,800 ft cross-gradient east-northeast, and KAFB-7 is 2,400 ft upgradient southeast (Figures 2-7 and 2-11). Depth to groundwater is estimated to be about 350 ft below grade (Figure 2-10); however, shallower perched water zones may occur. Hydraulic conductivity within HR1 is estimated at 2 to 171 ft/day (SNL, 1994). A general discussion of the hydrogeology at Kirtland AFB is presented in Section 2.5.

6.5.4 Nature and Extent of Contamination

The following sections describe the nature and extent of contamination based on the analytical result for soil samples submitted for analysis at ST-224. Analytical results are summarized in Table 6-9, where only the reportable concentrations are listed. Full analytical results are presented in Appendix F. Laboratory validation reports are presented in Appendix K.

Table 6-9. Summary of Reportable Concentrations for Soil Analyses at SWMU 10-7, Building 1031, Area Drain Lines (ST-224)[1]
(Concentrations mg/kg)

Chemical Class	Analyte	HHRB Action Level[2]	PQL UTL	Borehole Number and Sample Depth Interval (ft)	
				ST224C-01	*ST224C-02*
				1–3	1–3
METALS	Aluminum	78,000	14,700	4,550	7,970
	Arsenic	0.37	6.5	3.0	2.9
	Barium	5,500	735	101	114
	Calcium	N/A	121,000	41,300	52,600
	Chromium, total	390	21.6	3.9	6.3
	Cobalt	4,700	15.4	2.2	3.0
	Copper	2,900	223	51.2	10.9
	Iron	N/A	23,800	5,830	8,810
	Lead	400	17.5	3.2	4.7
	Magnesium	N/A	10,400	2,290	2,900
	Manganese	390	549	70.8	112
	Nickel	1,600	188	4.0	5.3
	Potassium	N/A	3,590	721	1,440
	Sodium	N/A	787	87.4	153
	Thallium	N/A	N/A	0.11	0.13
	Vanadium	550	55.3	16.0	20.6
	Zinc	23,000	114	26.8	19.9
OTHER	pH			8.8	8.2
	Moisture (%)			9.6	10.0

FOOTNOTES

1	Complete laboratory analytical results and method detection limits are presented in Appendix K.
2	Action level of RCRA Proposed Rule Subpart S (55 *FR* 30814, 7/27/90).
*	TPH action level is 100 mg/kg adopted from NMED UST regulations (NMED, 1990). SW-8015 analyzes volatile and semivolatile petroleum hydrocarbon fractions separately. The total concentration of the two fractions analyzed under SW-8015 will be used to assess compliance with stipulated action levels for the purpose of this RFI.
#	Denotes TCLP analysis, results in mg/l.
--	No Data.
FR	Field Replicate.
HHRB	Human health risk based.
J	Estimated value.
N/A	Not Applicable.
NA	Not Analyzed.
ND	Not detected above the method detection limit.
pCi/g	picocuries per gram.
PQL	Practical quantitation limits (defines VOC, SVOC, and TPH).
R	Reject NDs due to interference.
RAD	Radionuclides.
RE	Resample.
SVOC	Semivolatile organic compounds.
TPH	Total petroleum hydrocarbons.
U	Accept data (positive results may be influenced by lab contamination).
UJ	Estimated nondetect.
UTL	Upper tolerance limits (defines metals).
VOC	Volatile organic compounds.

Organic Compounds

No VOCs or SVOCs were detected in any of the samples at ST-224.

Petroleum Hydrocarbons

No gasoline or diesel range hydrocarbons were detected in any of the samples at ST-224.

Metals

Arsenic (2.9 to 3.0 mg/kg) was the only metal detected at a concentration above the HHRB action level of 0.37 mg/kg at ST-224, but below the 6.5 mg/kg UTL (Table 6-9). These concentrations appear to be naturally occurring throughout Kirtland AFB as discussed in Section 4.2.2.

Soil pH and Moisture

Soil pH ranged from 8.2 to 8.8 in these samples. Soil moisture values ranged from 9.6 to 10.0 percent (Table 6-9).

6.5.5 Conclusions and Recommendations

Conclusions

- No VOCs or SVOCs were detected in any of the samples collected at ST-224.
- No gasoline or diesel range hydrocarbons were detected in any of the samples collected at ST-224.
- Arsenic was the only metal detected at a concentration exceeding the HHRB action level; these concentrations appear to be naturally occurring throughout Kirtland AFB.
- The analytical results at ST-224 are not indicative of a release from this site.

Recommendations

- Based on the findings of the RFI, no further action is necessary; therefore, ST-224 does not require further investigation. A No Further Action proposal should be prepared.

6.6 SWMU 10-7, Building 1040, Area Drain Line (ST-228)

6.6.1 Site Background and Environmental Setting

ST-228 is 40 ft south of Building 1040, which is part of the NMANG complex in the western portion of Kirtland AFB. The drain is concrete, with a 2-ft-square metal grate cover, and is 2 ft deep. ST-228 receives runoff from surrounding areas, including an asphalt driveway and parking area. The unit discharges south approximately 110 ft to OWS ST-234 (Figure 5-18). The outflow line was characterized by the inflow line of ST-234 (Building 1051 OWS lines).

Building 1040 is located in the urban/industrial zone. Three production wells are located near ST-288: KAFB-7 is 3,150 ft south-southeast, KAFB-2 is 3,700 ft south-southwest, and KAFB-1 is 4,350 ft east (Figure 2-11).

6.6.2 Study Area Investigation

6.6.2.1 Previous Investigations

During the Stage 2B RFI, one subsurface soil sample was collected near the outflow of the area drain. The analytical results from the investigation did not indicate release at this site. These results are presented in the Stage 2B RFI Report (USAF, 1995).

6.6.2.2 Data Gaps

Prior to the Appendix III RFI, no data were available that indicated a release of contaminants in the subsurface soil having occurred from the outflow line of ST-228.

6.6.2.3 RFI Field Investigation

The objective of the investigation of the lines serving ST-228 was to determine if contamination exists in the soil adjacent to the wastes. The area drain outflow line was characterized by the sampling that was performed on ST-234 (OWS) inflow line (Section 5.24).

6.6.2.4 Laboratory Analysis

See Section 5.24.

6.6.3 Site Characteristics

6.6.3.1 Geology

The area surrounding ST-228 is underlain by unconsolidated alluvial sediment that is predominantly fine-grained sand and very fine-grained to fine-grained silty sand. Caliche was present just below the asphalt-soil interface as light- to heavily-stained patches. A discussion of the general geology at Kirtland AFB is presented in Section 2.4.

As a result of area drain installation, it is probable that backfill material is present to a depth at least equal to the unit's total depth.

6.6.3.2 Hydrogeology

Groundwater beneath the area surrounding ST-228 is found within the Upper Santa Fe sediment and is generally thought to be unconfined in the upper portion of the aquifer. This area is within the HR1 saturated zone setting as defined by SNL (Figure 2-9) (SNL, 1994). Hydrogeologic characterization in this portion of Kirtland AFB is complicated by the presence of numerous production wells (Figure 2-11). It is probable that uniform groundwater conditions do not exist in this region. Local cones of depression

associated with groundwater withdrawal have altered the groundwater flow direction in the vicinity of the well fields (Figure 2-7).

The gradient is probably north at this site. Three production wells are located near ST-228: KAFB-7 is 3,150 ft south-southeast and KAFB-2 is 3,700 ft south-southwest upgradient, and KAFB-1 is 4,350 ft cross-gradient east (Figures 2-7 and 2-11). Depth to groundwater is estimated to be 350 ft below grade; however, shallower perched water zones may occur (Figure 2-10). Hydraulic conductivity within HR1 is estimated at 2 to 171 ft/day (SNL, 1994). A general discussion of the hydrogeology at Kirtland AFB is presented in Section 2.5.

6.6.4 Nature and Extent of Contamination

Analytical results from the Stage 2B RFI, as well as the Appendix III RFI sampling at ST-234, do not indicate a release has occurred at this site.

6.6.5 Conclusions and Recommendations

- Based on the findings of the RFI, no further action is necessary; therefore, ST-228 does not require further investigation. A No Further Action proposal should be prepared

6.7 SWMU 10-2, Building 1046, Area Drain Lines (ST-233)

6.7.1 Site Background and Environmental Setting

ST-233, is in a small depression approximately 60 ft west of the northwest corner of Building 1046, the NMANG weapons shop in the western portion of Kirtland AFB (Figure 5-17). The drain is concrete, has a circular metal cover with drain holes, and is 1.8 ft in diameter and 1 ft deep. ST-233 is a flood control drain that receives runoff from the lawn area surrounding the drain, the roof of Building 1046, and possibly from the driveway area west of Building 1046 (USAF, 1993c). The unit discharges west approximately 36 ft via a culvert under the asphalt-paved road and into a drainage ditch.

Building 1046 is located in the urban/industrial zone. Three production wells are located near Building 1046: KAFB-7 is 2,800 ft south-southeast, KAFB-2 is 3,000 ft south-southwest, and KAFB-14 is 6,000 ft west (Figure 2-11).

6.7.2 Study Area Investigation

6.7.2.1 Previous Investigations

During the Stage 2B RFI, samples were collected from the perimeter of the area drain ST-233. Analytical results from the investigation indicated that no release had occurred at this site. These results are presented in the Stage 2B RFI Report (USAF, 1995).

6.7.2.2 Data Gaps

Prior to the Appendix III RFI, no data were available to confirm the presence or absence of contaminants in the subsurface soil surrounding the ST-233 area drain line.

6.7.2.3 RFI Field Investigation

The objective of the investigation of the ST-233 lines and the drain was to determine if contamination exists in the adjacent soil.

Since the Stage 2B RFI indicated no contamination and the drain line is less than 50 ft, no subsurface soil investigation was conducted adjacent to the drain line. The sampling from the Stage 2B RFI was used to characterize a 50-ft radius around the area drain.

6.7.2.4 Laboratory Analysis

No laboratory analysis were performed.

6.7.3 Site Characteristics

6.7.3.1 Geology

The area surrounding ST-233 is underlain by unconsolidated alluvial sediment that is predominantly fine-grained sand and very fine-grained to fine-grained silty sand. A discussion of the general geology at Kirtland AFB is presented in Section 2.4.

As a result of area drain installation, it is probable that backfill material is present around the unit to a depth equal to the unit's total depth.

6.7.3.2 Hydrogeology

Groundwater beneath ST-233 is found within the Upper Santa Fe sediments and is generally thought to be unconfined in the upper portion of the aquifer. This area is within the HR1 saturated zone setting as defined by SNL studies (Figure 2-9) (SNL, 1994). Hydrogeologic characterization in this portion of Kirtland AFB is complicated by the presence of numerous production wells (Figure 2-11). It is probable that uniform groundwater conditions do not exist in this region. Local cones of depression associated with groundwater withdrawal have altered the groundwater flow direction in the vicinity of the well fields (Figure 2-7).

The gradient is probably north at this site. Three production wells are located near Building 1046: KAFB-7 is 2,800 ft upgradient south-southeast, KAFB-2 is 3,000 ft upgradient south-southwest, and KAFB-14 is 6,000 ft cross-gradient west (Figures 2-7 and 2-11). Depth to groundwater is approximately 350 ft below grade (Figure 2-10); however, shallower perched water zones may occur. Hydraulic conductivity within HR1 is estimated at 2 to 171 ft/day (SNL, 1994).

6.7.4 Nature and Extent of Contamination

Analytical results from the Stage 2B RFI did not indicate a release had occurred at this site.

6.7.5 Conclusions and Recommendations

Based on the findings of the RFI, no further action is necessary; therefore, ST-233 does not require further investigation. A No Further Action proposal should be prepared.

6.8 SWMU 10-7, Building 1051, Area Drain Lines (ST-237)

6.8.1 Site Background and Environmental Setting

ST-237 is located southeast of Building 1051, the Aerospace Ground Equipment maintenance shop, in the NMANG area of Kirtland AFB (Figure 5-18). ST-237 is a concrete vault 5 ft square and 2 ft deep. A 1.7-ft square metal grate is centered on the top surface. The area drain receives inflow from the asphalt driveway between Buildings 1051, 1060, and 1061. It discharges north 40 ft to OWS ST-234 (Section 5.24), which discharges to the sanitary sewer.

ST-237 is located in the urban/industrial zone. Four production wells are located near ST-237: KAFB-1 is 4,600 ft east, KAFB-7 is 2,900 ft southeast, KAFB-2 is 3,800 ft southwest, and KAFB-14 is 6,700 west (Figure 2-11).

6.8.2 Study Area Investigation

6.8.2.1 Previous Investigations

During the Stage 2B RFI, samples were collected from the perimeter of ST-237. Analytical results were not indicative of a release from this unit. These results are presented in the Stage 2B RFI Report (USAF, 1995).

6.8.2.2 Data Gaps

Prior to the Appendix III RFI, no data were available to confirm the presence or absence of contaminants in the subsurface soil surrounding the area drain wastelines.

6.8.2.3 RFI Field Investigation

The objective of the investigation was to determine the presence or absence of contamination in soil to the lines.

Since the Stage 2B RFI investigation indicated no contamination and the drain lines are less than 50 ft, no subsurface soil investigation was conducted adjacent to the drain lines. The sampling from the Stage 2B RFI investigation was used to characterize a 50-ft radius around the area drain.

6.8.2.4 Laboratory Analysis

No laboratory analysis were performed.

6.8.3 Site Characteristics

6.8.3.1 Geology

The Building 1051 area is underlain by unconsolidated alluvial sediment that is predominantly very fine-grained to fine-grained sand and silty sand. Coarser grained sediment was occasionally encountered in the Stage 2B RFI investigation. A discussion of the general geology at Kirtland AFB is presented in Section 2.4.

As a result of area drain installation, it is probable that backfill material is present around the unit to a depth at least equal to the unit's total depth.

6.8.3.2 Hydrogeology

Groundwater beneath this area is found within the Upper Santa Fe sediments and is generally thought to be unconfined in the upper portion of the aquifer. This area is within the HR1 saturated zone setting as defined by SNL (Figure 2-9) (SNL, 1994). Hydrogeologic characterization in this portion of Kirtland AFB is complicated by the presence of numerous production wells (Figure 2-11). It is probable that uniform groundwater conditions do not exist in this region. Local cones of depression associated with groundwater withdrawal have altered the groundwater flow direction in the vicinity of the well fields (Figure 2-7).

The gradient is probably north at this site. Four production wells are located near ST-237: KAFB-1 is 4,600 ft cross-gradient east, KAFB-7 is 2,900 ft upgradient southeast, KAFB-2 is 3,800 ft upgradient southwest, and KAFB-14 is 6,700 ft cross-gradient west (Figures 2-7 and 2-11). Depth to groundwater is estimated to be 350 ft below grade (Figure 2-10); however, shallower perched water zones may occur. Hydraulic conductivity within HR1 is estimated at 2 to 171 ft/day (SNL, 1994). A general discussion of the hydrogeology at Kirtland AFB is presented in Section 2.5.

6.8.4 Nature and Extent of Contamination

Analytical results from the Stage B RFI did not indicate a release had occurred at this site.

6.8.5 Conclusions and Recommendations

- Based on the findings of the RFI, no further action is necessary; therefore, ST-237 does not require further investigation. A No Further Action proposal should be prepared.

6.9 SWMU 10-7, Building 20422, Area Drain Lines (ST-259)

6.9.1 Site Background and Environmental Setting

ST-259 is outside a heavy equipment wash rack just east of Building 20422 (Figure 5-33). The wash rack is a concrete slab with 18-in wide, inward sloping edges. ST-259 is in the middle of the wash rack and OWS ST-260 is on the southwest corner of the wash rack. ST-259 is concrete, is 6 ft x 3.5 ft x 6 ft, and has a metal grate cover. It receives washdown fluids from the wash rack and discharges 18 ft southwest to OWS ST-260. Building 20422 is a metal shed used to store and dispense heavy oil/asphalt used for road maintenance and is no longer in use. The ST-259 area drain and ST-260 OWS are scheduled for replacement in 1996.

Building 20422 is in the urban/industrial zone. Two production wells are located near ST-259: KAFB-1 is 2,550 ft northwest and Sandia-6 is 3,000 ft east-southeast (Figure 2-11).

6.9.2 Study Area Investigation

6.9.2.1 Previous Investigations

During the Stage 2B RFI, samples were collected from the perimeter of the area drain ST-259. Analytical results were not indicative of a release from this unit. These results are presented in the Stage 2B RFI Report (USAF, 1995).

6.9.2.2 Data Gaps

Prior to the Appendix III RFI, no data were available to confirm the presence or absence of contaminants in the subsurface soil surrounding the ST-259 area drain line.

6.9.2.3 RFI Field Investigation

The objective of the investigation was to determine the presence or absence of contamination in soil adjacent to the wastelines.

Since the Stage 2B RFI indicated no contamination was released and the drain lines are less than 50 ft, no subsurface soil investigation was conducted adjacent to the drain lines. The sampling from the Stage 2B RFI was used to characterize a 50-ft radius around the area drain.

6.9.2.4 Laboratory Analysis

No laboratory analysis was performed.

6.9.3 Site Characteristics

6.9.3.1 Geology

The Building 20422 area is underlain by unconsolidated alluvial sediment. The sediment is predominantly silty sand to gravelly sand, grading to clayey silt at the deeper depths. A discussion of the general geology at Kirtland AFB is presented in Section 2.4.

As a result of area drain installation, it is probable that backfill material is present around the unit to a depth at least equal to the unit's total depth.

6.9.3.2 Hydrogeology

Groundwater beneath the ST-259 area is found within the Upper Santa Fe sediment and is generally thought to be unconfined in the upper portion of the aquifer. This area is within the HR1 saturated zone setting as defined by SNL (Figure 2-9) (SNL, 1994). Hydrogeologic characterization in this portion of Kirtland AFB is complicated by the presence of numerous production wells (Figure 2-11). Uniform groundwater conditions in this region probably do not exist. Local cones of depression associated with groundwater withdrawal have altered the groundwater flow direction in the vicinity of the well fields.

The gradient is probably to the northwest (Figure 2-7). Two production wells are located near the OWS and area drain: KAFB-1 is 2,550 ft downgradient northwest and Sandia-6 is 3,000 ft upgradient east-southeast (Figures 2-7 and 2-11). Depth to groundwater is estimated to be 350 ft below grade; however, shallower perched water zones may occur (Figure 2-10). Hydraulic conductivity in the vicinity of HR1 is estimated at 2 to 171 ft/day (SNL, 1994). A more detailed discussion of the hydrogeology at Kirtland AFB is presented in Section 2.5.

6.9.4 Nature and Extent of Contamination

The Stage 2B RFI indicated a release had occurred at this site based on visual observations. As indicated by Stage 2B RFI analytical results, this leak is evidently not major (USAF, 1995). The units were cleaned and repaired in November 1994. The walls of the area drain were sandblasted and coated with an epoxy. The piping between the area drain and the OWS was sleeved with a 3-in. diameter pipe that was anchored inside the existing 4-in. pipe. The unit is scheduled for replacement in 1996.

6.9.5 Conclusions and Recommendations

Based on the findings of the RFI, no further action is necessary; therefore, ST-259 does not require further investigation. A No Further Action proposal should be prepared.

6.10 SWMU 10-2, Building 57001, Area Drain Line (ST-266)

6.10.1 Site Background and Environmental Setting

ST-266 is west of the north corner of Building 57001, which is part of the former Civil Engineering Research Facility located in the south-central portion of Kirtland AFB (Figure 6-6). The drain is concrete, has a metal grate cover, and is 6.8 ft x 4.8 ft x 3 ft. The unit is in a small depression and receives surface runoff from the surrounding asphalt-paved area and the northeast side of the building and from floor drains inside Building 57001. An inflow pipe enters the area drain on the south side; an outflow pipe exits the unit on the north side. The inflow pipe originates from the floor drains inside Building 57001. The outflow pipe discharges to a stormwater culvert that runs from east to west approximately 70 ft north of ST-266. The building floor drains are scheduled to be closed in 1996. ST-266 was investigated January 30, 1995.

Building 57001 is located on the Hubbell Bench, on the east boundary of the Albuquerque-Belen Basin. The nearest production well to ST-266 is KAFB-10. It is located 18,000 ft to the northwest and is controlled and operated by DOE and SNL (Figure 2-11).

6.10.2 Study Area Investigation

6.10.2.1 Previous Investigations

During the Stage 2B RFI, subsurface soil samples were collected from the perimeter of the area drain. The analytical results did indicate a possible release of arsenic (2.4 to 7.0 mg/kg) at this site. These results are presented in the Stage 2B RFI Report (USAF, 1995).

6.10.2.2 Data Gaps

Prior to the Appendix III RFI, no data were available to determine the presence or absence of contamination in the subsurface soil surrounding the ST-266 area drain line.

6.10.2.3 RFI Field Investigation

The objective of the investigation was to determine the presence or absence of contamination in the subsurface soil surrounding the ST-266 area drain line. The soil investigation was limited to the shallow subsurface.

Analytical results from samples collected during Stage 2B RFI were used to characterize the soil adjacent to the outflow line within a 50-ft radius of ST-266. Discharge is northward to a stormwater culvert that runs east to west approximately 70 ft.

On January 30, 1995, one borehole was drilled and sampled using a Geoprobe. The borehole was drilled adjacent to the outflow line and used to characterize the soil within a 50-ft radius. Based on engineering drawings and observed field conditions, the bottom of the outflow line was determined to be 3 ft below

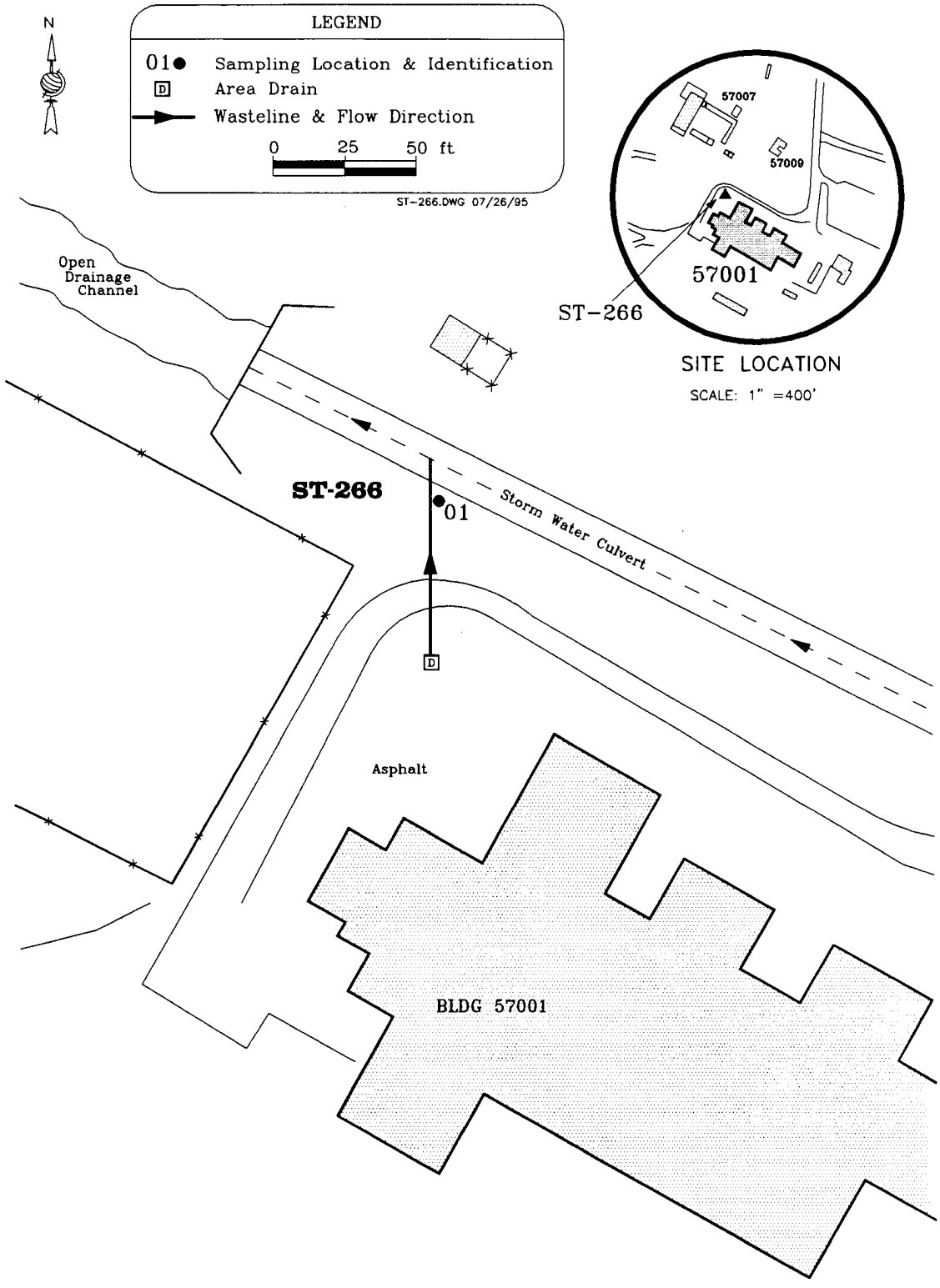


Figure 6-6. Soil Sampling Locations at SWMU 10-2, Building 57001, Area Drain Line (ST-266)

grade. The upper and lower 2-ft sections of the 5-ft interval below the base of the drain line was collected and submitted for analysis.

The analytical results collected during the Stage 2B RFI from ST-266-01, northwest of Building 57001, were used for background concentration data to compare to the samples collected at ST-266 during the Appendix III RFI.

Sampling operations and sampling handling procedures are described in Section 3.0. Borehole logs are in Appendix C.

6.10.2.4 Laboratory Analysis

One sample was analyzed for VOCs, SVOCs, TPH, metals, mercury (the expected contaminants associated with normal operations at this site), soil pH, and soil moisture. The four brass tubes in each 2-ft sample interval were field-screened for possible contamination using a beta-gamma meter and a FID. Both intervals showed elevated FID readings above background. The 3- to 5-ft sample interval showed a high of 8 ppm_v and the 6- to 8-ft sample had a high of 60 ppm_v; therefore, the 6- to 8-ft sample was submitted to the laboratory for analysis.

ST-266-01, collected during the Stage 2B RFI, was used as a background sample during the investigation of outflow line at ST-266. The soil sampling and analysis at the background hole included analyses for TPH, VOC, SVOC, metals, soil pH, and soil moisture.

6.10.3 Site Characteristics

6.10.3.1 Geology

The Building 57001 area is underlain by unconsolidated alluvial sediment and weathered granite. The sediment is gravelly well-graded sand to very fine-grained silty sand. The borehole did not penetrate into the Santa Fe Group sediment that presumably underlies this area. A discussion of the general geology at Kirtland AFB is presented in Section 2.4.

As a result of area drain and line installation, it is probable that backfill material is present adjacent and equal to the unit's total depth. Borehole logs for this site are presented in Appendix C.

6.10.3.2 Hydrogeology

This site is on the western edge of the Hydrogeologic Region III (HR3) saturated zone setting as defined by SNL (Figure 2-9). Bedrock in this area is inferred to be Permian- and Pennsylvanian-aged sedimentary rock. Near the mountains, bedrock is inferred to be Precambrian granite and metamorphic rock. Bedrock is covered by alluvial material and the thickness of this cover presumably increases west away from the mountains. Depth to groundwater is estimated at 90 to 100 ft below grade (Figure 2-10) (SNL, 1994).

Groundwater flow is west-northwest (Figure 2-6). The nearest production well to ST-266 is KAFB-10, nearly 4 mi downgradient northwest (Figures 2-7 and 2-11). Hydraulic conductivity values based on testing range from 6.52 to 114.5 ft/day. A more detailed discussion of the hydrogeology at Kirtland AFB is presented in Section 2.5.

6.10.4 Nature and Extent of Contamination

The following sections describe the nature and extent of contamination based on the analytical results for the soil sample submitted for analysis at ST-266. Analytical results for ST-266 are summarized in Table 6-10, where only the reportable concentrations are listed. Full analytical results are presented in Appendix F. Laboratory validation reports are presented in Appendix K.

Methylene chloride (0.008 mg/kg) was the only VOC analyte detected in the sample. The concentration was below the HHRB action level of 85 mg/kg. Methylene chloride was also detected in associated QC samples and is believed to be the result of laboratory contamination as discussed in Section 3.5.1.

No SVOCs were detected in the soil sample collected at ST-266.

Petroleum Hydrocarbons

No gasoline or diesel range hydrocarbons were detected in the soil sample at ST-266.

Metals

Arsenic (2.2 mg/kg) was the only metal detected at a concentration above the HHRB action level of 0.37 mg/kg at ST-224, but below the 6.5 mg/kg UTL (Table 6-10). This concentration appears to be naturally occurring throughout Kirtland AFB as discussed in Section 4.2.2.

Soil pH and Moisture

The soil pH was 9.0 in this sample. The soil moisture value was 6.6 percent (Table 6-10).

6.10.5 Conclusions and Recommendations

Conclusions

- One VOC was detected in the soil sample collected from this site; the concentration was below the HHRB action levels.
- No SVOCs were detected in the soil sample collected at ST-266.
- No gasoline or diesel range hydrocarbons were detected in the soil sample collected at ST-266 .
- Arsenic was the only metal detected at a concentration exceeding HHRB action levels; this concentration appears to be naturally occurring throughout Kirtland AFB.
- The analytical results at ST-266 are not indicative of a release from this site.

Recommendations

- Based on the findings of the RFI, no further action is necessary; therefore, ST-266 does not require further investigation. A No Further Action proposal should be prepared.

Table 6-10. Summary of Reportable Concentrations for Soil Analyses at SWMU 10-2, Building 57001, Area Drain Line (ST-266)[1] (Concentrations mg/kg)

Chemical Class	Analyte	HHRB Action Level[2]	PQL UTL	Borehole Number and Sample Depth Interval (ft) ST266C-01 6–8
VOC	Methylene chloride	85.0	0.005	0.008
METALS	Aluminum	78,000	14,700	4,690
	Arsenic	0.37	6.5	2.2
	Barium	5,500	735	93.3
	Calcium	N/A	121,000	154,000
	Chromium, total	390	21.6	4.9
	Cobalt	4,700	15.4	3.7
	Copper	2,900	223	55.1
	Iron	N/A	23,800	3,540
	Lead	400	17.5	7.3
	Magnesium	N/A	10,400	2,890
	Manganese	390	549	131
	Nickel	1,600	188	7.5
	Potassium	N/A	3,590	510
	Sodium	N/A	787	111
	Vanadium	550	55.3	7.1
	Zinc	23,000	114	30.3
OTHER	pH			9.0
	Moisture (%)			6.6

FOOTNOTES

1	Complete laboratory analytical results and method detection limits are presented in Appendix K.
2	Action level of RCRA Proposed Rule Subpart S (55 *FR* 30814, 7/27/90).
*	TPH action level is 100 mg/kg adopted from NMED UST regulations (NMED, 1990). SW-8015 analyzes volatile and semivolatile petroleum hydrocarbon fractions separately. The total concentration of the two fractions analyzed under SW-8015 will be used to assess compliance with stipulated action levels for the purpose of this RFI.
#	Denotes TCLP analysis, results in mg/l.
--	No Data.
FR	Field Replicate.
HHRB	Human health risk based.
J	Estimated value.
N/A	Not Applicable.
NA	Not Analyzed.
ND	Not detected above the method detection limit.
pCi/g	picocuries per gram.
PQL	Practical quantitation limits (defines VOC, SVOC, and TPH).
R	Reject NDs due to interference.
RAD	Radionuclides.
RE	Resample.
SVOC	Semivolatile organic compounds.
TPH	Total petroleum hydrocarbons.
U	Accept data (positive results may be influenced by lab contamination).
UJ	Estimated nondetect.
UTL	Upper tolerance limits (defines metals).
VOC	Volatile organic compounds.

7.0 Storm Sewer Systems

The storm sewer systems at Kirtland AFB are located in both industrial and residential areas, and include underground culverts and open drainage ditches. The exact age of the storm sewers is not known, but it is believed the sewers were constructed between 1950 and 1960.

The following storm sewer systems were investigated as part of the Appendix III RFI:

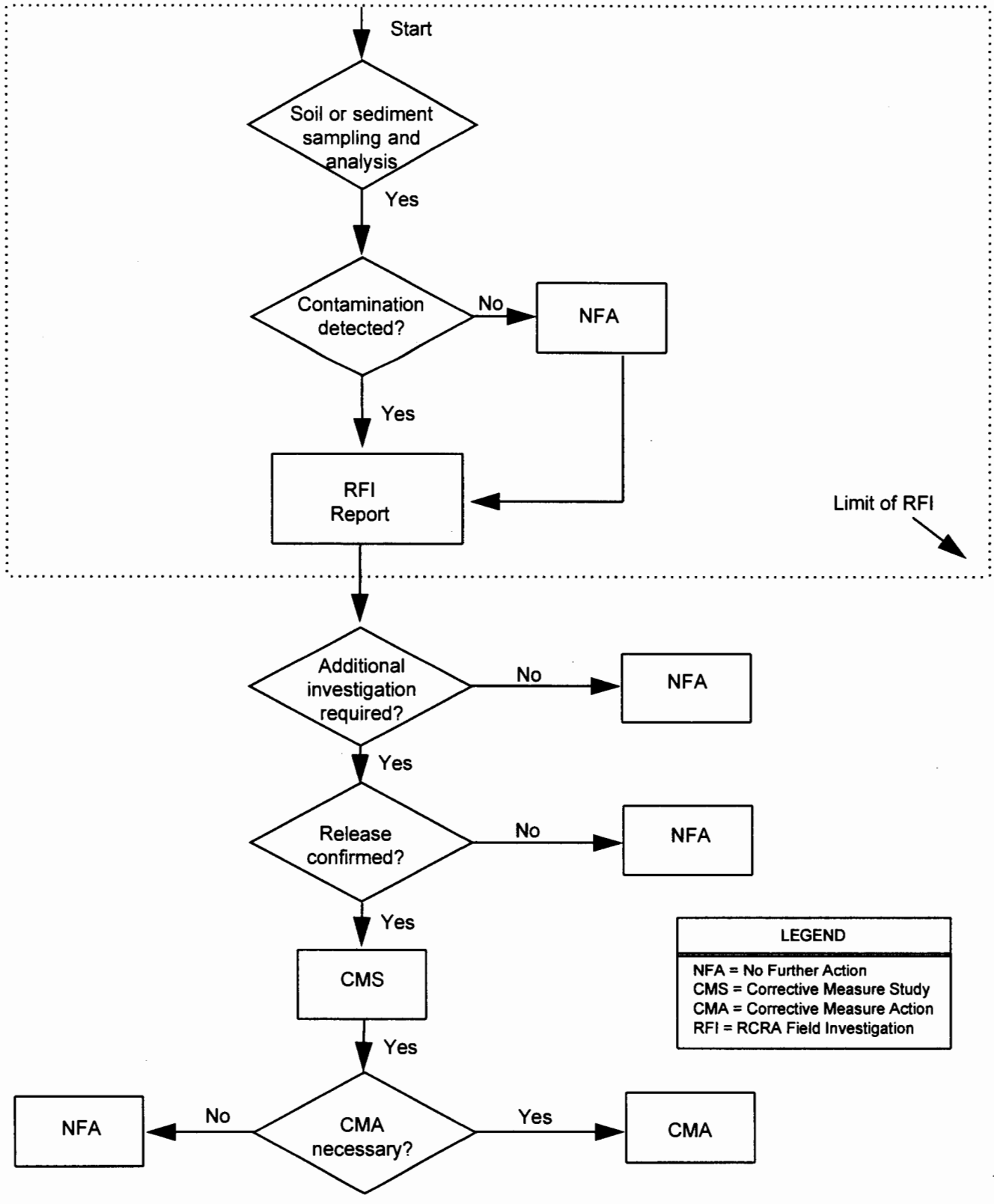
- SWMU 10-2H is the western-most storm sewer. It merges with the discharge of SWMU 10-2AF prior to entering the Tijeras Arroyo.
- SWMU 10-2I is the eastern-most storm sewer that also discharges into the Tijeras Arroyo.
- SWMU 10-2AF is the central storm sewer and is the largest of the three. Its discharge merges with the discharge from SWMU 10-2H prior to entering the Tijeras Arroyo.
- SWMU 10-2G is a storm drain at the Maintenance Shop of Building 1009; it discharges into SWMU 10-2I.

Table 7-1 provides a summary of the storm sewer systems investigated at Kirtland AFB. Figure 7-1 provides an investigative plan for storm sewer systems.

Table 7-1. Storm Sewers Summary

SWMU No.	Kirtland AFB No.	Type	Service Area	Location
10-2H	ST-285	West storm sewer, underground concrete culvert	Industrial	Western-most storm sewer; it runs primarily north-south and its discharge merges with a discharge from SWMU 10-2AF in a tributary of the Tijeras Arroyo
10-2I	ST-286	East storm sewer, underground concrete culvert, and open drainage ditch	Industrial	Eastern-most storm sewer; it runs primarily north-south and discharges to a tributary of the Tijeras Arroyo
10-2AF	ST-325	Central storm sewer, underground concrete culvert, and open drainage ditch	Industrial	Located between ST-285 and ST-286; it runs primarily north-south and its discharge merges with discharge from ST-285 in a tributary of the Tijeras Arroyo
10-2G	ST-331	Storm drain	Industrial	Located in the parking lot near Building 1009 and discharges into ST-286
10-2D	ST-329	Internal grease trap, drain, and lines inside Building 336	Industrial	Receives flow from inside Building 336 and discharges S to OWS ST-206, ST-207; discharges to the storm sewer

Figure 7-1.
Investigative Plan for Storm Sewers



Metals analyses were performed for sediment samples collected within the storm sewers, as with soil samples collected during the Appendix III RFI. Although comparisons are made within each site write-up between metal concentrations detected in storm sewer sediment samples and UTLs, such a comparison is not appropriate for determining whether a release has occurred. Accumulated sediments within storm sewers and drains are the final breakdown products of the native soil. Because the bedrock and native soil at Kirtland AFB are feldspar-rich, these breakdown products have a high clay content. Clays preferentially adsorb heavier cations (e.g., chromium, lead). With gravitational sorting by water flowing through the storm sewer system, it is expected that this sediment would have higher concentrations of these heavier constituents than undisturbed soil. Because metal concentrations in undisturbed soil were the basis for calculation of UTLs, it may not be possible to distinguish between a contaminant release and a natural accumulation of metals in storm sewer samples by using UTLs.

7.1 SWMU 10-2H, West Storm Sewer (ST-285)

7.1.1 Site Background and Environmental Setting

SWMU 10-2H serves the western portion of Kirtland AFB primarily in locations where industrial activities occur (i.e., automotive and heavy equipment repair and maintenance, jet engine repair and maintenance, equipment washdown operations, and fueling operations). The general location of the lines associated with SWMU 10-2H is shown on Figure 7-2. SWMU 10-2H consists of approximately 1.6 mi of pipe of varying diameters (12, 10, 8, 6, 4, and 3 in.) and is constructed primarily of reinforced and nonreinforced concrete pipe. SWMU 10-2H generally runs in the north-south direction and discharges into a tributary to the Tijeras Arroyo between Pads 1 and 2.

The lines associated with SWMU 10-2H are located in the urban/industrial zone. Two production wells are located near SWMU 10-2H: KAFB-13 is 2,800 ft west and KAFB-14 is 2,600 ft east.

7.1.2 Study Area Investigation

The area of investigation was limited to sediment sampling at specified locations within the storm sewer and to surface sampling at the discharge point of SWMU 10-2H.

7.1.2.1 Previous Investigations

No previous investigations have been performed at this site.

7.1.2.2 Data Gaps

No data were available to determine the presence or absence of contaminants in soil surrounding the SWMU 10-2H system prior to this investigation.

7.1.2.3 RFI Field Investigation

The objective of the investigation was to determine if contamination was present in subsurface soil adjacent to the storm sewer lines. On April 25 and 26, 1995, four samples, ST-285C-01 to ST-285C-04, were collected. Figure 7-2 shows sampling locations. Sediment samples ST-285C-01 to ST-285C-03

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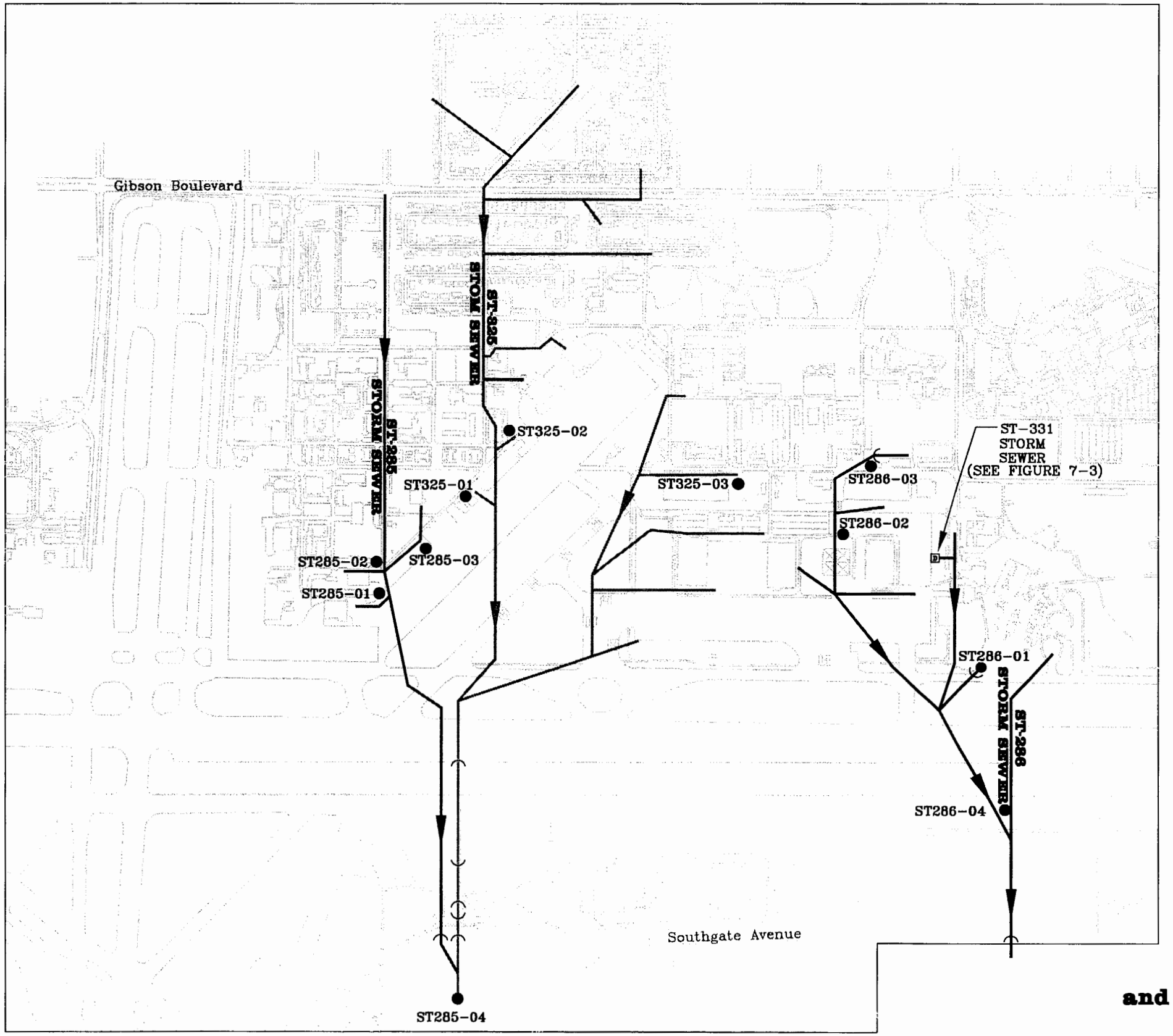


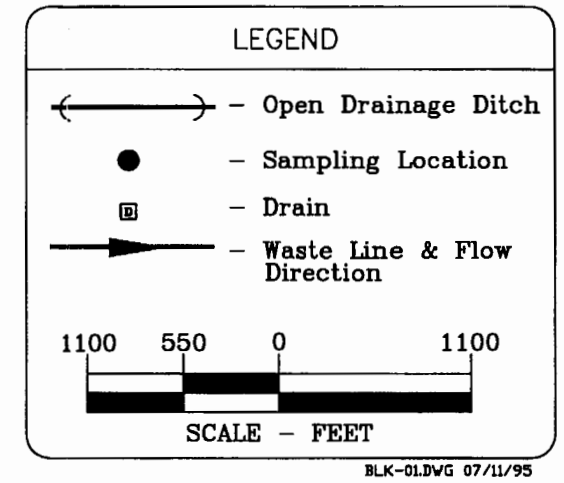


Figure 7-2
Soil Sampling Locations at SWMU 10-2H, West Storm Sewer (ST-285); SWMU 10-2I, East Storm Sewer (ST-286); and SWMU 10-2AF, Central Storm Sewer (ST-325)

Table 7-2. Samples Analyzed from SWMU 10-2H, West Storm Sewer (ST-285)

Samples	Sample Location	Sample Media	FID (ppm_v)
01	Storm drain at SW corner of Clark Ave. and Carlisle Blvd.	Sediment	0
02[a]	Storm drain W of SW corner of Mather St. and Carlisle Blvd.	Sediment	60
03	Storm drain S of Building 381	Sediment	0
04	Mouth of 10-2H culvert outlet	Surface soil	0

FID readings are values above background.

a. Replicate sample also collected at this location.

were collected from the bottom of storm drains located upstream of the discharge point of SWMU 10-2H. Soil sample ST-285C-04 was collected at the discharge point of SWMU 10-2H.

Background samples collected during the Stage 2B RFI were used as background concentration data for samples collected at SWMU 10-2H during this investigation.

Sampling operations and sample handling procedures are described in Section 3.0. Sample locations and replicate samples collected at this site are shown in Table 7-2.

7.1.2.4 Laboratory Analysis

Samples were analyzed for VOCs, SVOCs, TPH, metals (the expected contaminants associated with normal operations at this site), soil pH, and soil moisture. Upon retrieval, samples were field-screened with a beta-gamma meter and a FID. Except for one reading of 60 ppm_v, all field-screening instrument readings remained at background levels. Including one replicate sample, a total of five samples were collected and submitted for laboratory analysis during the SWMU 10-2H investigation.

During the Stage 2B RFI, background samples were used as background concentration data during the investigation of the lines associated with the SWMU 10-2H. Soil analysis at the background holes included analyses for VOCs, SVOCs, TPH, metals (the expected contaminants associated with normal operations in this area), soil pH, and soil moisture.

7.1.3 Site Characteristics

Subsurface samples were not collected in the vicinity of SWMU 10-2H during this investigation. Therefore, the general geology and hydrogeology are described using data from subsurface samples collected at nearby sites investigated during the Stage 2B and Appendix III RFIs (USAF, 1995).

7.1.3.1 Geology

SWMU 10-2H is underlain by unconsolidated alluvial sediments that are predominantly fine-grained sand and very fine-grained to fine-grained silty sand. A discussion of the general geology at Kirtland AFB is presented in Section 2.4.

As a result of the installation of the lines associated with SWMU 10-2H, it is probable that backfill material is present adjacent to each line to a depth equal to the total depth of each line.

7.1.3.2 Hydrogeology

Groundwater beneath the lines associated with SWMU 10-2H is found within the Upper Santa Fe sediments and is generally thought to be unconfined in the upper portion of the aquifer. This area is within the HR1 saturated zone setting as defined by SNL (Figure 2-9) (SNL, 1994). Hydrogeologic characterization in this portion of Kirtland AFB is complicated by the presence of numerous production wells (Figure 2-11). It is probable that uniform groundwater conditions do not exist in this region. Local cones of depression associated with groundwater withdrawal have altered the groundwater flow direction in the vicinity of the well fields (Figure 2-7).

The gradient is probably northeast at this site. Two production wells are located near SWMU 10-2H: KAFB-13 is 2,800 ft west and KAFB-14 is 2,600 ft east. Depth to groundwater is estimated to be 350 ft below grade (Figure 2-10); however, shallower perched water zones may occur. Hydraulic conductivity within HR1 is estimated at 2 to 171 ft/day (SNL, 1994). A general discussion of the hydrogeology at Kirtland AFB is presented in Section 2.5.

7.1.4 Nature and Extent of Contamination

The following sections describe the nature and extent of contamination based on the analytical results for sediment and surface soil samples submitted for analysis from SWMU 10-2H. Analytical results are summarized in Table 7-3, where only the reportable concentrations are listed. Full analytical results are presented in Appendix F. Laboratory validation reports are presented in Appendix K.

Organic Compounds

Four VOCs, methylene chloride, trichloroethylene, m,p-xylene (sum of isomers), and o-xylene, were detected in one or more of the sediment samples collected for SWMU 10-2H. Methylene chloride and trichloroethylene were detected in the field replicate of ST-285C-02 at concentrations of 0.031 and 0.042 mg/kg, respectively. The compounds m,p-xylene (sum of isomers) and o-xylene were detected in sample ST-285C-03 at concentrations of 0.056 and 0.037 mg/kg, respectively. All detected VOC concentrations are below their respective HHRB values.

A total of 20 SVOCs was detected in samples collected at SWMU 10-2H. Nineteen SVOCs were detected in sample ST-285C-01, five of which exceeded respective HHRB action levels. These compounds include benzo(a)anthracene, benzo(b)fluoranthene, and indeno(1,2,3-c,d)pyrene detected at concentrations of 85, 19, and 6.9 mg/kg, respectively, which exceed the HHRB action level of 0.88 mg/kg for these compounds. Benzo(k)fluoranthene was detected at a concentration of 10 mg/kg, exceeding the HHRB action level of 8.8 mg/kg; benzo(a)pyrene was detected at a concentration of 13 mg/kg, exceeding the HHRB action level of 0.088 mg/kg.

Petroleum Hydrocarbons

Gasoline range hydrocarbons were detected in two samples and the field replicate at concentrations ranging from 0.27 to 3.3 mg/kg, below the NMED action level of 100 mg/kg.

Table 7-3. Summary of Reportable Concentrations for Soil Analyses at SWMU 10-2H, West Storm Sewer (ST-285)[1]
(Concentrations mg/kg)

Chemical Class	Analyte	HHRB Action Level[2]	PQL UTL	Borehole Number and Sample Depth Interval (ft)				
				ST285C-01	ST285C-02		ST285C-03	ST285C-04
				0–0	0–0 FR	0–0	0–0	0–0
VOC	Methylene chloride	85.0	0.005	ND	0.031	ND	ND	ND
	Trichloroethylene	58.0	0.005	ND	0.042	ND	ND	ND
	m,p-Xylene (sum of isomers)	160,000	N/A	ND	ND	ND	0.056	ND
	o-Xylene	160,000	N/A	ND	ND	ND	0.037	ND
SVOC	Acenapthene	4,700	0.70	15.0	ND	ND	ND	ND
	Anthracene	23,000	N/A	12.0	ND	ND	ND	ND
	Benzo(a)anthracene	0.88	0.70	35.0	ND	ND	ND	ND
	Benzo(a)pyrene	0.088	0.70	13.0	ND	ND	ND	ND
	Benzo(b)fluoranthene	0.88	0.70	19.0	ND	ND	ND	ND
	Benzo(g,h,i)perylene	N/A	0.70	9.2	ND	ND	ND	ND
	Benzo(k)fluoranthene	8.8	N/A	10.0	ND	ND	ND	ND
	Benzyl butyl phthalate	16,000	N/A	7.3	ND	ND	1.8	ND
	Bis(2-ethylhexyl)phthalate	46.0	0.70	2.1	0.55	2.8	3.2	ND
	Chrysene	88.0	0.70	27.0	ND	ND	ND	ND
	Di-n-butylphthalate	7,800	0.70	7.5	ND	ND	1.4	ND
	Di-n-octylphthalate	1,600	0.70	ND	ND	0.64	ND	ND
	Dibenzofuran	310	0.70	10.0	ND	ND	ND	ND
	Fluoranthane	3,100	0.70	140	0.81	0.55	ND	ND
	Fluorene	3,100	0.70	14.0	ND	ND	ND	ND
	Indeno(1,2,3-c,d)pyrene	0.88	0.70	6.9	ND	ND	ND	ND
	2-Methylnaphthalene	N/A	0.70	9.8	ND	2.2	3.2	ND
	Naphthalene	3,100	0.70	3.0	ND	2.6	2.6	ND
	Phenanthrene	N/A	0.70	140	0.60	ND	ND	ND
	Pyrene	2,300	0.70	110	0.49	0.46	ND	ND
TPH	Diesel fraction	100	10.0	170	65.0	530	1,600	18.0
	Gasoline fraction	100	1.0	ND	3.3	ND	1.5	0.27
METALS	Aluminum	78,000	14,700	2,940	1,520	2,110	2,540	1,750
	Antimony	31.0	N/A	0.81	ND	ND	4.0	ND
	Arsenic	0.37	6.5	1.4	1.9	2.6	3.9	1.6
	Barium	5,500	735	145	122	110	205	32.2
	Cadmium	39.0	N/A	1.2	3.5	2.6	28.2	ND
	Calcium	N/A	121,000	19,300	9,380	8,910	13,800	7,450
	Chromium, total	390	21.6	22.6	27.3	21.0	116	75.9
	Cobalt	4,700	15.4	3.2	1.6	1.5	3.6	2.3
	Copper	2,900	223	27.8	22.2	17.0	157	5.4
	Iron	N/A	23,800	5,210	10,700	10,200	17,400	4,630
	Lead	400	17.5	65.5	47.0	446	655	256
	Magnesium	N/A	10,400	1,460	699	958	1,300	851
	Manganese	390	549	226	77.0	98.1	109	68.6
	Mercury	23.0	N/A	ND	ND	ND	0.48	ND
	Nickel	1,600	188	5.7	3.1	3.1	7.9	ND
	Potassium	N/A	3,590	719	256	409	509	361
	Sodium	N/A	787	103	90.7	83.1	62.5	71.2
	Vanadium	550	55.3	12.5	11.5	11.7	15.4	9.4
	Zinc	23,000	114	90.4	59.2	52.3	356	27.4
OTHER	pH			8.4	8.0	7.9	7.7	7.7
	Moisture (%)			10.7	14.9	14.8	16.8	7.1

FOOTNOTES

1	Complete laboratory analytical results and method detection limits are presented in Appendix K.
2	Action level of RCRA Proposed Rule Subpart S (55 *FR* 30814, 7/27/90).
*	TPH action level is 100 mg/kg adopted from NMED UST regulations (NMED, 1990). SW-8015 analyzes volatile and semivolatile petroleum hydrocarbon fractions separately. The total concentration of the two fractions analyzed under SW-8015 will be used to assess compliance with stipulated action levels for the purpose of this RFI.
#	Denotes TCLP analysis, results in mg/l.
--	No Data.
FR	Field Replicate.
HHRB	Human health risk based.
J	Estimated value.
N/A	Not Applicable.
NA	Not Analyzed.
ND	Not detected above the method detection limit.
pCi/g	picocuries per gram.
PQL	Practical quantitation limits (defines VOC, SVOC, and TPH).
R	Reject NDs due to interference.
RAD	Radionuclides.
RE	Resample.
SVOC	Semivolatile organic compounds.
TPH	Total petroleum hydrocarbons.
U	Accept data (positive results may be influenced by lab contamination).
UJ	Estimated nondetect.
UTL	Upper tolerance limits (defines metals).
VOC	Volatile organic compounds.

Diesel range hydrocarbons were detected in all samples collected at concentrations ranging from 18 to 1,600 mg/kg. Except for ST-285C-04 (18 mg/kg) and the field replicate (65 mg/kg), all concentrations were above the NMED action level of 100 mg/kg.

Metals

Table 7-3 lists all reportable metal concentrations detected at SWMU 10-2H and the respective UTL and HHRB action level concentrations. Arsenic and lead were the only metals detected in one or more samples at concentrations greater than HHRB action levels. Arsenic was detected in all samples at concentrations ranging from 1.4 to 3.9 mg/kg, exceeding the HHRB action level of 0.37 mg/kg, but below the 6.5 mg/kg UTL. Lead was detected in all samples at a concentrations ranging from 47 to 655 mg/kg. The lead concentrations detected in two samples, ST-285C-02 and ST-285C-03, exceed the HHRB action level of 400 mg/kg. All lead concentrations detected exceed the 17.5 mg/kg UTL. Chromium (total) was detected in all but one sample at concentrations exceeding the 21.6 mg/kg UTL. The concentration of zinc in sample ST-285C-03 (356 mg/kg) exceeds the 114 mg/kg UTL.

These concentrations of arsenic appear to be naturally occurring throughout Kirtland AFB as discussed in Section 4.2.2. Elevated concentrations of lead, chromium (total), and zinc may be the result of sediment sorting by flowing water within the storm sewer as discussed in Section 7.0.

Soil pH and Moisture

Soil pH values ranged from 7.7 to 8.4 in these samples. Soil moisture values ranged from 7.1 to 16.8 percent.

7.1.5 Conclusions and Recommendations

Conclusions

- Four VOCs were detected in the sediment samples submitted for analysis at this site; all concentrations were below HHRB action levels.
- Twenty SVOCs were detected in the sediment samples submitted for analysis at this site; eleven of these were found at location ST-285C-01. The SVOCs detected at concentrations above HHRB action levels were: benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, and indeno(1,2,3-c,d)pyrene.
- Gasoline range hydrocarbons were detected in two samples and one field replicate at concentrations below the NMED action level of 100 mg/kg.
- Diesel range hydrocarbons were detected in all samples. Three of the sediment samples contained concentrations in excess of the NMED action level of 100 mg/kg.
- Arsenic was detected at concentrations exceeding the HHRB action level. All arsenic concentrations were above the of 0.37 mg/kg HHRB action level, but below the 6.5 mg/kg UTL. These concentrations of arsenic appear to be naturally occurring throughout Kirtland AFB as discussed in Section 4.2.2.

- Lead (446 mg/kg and 655 mg/kg) was detected in two samples at concentrations exceeding the HHRB action level of 400 mg/kg. All lead concentrations were above the 17.5 mg/kg UTL value. Chromium (total) was detected in all samples at concentrations at or exceeding the 21.6 mg/kg UTL. The concentration of zinc detected in one sample exceeded the 114 mg/kg UTL. Elevated concentrations of lead, chromium (total), and zinc may be the result of sediment sorting by flowing water within the storm sewer as discussed in Section 7.0.

- The analytical results at SWMU 10-2H indicate contaminants are present in sediment samples (ST-285C-01, ST-285C-02, and ST-285C-03) collected from the storm drain locations. No information is available to determine if contaminants have been released to the surrounding soil.

- No VOCs or SVOCs were detected in surface soil sample ST-285C-04. TPH and metal concentrations detected did not exceed HHRB action levels (with the exception of arsenic). The TPH concentrations, similar to concentrations detected in background samples analyzed during the Appendix III RFI, are not conclusive evidence that a release occurred at this location. Without the presence of other release indicators (VOCs, SVOCs, and metals), it is probable that the TPH concentration is not attributable to a release.

Recommendations

- Because of the presence of PAHs, TPH, and metal concentrations above HHRB action levels, further investigations of the soil in the vicinity of the storm sewers is necessary.

- Further investigation in the areas where samples ST-285C-01, ST-285C-02, and ST-285C-03 were collected is recommended to determine if these constituents have been released to surrounding soil.

- It is recommended that the storm sewers where samples ST-285C-01, ST-285C-02, and ST-285C-03 were collected be cleaned and that the removed sediments be properly disposed.

- Identify any activities in the vicinity of ST-285C-01, ST-285C-02, and ST-285C-03 that may be contributing contaminants to the system and implement measures to prevent future releases.

7.2 SWMU 10-2I, East Storm Sewer (ST-286)

7.2.1 Site Background and Environmental Setting

SWMU 10-2I serves the eastern portion of Kirtland AFB primarily in locations where activities such as automotive and heavy equipment repair and maintenance, jet engine repair and maintenance, equipment washdown operations, and fueling operations occur. The general location of the lines associated with SWMU 10-2I are shown on Figure 7-2. This storm sewer is approximately 2.1 miles long, including 0.3 miles of open drainage ditches. The underground storm sewer consists of reinforced and non-reinforced concrete pipe of varying diameters (12, 10, 8, 6, 4, and 3 in.). SWMU 10-2I generally runs in the north-south direction but does have lateral components that run in the east-west direction. It discharges into a tributary of the Tijeras Arroyo.

The lines associated with SWMU 10-2I are located in the urban/industrial zone. The nearest production well to SWMU 10-2I is KAFB-13, 1,700 ft west.

7.2.2 Study Area Investigation

The study area investigation was limited to surface soil sampling at the discharge point and sediment sampling at selected storm drains of SWMU 10-2I.

7.2.2.1 Previous Investigations

No previous investigations have been performed at this site.

7.2.2.2 Data Gaps

No data were available to determine the presence or absence of contaminants in soil surrounding the SWMU 10-2I system prior to this investigation.

7.2.2.3 RFI Field Investigation

The objective of the investigation was to determine if contamination was present in subsurface soils adjacent to the storm sewer lines. Four samples, designated ST-286C-01 to ST-286C-04, were collected on April 25 and April 26, 1995. Figure 7-2 shows sampling locations. Soil sample ST-286C-01 was collected from a ditch intersecting the flightline upstream of the discharge point of SWMU 10-2I. Sediment samples ST-286C-02 and ST-286C-03 were collected from the bottom of storm drains located upstream of the discharge point of SWMU 10-2I. Soil sample ST-286C-04 was collected at the discharge point of SWMU 10-2I.

Background samples collected during the Stage 2B RFI were used as background concentration data for samples collected for SWMU 10-2I during this investigation.

Sampling operations and sample handling procedures are described in Section 3.0. Sample locations at this site are shown in Table 7-4. Sampling logs for SWMU 10-2I are in Appendix C.

Table 7-4. Samples Analyzed from SWMU 10-2I, East Storm Sewer (ST-286)

Samples	Sample Location
01	In ditch where storm sewer intersects Flight Line Rd.
02	In storm drain between Buildings 1001 and 1002
03	In storm drain at NE corner of Randolph St. and Truman St.
04	Mouth of 10-2I culvert outlet

7.2.2.4 Laboratory Analysis

Samples were analyzed for VOCs, SVOCs, TPH, metals, soil pH, and soil moisture. Samples were field-screened with a beta-gamma meter and a FID. All field-screening instrument readings remained at background levels throughout sampling at SWMU 10-2I. A total of four soil samples were collected and submitted for laboratory analysis during the SWMU 10-2I investigation.

Background samples collected during the Stage 2B RFI were used as background concentration data during the investigation of the lines associated with the west storm sewer. Soil analysis at the background holes included analyses for VOCs, SVOCs, TPH, metals (the expected contaminants associated with normal operations in this area), soil pH, and soil moisture.

7.2.3 Site Characteristics

Subsurface samples were not collected in the vicinity of SWMU 10-2I during this investigation. Therefore, the general geology and hydrogeology is described using data from subsurface samples collected at nearby sites investigated during the Stage 2B and Appendix III RFIs.

7.2.3.1 Geology

SWMU 10-2I is underlain by unconsolidated alluvial sediments that are predominantly fine-grained sand and very fine-grained to fine-grained silty sand. A discussion of the general geology at Kirtland AFB is presented in Section 2.4.

As a result of the installation of the lines associated with SWMU 10-2I, it is probable that backfill material is present adjacent to each line to a depth equal to the total depth of each line.

7.2.3.2 Hydrogeology

Groundwater beneath the lines associated with SWMU 10-2I is found within the Upper Santa Fe sediments and is generally thought to be unconfined in the upper portion of the aquifer. This area is within the HR1 saturated zone setting as defined by SNL (Figure 2-9) (SNL, 1994). Hydrogeologic characterization in this portion of Kirtland AFB is complicated by the presence of numerous production wells (Figure 2-11). It is probable that uniform groundwater conditions do not exist in this region. Local cones of depression associated with groundwater withdrawal have altered the groundwater flow direction in the vicinity of the well fields (Figure 2-7).

The gradient is probably northeast at this site. The production well near SWMU 10-2I is KAFB-13, 1,700 ft west. Depth to groundwater is estimated to be 350 ft below grade (Figure 2-10); however, shallower perched water zones may occur. Hydraulic conductivity within HR1 is estimated at 2 to 171 ft/day (SNL, 1994). A general discussion of the hydrogeology at Kirtland AFB is presented in Section 2.5.

7.2.4 Nature and Extent of Contamination

The following sections describe the nature and extent of contamination based on the analytical results for soil samples submitted for analysis from SWMU 10-2I. Analytical results are summarized in Table 7-5, where only the reportable concentrations are listed. Full analytical results are presented in Appendix F. Laboratory validation reports are presented in Appendix K.

Organic Compounds

No VOCs were detected in soil samples collected from SWMU 10-2I.

Twenty SVOCs were detected in samples collected at this site; the majority of these compounds were detected in sample ST-286C-02. Detected concentrations ranged from 0.49 mg/kg to 140 mg/kg. Compounds detected above HHRB action levels include benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, and indeno(1,2,3-c,d)pyrene. Benzo(a)anthracene, benzo(b)fluoranthene, and indeno(1,2,3-c,d)pyrene were detected in ST-286C-02 at concentrations of 40.0, 20.0, and 5.6 mg/kg, respectively, exceeding the HHRB action level for these compounds of 0.88 mg/kg. Benzo(k)fluoranthene was detected in ST-286C-02 at a concentration of 10.0 mg/kg, exceeding the HHRB action level of 8.8 mg/kg. Benzo(a)pyrene was detected in ST-286C-02 at a concentration of 13.0 mg/kg, exceeding the 0.088 mg/kg HHRB action level for this compound.

Petroleum Hydrocarbons

Gasoline range hydrocarbons were not detected in the soil samples.

Diesel range hydrocarbons were detected in all four samples at concentrations ranging from 6.7 to 540 mg/kg. The concentrations of diesel range hydrocarbons detected in two samples, ST-286C-02 (540 mg/kg) and ST-285C-03 (160 mg/kg), were above the NMED action level of 100 mg/kg.

Metals

Table 7-5 lists all reportable metal concentrations detected at SWMU 10-2I and the respective UTL and HHRB action level concentrations. Arsenic and lead were the only metals detected in one or more samples at concentrations greater than HHRB action levels. Arsenic (1.5 to 2.4 mg/kg) was detected in all samples at concentrations exceeding the HHRB action level of 0.37 mg/kg, but below the 6.5 mg/kg UTL. Lead was detected in all samples at concentrations ranging from 4.4 to 419 mg/kg. The lead concentration detected in ST-286C-02 (419 mg/kg) exceeds the HHRB action level of 400 mg/kg and the 17.5 mg/kg UTL. Chromium (total) was detected in all samples at concentrations ranging from 5.7 to 116 mg/kg. The chromium (total) concentration detected in ST-286C-02 (116 mg/kg) exceeds the 21.6 mg/kg UTL, but does not exceed the HHRB action level of 390.0 mg/kg.

These concentrations of arsenic appear to be naturally occurring throughout Kirtland AFB as discussed in Section 4.2.2. Elevated concentrations of lead, chromium (total), and zinc may be the result of sediment sorting by flowing water within the storm sewer as discussed in Section 7.0.

Table 7-5. Summary of Reportable Concentrations for Soil Analyses at SWMU 10-2I, East Storm Sewer (ST-286)[1]
(Concentrations mg/kg)

Chemical Class	Analyte	HHRB Action Level[2]	PQL UTL	Borehole Number and Sample Depth Interval (ft)			
				ST286C-01	*ST286C-02*	*ST286C-03*	*ST286C-04*
				0–0	0–0	0–0	0–0
SVOC	Acenaphthylene	N/A	0.70	ND	0.60	ND	ND
	Acenapthene	4,700	0.70	ND	2.3	ND	ND
	Anthracene	23,000	N/A	ND	3.3	ND	ND
	Benzo(a)anthracene	0.88	0.70	ND	40.0	ND	ND
	Benzo(a)pyrene	0.088	0.70	ND	13.0	ND	ND
	Benzo(b)fluoranthene	0.88	0.70	ND	20.0	ND	ND
	Benzo(g,h,i)perylene	N/A	0.70	ND	4.6	ND	ND
	Benzo(k)fluoranthene	8.8	N/A	ND	10.0	ND	ND
	Benzyl butyl phthalate	16,000	N/A	ND	0.70	25.0	ND
	Bis(2-ethylhexyl)phthalate	46.0	0.70	ND	2.5	ND	ND
	Chrysene	88.0	0.70	ND	51.0	ND	ND
	Di-n-butylphthalate	7,800	0.70	ND	9.2	ND	ND
	Dibenzofuran	310	0.70	ND	0.96	ND	ND
	Fluoranthane	3,100	0.70	ND	140	ND	0.79
	Fluorene	3,100	0.70	ND	1.9	ND	ND
	Indeno(1,2,3-c,d)pyrene	0.88	0.70	ND	5.6	ND	ND
	2-Methylnaphthalene	N/A	0.70	ND	0.49	ND	ND
	Naphthalene	3,100	0.70	ND	1.2	ND	ND
	Phenanthrene	N/A	0.70	ND	22.0	ND	ND
	Pyrene	2,300	0.70	ND	130	ND	ND
TPH	Diesel fraction	100	10.0	6.7	540	160	38.0
METALS	Aluminum	78,000	14,700	4,570	2,440	3,030	3,420
	Antimony	31.0	N/A	ND	0.83	ND	ND
	Arsenic	0.37	6.5	2.4	2.2	1.9	1.5
	Barium	5,500	735	86.4	260	116	47.9
	Cadmium	39.0	N/A	ND	6.3	ND	0.96
	Calcium	N/A	121,000	41,000	17,900	20,400	14,800
	Chromium, total	390	21.6	5.7	116	17.6	8.9
	Cobalt	4,700	15.4	3.4	6.2	3.3	3.6
	Copper	2,900	223	5.3	54.8	14.2	18.0
	Iron	N/A	23,800	6,700	6,650	6,990	8,500
	Lead	400	17.5	4.4	419	55.7	20.2
	Magnesium	N/A	10,400	2,510	1,300	1,730	1,540
	Manganese	390	549	101	99.8	127	127
	Mercury	23.0	N/A	ND	0.15	ND	ND
	Nickel	1,600	188	3.3	5.4	5.1	5.3
	Potassium	N/A	3,590	855	538	677	697
	Silver	390	N/A	ND	ND	ND	2.1
	Sodium	N/A	787	62.5	97.3	101	55.6
	Vanadium	550	55.3	16.2	11.1	13.3	13.1
	Zinc	23,000	114	20.2	217	85.6	104
OTHER	pH			8.5	8.4	8.4	8.6
	Moisture (%)			6.3	17.1	1.2	6.7

FOOTNOTES

1	Complete laboratory analytical results and method detection limits are presented in Appendix K.
2	Action level of RCRA Proposed Rule Subpart S (55 *FR* 30814, 7/27/90).
*	TPH action level is 100 mg/kg adopted from NMED UST regulations (NMED, 1990). SW-8015 analyzes volatile and semivolatile petroleum hydrocarbon fractions separately. The total concentration of the two fractions analyzed under SW-8015 will be used to assess compliance with stipulated action levels for the purpose of this RFI.
#	Denotes TCLP analysis, results in mg/l.
--	No Data.
FR	Field Replicate.
HHRB	Human health risk based.
J	Estimated value.
N/A	Not Applicable.
NA	Not Analyzed.
ND	Not detected above the method detection limit.
pCi/g	picocuries per gram.
PQL	Practical quantitation limits (defines VOC, SVOC, and TPH).
R	Reject NDs due to interference.
RAD	Radionuclides.
RE	Resample.
SVOC	Semivolatile organic compounds.
TPH	Total petroleum hydrocarbons.
U	Accept data (positive results may be influenced by lab contamination).
UJ	Estimated nondetect.
UTL	Upper tolerance limits (defines metals).
VOC	Volatile organic compounds.

Soil pH and Moisture

Soil pH values ranged from 8.4 to 8.6 in these samples. Soil moisture values ranged from 1.2 to 17.1 percent.

7.2.5 Conclusions and Recommendations

Conclusions

- No VOCs were detected in samples collected at this site.
- A total of 20 SVOCs were detected in samples collected at this site. Compounds detected above HHRB action levels, found in sample ST-285C-02, include benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, and indeno(1,2,3-c,d)pyrene.
- Gasoline range hydrocarbons were not detected in the soil samples.
- Diesel range hydrocarbons were detected in all samples. Two of these samples (ST-285C-02 and ST-284C-03) contained concentrations in excess of the NMED action level of 100 mg/kg.
- All arsenic concentrations were above the 0.37 mg/kg HHRB action level, but below the 6.5 mg/kg UTL. These concentrations of arsenic appear to be naturally occurring throughout Kirtland AFB.
- Lead was detected in one sample at 419 mg/kg, exceeding the HHRB action level of 400 mg/kg. The lead concentration detected in three samples (419, 55.7, and 20.2 mg/kg) also exceeds the 17.5 mg/kg UTL. Chromium (total) was detected in one sample at a concentration exceeding the 21.6 mg/kg UTL. Elevated concentrations of lead and chromium (total) may be the result of sediment sorting by flowing water within the storm sewer as discussed in Section 7.0.
- The analytical results at SWMU 10-2I indicate contaminants are present in the sediment sample (ST-286C-02) collected from one of the storm drain locations. No information is available to determine if contaminants have been released to the surrounding soil.

Recommendations

- Due to the presence of SVOCs, TPH, and metal concentrations above HHRB action levels, further investigation of the soil in the vicinity of the storm sewers is necessary.
- Further investigation in the areas where samples ST-286C-02 and ST-286C-03 were collected is recommended to determine if contaminants have been released to surrounding soil.
- It is recommended that the storm sewers be cleaned where samples ST-285C-02 and ST-286C-03 were collected and that the removed sediments be properly disposed of.
- Identify any activities in the vicinity of ST-286C-02 and ST-286C-03 that may be contributing contaminants to the system and implement measures to prevent future releases.

7.3 SWMU 10-2AF, Central Storm Sewer (ST-325)

7.3.1 Site Background and Environmental Setting

SWMU 10-2AF serves the central portion of Kirtland AFB primarily in locations where industrial activities such as automotive and heavy equipment repair and maintenance, jet engine repair and maintenance, equipment washdown operations, and fueling operations occur. The general location of the lines associated with SWMU 10-2AF is shown on Figure 7-2. SWMU 10-2AF is approximately 4.2 mi long and includes 0.3 miles of open drainage ditches. The underground storm sewer system pipe consists of reinforced and non-reinforced concrete pipe of varying diameters (12, 10, 8, 6, 4, and 3 in.). SWMU 10-2AF primarily runs in the north-south direction but does have laterals that run in the east-west direction. It merges with the discharge from SWMU 10-2H in a tributary of the Tijeras Arroyo.

The lines associated with SWMU 10-2AF are in the urban/industrial zone. The nearest production well is KAFB-14, 50 ft south.

7.3.2 Study Area Investigation

The study area investigation was limited to sediment sampling at selected storm drains of SWMU 10-2AF.

7.3.2.1 Previous Investigations

No previous investigations have been performed at this site.

7.3.2.2 Data Gaps

No data were available to determine the presence or absence of contaminants in soil surrounding SWMU 10-2AF prior to this investigation.

7.3.2.3 RFI Field Investigation

The objective of the investigation was to determine if contamination was present in the system and if releases have contaminated soil adjacent to the discharge. Three sediment samples, designated ST-325C-01 to ST-325C-03, were collected at this site on April 25 and April 26, 1995, from the bottom of storm drains located upstream of the discharge point of SWMU 10-2AF. Figure 7-2 shows sampling locations. The west storm sewer SWMU 10-2H (Section 7.1) and the central storm sewer (SWMU 10-2AF) merge to form a single outlet. Therefore, the surface soil sample collected from the soil approximately 5 ft from the outlet of the west storm sewer was also used to characterize the outlet of the central storm sewer.

Background samples collected during the Stage 2B RFI were used as background concentration data for samples collected for SWMU 10-2AF during this investigation.

Sampling operations and sample handling procedures are described in Section 3.0. Sample locations at this site are shown in Table 7-6. All samples were collected from the soil surface. Sampling logs for SWMU 10-2AF are in Appendix C.

Table 7-6. Samples Analyzed from SWMU 10-2AF, Central Storm Sewer (ST-325)

Sample	Sample Location
01	In storm drain NE of Building 377
02	In storm drain NW of Building 376
03	In storm drain E of Building 1015

7.3.2.4 Laboratory Analysis

Samples were analyzed for VOCs, SVOCs, TPH, metals, soil pH, and soil moisture. Samples were field-screened with a beta-gamma meter and a FID. All field-screening instrument readings remained at background levels throughout sampling at SWMU 10-2AF. Three samples were collected and submitted for laboratory analysis during the SWMU 10-2AF investigation.

Background samples collected during the Stage 2B RFI were used as background concentration data during the investigation of the lines associated with SWMU 10-2AF. Soil analysis at the background holes included analyses for VOCs, SVOCs, TPH, metals (the expected contaminants associated with normal operations in this area), soil pH, and soil moisture.

7.3.3 Site Characteristics

Subsurface samples were not collected in the vicinity of the central storm sewer during this investigation. Therefore, the general geology and hydrogeology are described using data from subsurface samples collected at nearby sites investigated during the Stage 2B and Appendix III RFIs.

7.3.3.1 Geology

The central storm sewer is underlain by unconsolidated alluvial sediments that are predominantly fine-grained sand and very fine-grained to fine-grained silty sand. A discussion of the general geology at Kirtland AFB is presented in Section 2.4.

As a result of the installation of the lines associated with the central storm sewer, it is probable that backfill material is present adjacent to each line to a depth equal to the total depth of each line.

7.3.3.2 Hydrogeology

Groundwater beneath the lines associated with the central storm sewer is found within the Upper Santa Fe sediments and is generally thought to be unconfined in the upper portion of the aquifer. This area is within the HR1 saturated zone setting as defined by SNL (Figure 2-9) (SNL, 1994). Hydrogeologic characterization in this portion of Kirtland AFB is complicated by the presence of numerous production wells (Figure 2-11). It is probable that uniform groundwater conditions do not exist in this region. Local cones of depression associated with groundwater withdrawal have altered the groundwater flow direction in the vicinity of the well fields (Figure 2-7).

The gradient is probably northeast at this site. The production well near SWMU 10-2AF is KAFB-14, 50 ft south. Depth to groundwater is estimated to be 350 ft below grade (Figure 2-10); however, shallower perched water zones may occur. Hydraulic conductivity within HR1 is estimated at 2 to 171 ft/day (SNL, 1994). A general discussion of the hydrogeology at Kirtland AFB is presented in Section 2.5.

7.3.4 Nature and Extent of Contamination

The following sections describe the nature and extent of contamination based on the analytical results for soil samples submitted for analysis from SWMU 10-2AF. Analytical results are summarized in Table 7-7, where only the reportable concentrations are listed. Full analytical results are presented in Appendix F. Laboratory validation reports are presented in Appendix K.

Organic Compounds

No VOCs were detected in sediment samples collected from SWMU 10-2AF.

Ten SVOCs were detected in samples collected at this site. The majority of these compounds were detected in sample ST-325C-02. Detected concentrations ranged from 0.42 mg/kg to 1.6 mg/kg. Benzo(a)pyrene (0.48 mg/kg) was the only SVOC detected above the HHRB action level of 0.088 mg/kg.

Two phthalates (benzyl butyl phthalate and bis(2-ethylhexyl)phthalate) were also detected in samples collected at this site. None of these concentrations were above HHRB action levels.

Petroleum Hydrocarbons

Diesel range hydrocarbons were detected in all three samples at concentrations ranging from 22 to 75 mg/kg; these levels are below the NMED action level of 100 mg/kg.

Metals

Table 7-7 lists all reportable metal concentrations detected at SWMU 10-2AF and the respective UTL and HHRB action level concentrations. Arsenic (1.8 to 2.8 mg/kg) was the only metal detected at concentrations greater than the HHRB action level; these detections were below the UTL of 6.5 mg/kg. Chromium (total), lead, and zinc were detected in one or more samples at concentrations exceeding

Table 7-7. Summary of Reportable Concentrations for Soil Analyses at SWMU 10-2AF, Central Storm Sewer (ST-325)[1]
(Concentrations mg/kg)

Chemical Class	Analyte	HHRB Action Level[2]	PQL UTL	Borehole Number and Sample Depth Interval (ft)		
				ST325C-01	*ST325C-02*	*ST325C-03*
				0–0	0–0	0–0
SVOC	Benzo(a)anthracene	0.88	0.70	ND	0.54	ND
	Benzo(a)pyrene	0.088	0.70	ND	0.48	ND
	Benzo(b)fluoranthene	0.88	0.70	ND	0.42	ND
	Benzo(k)fluoranthene	8.8	N/A	ND	0.49	ND
	Benzyl butyl phthalate	16,000	N/A	ND	ND	1.0
	Bis(2-ethylhexyl)phthalate	46.0	0.70	0.94	ND	1.6
	Chrysene	88.0	0.70	ND	0.58	ND
	Fluoranthane	3,100	0.70	ND	1.4	1.2
	Phenanthrene	N/A	0.70	ND	1.1	ND
	Pyrene	2,300	0.70	ND	1.1	1.1
TPH	Diesel fraction	100	10.0	22.0	26.0	75.0
METALS	Aluminum	78,000	14,700	2,190	3,670	4,080
	Arsenic	0.37	6.5	1.9	2.8	1.8
	Barium	5,500	735	50.9	125	108
	Cadmium	39.0	N/A	ND	0.70	0.67
	Calcium	N/A	121,000	6,910	14,600	25,700
	Chromium, total	390	21.6	50.4	12.4	21.7
	Cobalt	4,700	15.4	2.4	3.9	3.5
	Copper	2,900	223	12.0	15.8	19.9
	Iron	N/A	23,800	5,040	10,900	6,750
	Lead	400	17.5	202	112	100
	Magnesium	N/A	10,400	1,040	1,750	2,200
	Manganese	390	549	114	236	129
	Nickel	1,600	188	2.4	3.7	8.2
	Potassium	N/A	3,590	453	631	797
	Sodium	N/A	787	77.8	148	101
	Vanadium	550	55.3	8.9	25.9	14.8
	Zinc	23,000	114	118	90.7	142
OTHER	pH			8.8	8.4	8.7
	Moisture (%)			5.9	0.60	25.2

FOOTNOTES

1	Complete laboratory analytical results and method detection limits are presented in Appendix K.
2	Action level of RCRA Proposed Rule Subpart S (55 *FR* 30814, 7/27/90).
*	TPH action level is 100 mg/kg adopted from NMED UST regulations (NMED, 1990). SW-8015 analyzes volatile and semivolatile petroleum hydrocarbon fractions separately. The total concentration of the two fractions analyzed under SW-8015 will be used to assess compliance with stipulated action levels for the purpose of this RFI.
#	Denotes TCLP analysis, results in mg/l.
--	No Data.
FR	Field Replicate.
HHRB	Human health risk based.
J	Estimated value.
N/A	Not Applicable.
NA	Not Analyzed.
ND	Not detected above the method detection limit.
pCi/g	picocuries per gram.
PQL	Practical quantitation limits (defines VOC, SVOC, and TPH).
R	Reject NDs due to interference.
RAD	Radionuclides.
RE	Resample.
SVOC	Semivolatile organic compounds.
TPH	Total petroleum hydrocarbons.
U	Accept data (positive results may be influenced by lab contamination).
UJ	Estimated nondetect.
UTL	Upper tolerance limits (defines metals).
VOC	Volatile organic compounds.

UTLs but below HHRB action levels. Chromium (total) was detected in one sample at a concentration (50.4 mg/kg) exceeding the 21.6 mg/kg UTL. Lead was detected in all samples at concentrations ranging from 100 to 202 mg/kg, exceeding the 17.5 mg/kg UTL. Zinc was detected in two samples at concentrations (118 and 142 mg/kg) exceeding the 114 mg/kg UTL.

These concentrations of arsenic appear to be naturally occurring throughout Kirtland AFB as discussed in Section 4.2.2. Elevated concentrations of lead, chromium (total), and zinc indicate that these materials may be the result of sediment sorting by flowing water within the storm sewer as discussed in Section 7.0.

Soil pH and Moisture

Soil pH values ranged from 8.4 to 8.8 in these samples. Soil moisture values ranged from 0.60 to 25.2 percent.

7.3.5 Conclusions and Recommendations

Conclusions

- No VOCs were detected in samples collected at this site.
- A total of ten SVOCs were detected in samples collected at this site. The majority of these compounds were detected in sample ST-325C-02. Benzo(a)pyrene (0.48 mg/kg) was the only SVOC detected above the HHRB action level of 0.088 mg/kg.
- Elevated diesel range hydrocarbons were detected in all samples. Although the concentrations were below the NMED action level of 100 mg/kg, the concentrations exceeded concentrations detected in background samples (analyzed during the Appendix III RFI) and are potential indicators that a release may have occurred.
- Arsenic was detected at concentrations exceeding the HHRB action level; all concentrations were above the 0.37 mg/kg HHRB action level, but below the 6.5 mg/kg UTL. These concentrations appear to be naturally occurring throughout Kirtland AFB as discussed in Section 4.2.2.
- Chromium (total) was detected in one sample at a concentration (50.4 mg/kg) exceeding the 21.6 mg/kg UTL. Lead was detected in all samples at a concentrations exceeding the 17.5 mg/kg UTL. Zinc was detected in two samples at concentrations exceeding the 114 mg/kg UTL. None of these detections exceeded HHRB action levels. Elevated concentrations of lead, chromium (total), and zinc may be the result of sediment sorting by flowing water within the storm sewer as discussed in Section 7.0.
- The analytical results at SWMU 10-2AF indicate contaminants are present in the sediment sample ST-325C-02. No information is available to determine if contaminants have been released to the surrounding soil.

Recommendations

- Further investigation in the areas where samples ST-325C-01, ST-325C-02, and ST-325C-03 were collected is recommended to determine if contaminants have been released to surrounding soil.
- It is recommended the storm sewer where sediment samples ST-325C-01, ST-325C-02, and ST-325C-03 were collected be cleaned and the removed sediments be properly disposed.
- Identify any activities in the vicinity of ST-325C-01, ST-325C-02, and ST-325C-03 that may be contributing contaminants to the system and implement measures to prevent future releases.

7.4 SWMU 10-2G, Building 1009, Storm Drain (ST-331)

7.4.1 Site Background and Environmental Setting

SWMU 10-2G receives stormwater runoff from Building 1009, an aircraft maintenance shop. Jet engine repair and maintenance are the industrial activities at this site. SWMU 10-2G has a metal grate cover and discharges into storm sewer line SWMU 10-2I (Figure 7-3).

SWMU 10-2G is in the urban/industrial zone. Two production wells are located at SWMU 10-2G: KAFB-2 is 2,800 ft southeast and KAFB-14 is 3,000 ft west-northwest.

7.4.2 Study Area Investigation

The study area investigation was limited to sediment sampling at storm drain SWMU 10-2G.

7.4.2.1 Previous Investigations

No previous investigations have been performed at this site.

7.4.2.2 Data Gaps

No data were available to determine the presence or absence of contaminants in soil surrounding SWMU 10-2G system prior to this investigation.

7.4.2.3 RFI Field Investigation

The objective of the investigation was to determine if contaminants have been introduced into the storm drain of SWMU 10-2G. One sediment sample, ST-331C-01, was collected on April 26, 1995, from the bottom of storm drain SWMU 10-2G. Figure 7-3 shows the sampling location. The east storm sewer (SWMU 10-2I) (Section 7.2) and the storm drain at Building 1009 (SWMU 10-2G) merge to form a single outlet. Therefore, the surface soil sample that was collected from the outlet for the east storm sewer investigation was also used to characterize the outlet to the storm drain at Building 1009.

Background samples collected during the Stage 2B RFI were used as background concentration data for samples collected for SWMU 10-2G during this investigation.

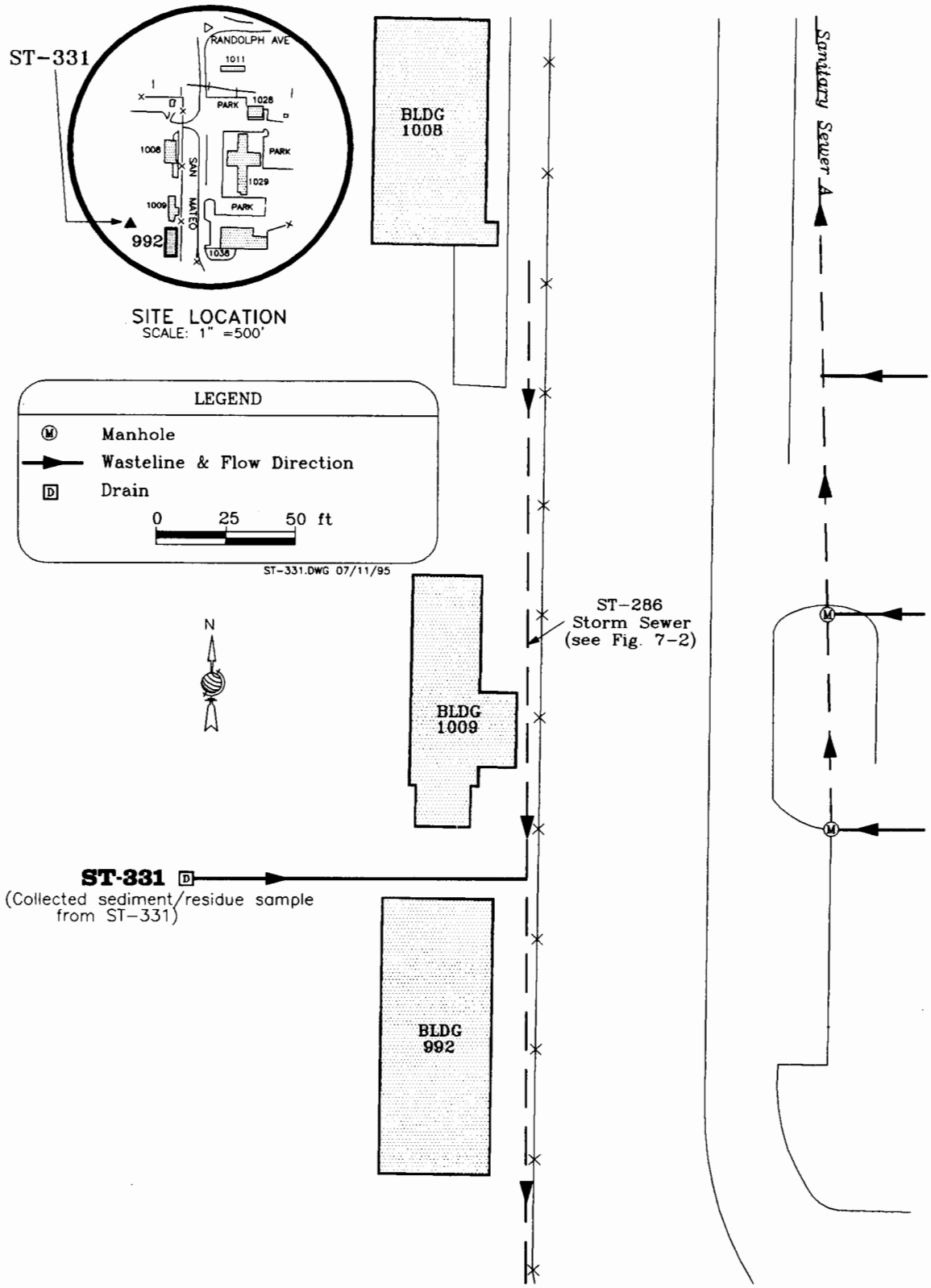


Figure 7-3. Soil Sampling Locations at SWMU 10-2G, Building 1009, Storm Drain (ST-331)

Sampling operations and sample handling procedures are described in Section 3.0. All samples were collected from the soil surface. Sampling logs for SWMU 10-2G are in Appendix C.

7.4.2.4 Laboratory Analysis

Samples were analyzed for VOCs, SVOCs, TPH, metals (the expected contaminants associated with normal operations at this site), soil pH, and soil moisture. Samples were field-screened with a beta-gamma meter and a FID. All field-screening instrument readings remained at background levels throughout sampling at SWMU 10-2G. One sample was collected and submitted for laboratory analysis during the SWMU 10-2G investigation.

Background samples collected during the Stage 2B RFI were used as background concentration data during the investigation of the lines associated with SWMU 10-2H. Soil analysis at the background holes included analyses for VOCs, SVOCs, TPH, metals, soil pH, and soil moisture.

7.4.3 Site Characteristics

Subsurface samples were not collected in the vicinity of the Building 1009 storm sewer during this investigation. Therefore, the general geology and hydrogeology is described using information collected at nearby sites investigated during the Stage 2B and Appendix III RFIs.

7.4.3.1 Geology

The Building 1009 storm sewer is underlain by unconsolidated alluvial sediments that are predominantly fine-grained sand and very fine-grained to fine-grained silty sand. A discussion of the general geology at Kirtland AFB is presented in Section 2.4.

As a result of the installation of the lines associated with the Building 1009 storm sewer, it is probable that backfill material is present adjacent to each line to a depth equal to the total depth of each line.

7.4.3.2 Hydrogeology

Groundwater beneath the lines associated with the Building 1009 storm sewer is found within the Upper Santa Fe sediments and is generally thought to be unconfined in the upper portion of the aquifer. This area is within the HR1 saturated zone setting as defined by SNL (Figure 2-9) (SNL, 1994). Hydro-geologic characterization in this portion of Kirtland AFB is complicated by the presence of numerous production wells (Figure 2-11). It is probable that uniform groundwater conditions do not exist in this region. Local cones of depression associated with groundwater withdrawal have altered the groundwater flow direction in the vicinity of the well fields (Figure 2-7).

The gradient is probably northeast at this site. Two production wells are located near SWMU 10-2H: KAFB-2 is 2,800 ft (upgradient) southeast and KAFB-14 is 3,000 ft (downgradient) west-northwest. Depth to groundwater is estimated to be 350 ft below grade (Figure 2-10); however, shallower perched water zones may occur. Hydraulic conductivity within HR1 is estimated at 2 to 171 ft/day (SNL, 1994). A general discussion of the hydrogeology at Kirtland AFB is presented in Section 2.5.

7.4.4 Nature and Extent of Contamination

The following sections describe the nature and extent of contamination based on the analytical results for soil samples submitted for analysis from SWMU 10-2G. Analytical results are summarized in Table 7-8, where only the reportable concentrations are listed. Full analytical results are presented in Appendix F. Laboratory validation reports are presented in Appendix K.

Organic Compounds

No VOCs were detected in the sediment sample collected from SWMU 10-2G.

Nine SVOCs were detected in the sediment sample collected at this site. Concentrations ranged from 4.0 mg/kg to 19.0 mg/kg. Compounds detected above HHRB action levels include benzo(a)anthracene, benzo(a)pyrene, and benzo(b)fluoranthene. Benzo(a)anthracene and benzo(b)fluoranthene were detected at concentrations of 6.0 and 5.9 mg/kg, respectively, exceeding the HHRB action level of 0.88 mg/kg. Benzo(a)pyrene was detected at a concentration of 5.1 mg/kg, exceeding the 0.088 mg/kg HHRB action level for this compound.

Petroleum Hydrocarbons

Diesel range hydrocarbons were detected the sample at a concentration of 98 mg/kg; this is below the NMED action level of 100 mg/kg.

Metals

Table 7-8 lists all reportable metal concentrations detected at SWMU 10-2G and the respective UTL and HHRB action level concentrations. Arsenic was the only metal detected at concentrations greater than the HHRB action level; the concentration of 2 mg/kg exceeded the HHRB action level of 0.37 mg/kg, but was below the 6.5 mg/kg UTL. Lead and zinc were the only metals detected at concentrations exceeding UTLs. Lead was detected at a concentration of 117 mg/kg, exceeding the 17.5 mg/kg UTL. Zinc was detected at a concentration of 122 mg/kg, exceeding the 114 mg/kg UTL.

These concentrations of arsenic appear to be naturally occurring throughout Kirtland AFB as discussed in Section 4.2.2. Elevated concentrations of lead and zinc may be the result of sediment sorting by flowing water within the storm sewer as discussed in Section 7.0.

Soil pH and Moisture

The soil pH and soil moisture values for ST-331C-01 were 8.1 and 16.8, respectively.

Table 7-8. Summary of Reportable Concentrations for Soil Analyses at SWMU 10-2G, Building 1009, Storm Drain (ST-331)[1]
(Concentrations mg/kg)

Chemical Class	Analyte	HHRB Action Level[2]	PQL UTL	Borehole Number and Sample Depth Interval (ft) ST331C-01 0–0
SVOC	Benzo(a)anthracene	0.88	0.70	6.0
	Benzo(a)pyrene	0.088	0.70	5.1
	Benzo(b)fluoranthene	0.88	0.70	5.9
	Benzo(k)fluoranthene	8.8	N/A	6.1
	Chrysene	88.0	0.70	10.0
	Di-n-butylphthalate	7,800	0.70	4.1
	Fluoranthane	3,100	0.70	18.0
	Phenanthrene	N/A	0.70	4.0
	Pyrene	2,300	0.70	19.0
TPH	Diesel fraction	100	10.0	98.0
METALS	Aluminum	78,000	14,700	3,140
	Arsenic	0.37	6.5	2.0
	Barium	5,500	735	123
	Cadmium	39.0	N/A	3.7
	Calcium	N/A	121,000	7,990
	Chromium, total	390	21.6	29.8
	Cobalt	4,700	15.4	3.4
	Copper	2,900	223	69.5
	Iron	N/A	23,800	7,130
	Lead	400	17.5	117
	Magnesium	N/A	10,400	1,490
	Manganese	390	549	92.5
	Nickel	1,600	188	6.5
	Potassium	N/A	3,590	610
	Silver	390	N/A	3.6
	Sodium	N/A	787	105
	Vanadium	550	55.3	13.5
	Zinc	23,000	114	122
OTHER	pH			8.1
	Moisture (%)			16.8

FOOTNOTES

1	Complete laboratory analytical results and method detection limits are presented in Appendix K.
2	Action level of RCRA Proposed Rule Subpart S (55 *FR* 30814, 7/27/90).
*	TPH action level is 100 mg/kg adopted from NMED UST regulations (NMED, 1990). SW-8015 analyzes volatile and semivolatile petroleum hydrocarbon fractions separately. The total concentration of the two fractions analyzed under SW-8015 will be used to assess compliance with stipulated action levels for the purpose of this RFI.
#	Denotes TCLP analysis, results in mg/l.
--	No Data.
FR	Field Replicate.
HHRB	Human health risk based.
J	Estimated value.
N/A	Not Applicable.
NA	Not Analyzed.
ND	Not detected above the method detection limit.
pCi/g	picocuries per gram.
PQL	Practical quantitation limits (defines VOC, SVOC, and TPH).
R	Reject NDs due to interference.
RAD	Radionuclides.
RE	Resample.
SVOC	Semivolatile organic compounds.
TPH	Total petroleum hydrocarbons.
U	Accept data (positive results may be influenced by lab contamination).
UJ	Estimated nondetect.
UTL	Upper tolerance limits (defines metals).
VOC	Volatile organic compounds.

7.4.5 Conclusions and Recommendations

Conclusions

- No VOCs were detected in the sample collected at this site.
- A total of nine SVOCs were detected in samples collected at this site. Compounds detected above HHRB action levels include benzo(a)anthracene, benzo(a)pyrene, and benzo(b)fluoranthene.
- Diesel range hydrocarbons were detected at 98 mg/kg. Although the concentration did not exceed the NMED action level of 100 mg/kg, it exceeded those detected in background samples analyzed during the Appendix III RFI and is a potential indicator that a release may have occurred.
- Arsenic was detected at a concentration exceeding the HHRB action level of 0.37 mg/kg, but below the 6.5 mg/kg UTL. These concentrations of arsenic appear to be naturally occurring throughout Kirtland AFB as discussed in Section 4.2.2.
- Lead and zinc were detected at concentrations exceeding their UTL values of 17.5 mg/kg and 114 mg/kg, respectively. Elevated concentrations of lead and zinc may be the result of sediment sorting by flowing water within the storm sewer as discussed in Section 7.0.
- The analytical results at SWMU 10-2G indicate contaminants are present in the sediment sample collected from the ST-331C-01 storm drain location. No information is available to determine if contaminants have been released to the surrounding soil.

Recommendations

- Because of the presence of SVOCs, metal concentrations, and diesel range hydrocarbons above or near the respective HHRB action levels, further investigation of the soil in the vicinity of the storm drain is necessary.
- It is recommended that the storm drain 10-2G (ST-331) be cleaned and that the removed sediments be properly disposed.
- Identify any activities in the vicinity of SWMU 10-2G that may be contributing contaminants and implement measures to prevent future releases.

7.5 SWMU 10-2D, Building 336, Internal Drains and Lines (ST-329)

7.5.1 Site Background and Environmental Setting

ST-329, Building 336, internal drains and lines, are also part of the inflow lines for ST-206 and ST-207. These inflow lines were investigated as part of the Appendix III RFI. Results of the investigation of those inflow lines are discussed in Sections 5.6 and 5.7. These drains are cross-connected to the storm sewers via ST-206 and ST-207.

8.0 Septic Tanks, Leach Fields, and Lines

This section of the RFI Report addresses the septic tanks, leach fields, and inflow/outflow lines of 41 septic systems at Kirtland AFB. The majority of the tanks discharge to leach fields; others may be self-contained or discharge to leach pits. The septic systems have been identified as potential sources of soil contamination.

Septic systems are used throughout Kirtland AFB at locations not served by sanitary sewer lines. Septic tanks receive waste from both industrial and nonindustrial sources on the base (urban industrial area, parts of the MWSA, and the southern portion of the base). The septic tanks receive wastes via inflow lines. Within the septic tank, solids and heavy waste settle and are subject to biological activity that decompose the waste; liquids and suspended substances are discharged via an outflow to a network of porous drain pipes, where they enter the surrounding soil through a leach field. *In situ* biological activity further decomposes septic waste after it has entered the surrounding soil.

The investigative plan for the septic system is shown in Figure 8-1. Soil samples were collected at the leach field (or adjacent to the septic tank or leach pits where a leach field is not present). The results associated with the Appendix III RFI sampling and analysis are presented in the following sections. Summary information about the septic systems is presented in Table 8-1. The general locations of the systems are described on that table and are shown in Figure 1-2. Maps of each septic system are presented in the subsections.

The investigation plan for each septic system is included in Table 8-2. As indicated, soil samples were collected in the leach field area or adjacent to the septic tank or leach pit (if a leach field is not present). Soil samples were collected at a starting depth equal to the base of the leach field line, septic tank, or leach pit. A 5-ft interval consisting of two, 2-ft intervals of recovered soil was subject to field-screening using a FID. The interval demonstrating the highest meter reading from each borehole was retained for laboratory analysis. If no sample interval demonstrated an elevated meter reading, the sample collected just below the line or unit was retained for laboratory analysis.

Each of the following subsections contain a description of each site, its environmental setting, data gaps, nature and extent of contamination, conclusions, and recommendations.

8.1 SWMU ST-273, Building 618, Septic Tank and Lines (ST-273)

8.1.1 Site Background and Environmental Setting

Septic tank SWMU ST-273 is located approximately 190 ft west-northwest of Building 618, the Missile and Space Engineering Research Facility, in the northwest portion of Kirtland AFB (Figure 8-2). ST-273 was investigated on February 16, 1995.

Based on engineering drawings and observed site conditions, there are two inflow sources from Building 618 to septic tank SWMU ST-273. The total of the two inflow line lengths is approximately 320 ft. Potentially, the septic tank could have received contaminants from Building 618. Possible leakage from the septic tank could have contaminated adjacent soil.

Figure 8-1.
Investigative Plan for Septic Tank, Leach Fields, and Lines

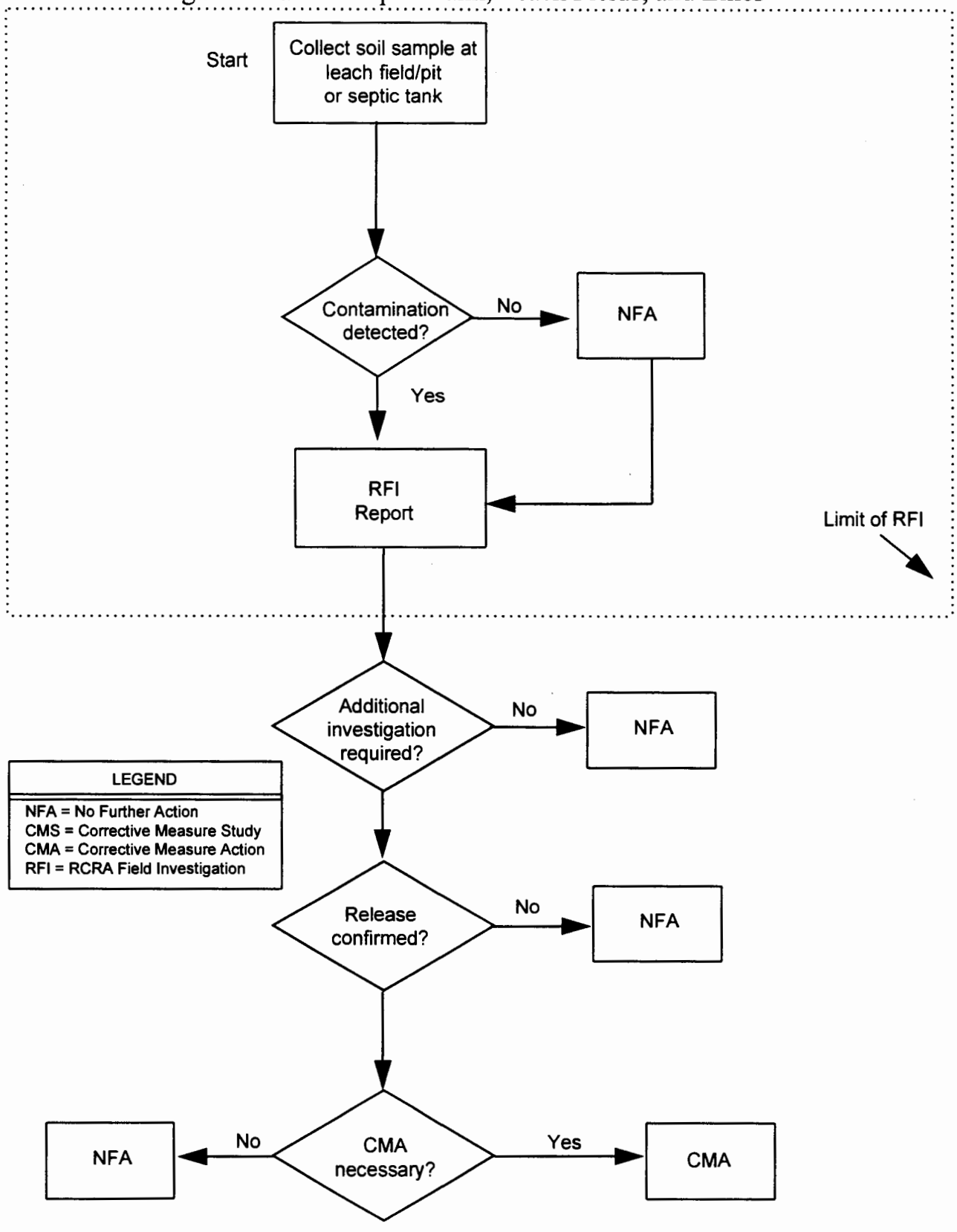


Table 8-1. Summary of Septic Tanks, Leach Fields, and Lines

SWMU No.	Kirtland AFB No.	Unit Name	Approximate Location	Approximate Measurements (ft)		
				Inflow Line	Outflow Line	Leach Field Dimensions (ft)
ST-273	ST-273	Building 618 Septic tank and lines	190 ft W-SW of Building 618	320	0	No leach field mapped
10-21	ST-287	Building 525 Septic tank, leach field, and lines	10 ft S of Building 525	10	15	50 x 20
10-21	ST-288	Building 614 Leach field and lines	See Figure 8-4	0	90	20 x 20
10-21	ST-289	Building 617 Septic tanks, leach fields, and lines	See Figure 8-5	333	37	45 x 20 and 30 x 25
10-21	ST-290	Building 619 Septic tank, leach field, and lines	15 ft S of Building 619	15	40	50 x 20
10-21	ST-291	Building 618 Septic tank, leach field, and lines	See Figure 8-7	40	4	25 x 15
10-21	ST-292	Building 622 Septic tank, leach field, and lines	45 ft E of Building 622	52	8	60 x 20
10-21	ST-293	Building 37570 Septic tank, leach field, and lines	75 ft W of Building 37570	75	20	Seepage pit 8-ft diameter
10-21	ST-294	Building 633 Septic tank, leach field, and lines	190 ft S-SW of Building 633	190	15	200 x 40
10-21	ST-295	Building 638 Septic tank, leach field, and lines	160 ft S-SE of Building 638	230	15	100 x 40
10-21	ST-296	Building 702 Septic tank, leach field, and lines	200 ft E of Building 702	240	10	50 x 40
10-21	ST-297	Building 707 Septic tank, leach field, and lines	65 ft SW of Building 707	65	75	50 x 30
10-21	ST-298	Buildings 730/734 Septic tank, leach field, and lines	100 ft S-SE of Building 734	310	20	50 x 50

Table 8-1. Summary of Septic Tanks, Leach Fields, and Lines (Continued)

SWMU No.	Kirtland AFB No.	Unit Name	Approximate Location	Approximate Measurements (ft)		
				Inflow Line	Outflow Line	Leach Field Dimensions
10-21	ST-299	Building 751 Septic tank, leach field, and lines	400 ft SW of Building 751	650	15	60 x 50
10-21	ST-300	Building 20199 Septic tank, leach field, and lines	55 ft S of Building 20199	55	100	105 x 40
10-21	ST-301	Building 20560 Septic tank, leach field, and lines	95 ft NW of Building 20560	700	80	60 x 50
10-21	ST-302	Building 20599 Septic tank, leach field, and lines	95 ft S-SW of Building 20599	135	10	135 x 10
10-21	ST-303	Building 20749 Septic tank, leach field, and lines	80 ft S of Building 20749	120	20	100 x 45
10-21	ST-304	Building 20797 Septic tank, leach field, and lines	200 ft S of Building 20797	250	150	80 x 50
10-21	ST-305	Building 28054 Septic tank, leach field, and lines	9 ft E of Building 28054	9	160	60 x 44
10-21	ST-306	Building 28054 Septic tank, leach field, and lines	9 ft E of Building 28054	9	160	60 x 44
10-21	ST-307	Building 30101 Septic tank, leach field, and lines	5 ft S of Building 30101	30	125	70 x 25
10-21	ST-308	Building 37511 Septic tank, leach field, and lines	420 ft SW of Building 37511	420	30	110 x 30
10-21	ST-309	Building 37504 Septic tank, leach field, and lines	45 ft N-NW of Building 37504	75	10	80 x 40
10-21	ST-310	Buildings 37507/37508/ 37513 Septic tank, leach field, and lines	340 ft W of Buildings 37507/37508/37513	510	15	200 x 10
10-21	ST-311	Building 37501 and Bunker 37404 Septic tank, leach field, and lines	~25 ft SE of Building 37515 (See Figure 8-26)	380	5	70 x 25

Table 8-1. Summary of Septic Tanks, Leach Fields, and Lines (Concluded)

SWMU No.	Kirtland AFB No.	Unit Name	Approximate Location	Approximate Measurements (ft)		
				Inflow Line	Outflow Line	Leach Field Dimensions
10-21	ST-312	Building 37503 and Bunker 37410 Septic tank, leach field, and lines	145 ft W-SW of Building 37503	340	15	30 x 30
10-21	ST-313	Buildings 37529/ 37530 Septic tank, leach field, and lines	350 ft W of Buildings 37529 and 37530	510	12	200 x 20
10-21	ST-314	Buildings 48056/48059 Septic tank, leach field, and lines	40 ft NW of Buildings 48056	60	70	Three leach pits
10-21	ST-315	Abandoned septic tank and line	440 ft NW of Building 30101	450	0	No leach field mapped
10-21	ST-316	Buildings 57003/57012 Septic tank, leach field, and lines	95 ft SE Building 57003	160	15	70 x 36
10-21	ST-317	Building 57011 Septic tank, leach field, and lines	15 ft E of Building 57011	20	390	50 x 60
10-21	ST-318	Building 37200 Septic tank, leach field, and lines	95 ft W-NW of Building 37200	130	5	60 x 7
10-21	ST-319	Building 37541 Septic tank, leach field, and lines	75 ft N-NW of Building 37541	130	25	190 x 8
10-21	ST-320	Building 20149 Septic tank, leach field, and lines				
10-21	ST-322	Buildings 37507/ 37508/37513 Septic tank, leach field, and lines	340 ft W of Buildings 37507/37508/37513	510	15	200 x 10
10-21	ST-323	Building 29042 Septic tank and lines	30 ft N of Building 29042	30	0	No leach field mapped
10-21	ST-324	Building 29051 Septic tank, leach field, and lines	40 ft W of Building 29051	110	10	95 x 30
10-21	ST-330	Building 1032 Septic tank, leach field, and lines	~290 ft W of Building 1032	500	15	80 x 40
10-21	ST-333	Building 66001 Septic tank, leach field, and lines	~5 ft W of Building 66001	5	210	95 x 4
ST-340	ST-340	Buildings 57001/ 57002 Septic tank, leach field, and lines	~90 ft NW of Building 57001	410	20	80 x 60

Table 8-2. Investigative Matrix - Septic Tanks, Leach Fields, and Lines

SWMU No.	Kirtland AFB No./ Data Needs	Location	Number of *Samples/ Boreholes	Analyses	Selected Analytical Option
ST-273	ST-273 Investigated potential release of contaminants in the near-surface vadose zone from 3 to 8 ft	Building 618 Samples collected adjacent to the septic tank and one background borehole	4/4	VOCs SVOCs Metals TPH Soil pH Soil moisture	Level III Pkg Level III Pkg Level III Pkg Level III Pkg Level III Pkg Level III Pkg
10-21	ST-287 Investigated potential release of contaminants in the near-surface vadose zone from 3 to 8 ft	Building 523 Samples from the leach field area and one background borehole	4/4	VOCs SVOCs Metals TPH Soil pH Soil moisture	Level III Pkg Level III Pkg Level III Pkg Level III Pkg Level III Pkg Level III Pkg
10-21	ST-288 Investigated potential release of contaminants in the near-surface vadose zone from 3 to 8 ft	Building 614 Samples from the leach field area and one background borehole	5/4 One replicate and four normal samples	VOCs SVOCs Metals TPH Soil pH Soil moisture	Level III Pkg Level III Pkg Level III Pkg Level III Pkg Level III Pkg Level III Pkg
10-21	ST-289 Investigated potential release of contaminants in the near-surface vadose zone from 3 to 8 ft in one leach field and 4 to 9 ft in the other	Building 617 Samples from the leach field area and one background borehole	8/7 One replicate and seven normal samples	VOCs SVOCs Metals TPH Soil pH Soil moisture	Level III Pkg Level III Pkg Level III Pkg Level III Pkg Level III Pkg Level III Pkg
10-21	ST-290 Investigated potential release of contaminants in the near-surface vadose zone from 3 to 8 ft	Building 619 Samples from the leach field area	3/3	VOCs SVOCs Metals TPH Soil pH Soil moisture	Level III Pkg Level III Pkg Level III Pkg Level III Pkg Level III Pkg Level III Pkg
10-21	ST-291 Investigated potential release of contaminants in the near-surface vadose zone from 3 to 8 ft	Building 617 Samples collected from the leach field area	3/3	VOCs SVOCs Metals TPH Soil pH Soil moisture	Level III Pkg Level III Pkg Level III Pkg Level III Pkg Level III Pkg Level III Pkg
10-21	ST-292 Investigated potential release of contaminants in the near-surface vadose zone from 4 to 9 ft	Building 622 Samples from the leach field area and one background borehole	4/4	VOCs SVOCs Metals TPH Soil pH Soil moisture	Level III Pkg Level III Pkg Level III Pkg Level III Pkg Level III Pkg Level III Pkg

Table 8-2. Investigative Matrix - Septic Tanks, Leach fields, and Lines (Continued)

SWMU No.	Kirtland AFB No./ Data Needs	Location	Number of *Samples/ Boreholes	Analyses	Selected Analytical Option
10-21	ST-293 Investigated potential release of contaminants in the near-surface vadose zone from 3 to 8 ft	Building 37570 Samples collected adjacent to seepage pit and one background borehole	4/3 One replicate and three normal samples	VOCs SVOCs Metals TPH Soil pH Soil moisture	Level III Pkg Level III Pkg Level III Pkg Level III Pkg Level III Pkg Level III Pkg
10-21	ST-294 Investigated potential release of contaminants in the near-surface vadose zone from 3 to 8 ft	Building 633 Samples from the leach field area and one background borehole	4/4	VOCs SVOCs Metals TPH Soil pH Soil moisture	Level III Pkg Level III Pkg Level III Pkg Level III Pkg Level III Pkg Level III Pkg
10-21	ST-295 Investigated potential release of contaminants in the near-surface vadose zone from 3 to 8 ft	Building 638 Samples collected from the leach field area	4/4	VOCs SVOCs Metals TPH Soil pH Soil moisture	Level III Pkg Level III Pkg Level III Pkg Level III Pkg Level III Pkg Level III Pkg
10-21	ST-296 Investigated potential release of contaminants in the near-surface vadose zone from 2 to 7 ft	Building 702 Samples from the leach field area and one background borehole	5/4 One replicate and four normal samples	VOCs SVOCs Metals TPH Soil pH Soil moisture	Level III Pkg Level III Pkg Level III Pkg Level III Pkg Level III Pkg Level III Pkg
10-21	ST-297 Investigated potential release of contaminants in the near-surface vadose zone from 3 to 8 ft	Building 707 Samples from the leach field area and one background borehole	4/4	VOCs SVOCs Metals TPH Soil pH Soil moisture	Level III Pkg Level III Pkg Level III Pkg Level III Pkg Level III Pkg Level III Pkg
10-21	ST-298 Investigated potential release of contaminants in the near-surface vadose zone from 3 to 8 ft.	Buildings 730/734 Samples from the leach field area and one background borehole.	4/4	VOCs SVOCs Metals TPH Soil pH Soil moisture	Level III Pkg Level III Pkg Level III Pkg Level III Pkg Level III Pkg Level III Pkg
10-21	ST-299 Investigated potential release of contaminants in the near-surface vadose zone from 3 to 8 ft	Building 751 Samples from the leach field area and one background borehole	4/4	VOCs SVOCs Metals TPH Soil pH Soil moisture	Level III Pkg Level III Pkg Level III Pkg Level III Pkg Level III Pkg Level III Pkg

Table 8-2. Investigative Matrix - Septic Tanks, Leach fields and Lines (Continued)

SWMU No.	Kirtland AFB No./ Data Needs	Location	Number of *Samples/ Boreholes	Analyses	Selected Analytical Option
10-21	ST-300 Investigated potential release of contaminants in the near-surface vadose zone from 3 to 8 ft	Building 20199 Samples from the leach field area and one background borehole	4/4	VOCs SVOCs Metals TPH Soil pH Soil moisture	Level III Pkg Level III Pkg Level III Pkg Level III Pkg Level III Pkg Level III Pkg
10-21	ST-301 Investigated potential release of contaminants in the near-surface vadose zone from 3 to 8 ft	Building 20560 Samples from the leach field area and one background borehole	5/4 One replicate and four normal samples	VOCs SVOCs Metals TPH Soil pH Soil moisture	Level III Pkg Level III Pkg Level III Pkg Level III Pkg Level III Pkg Level III Pkg
10-21	ST-302 Investigated potential release of contaminants in the near-surface vadose zone from 3 to 8 ft	Building 20599 Samples from the leach field area and one background borehole	4/4	VOCs SVOCs Metals TPH Soil pH Soil moisture	Level III Pkg Level III Pkg Level III Pkg Level III Pkg Level III Pkg Level III Pkg
10-21	ST-303 Investigated potential release of contaminants in the near-surface vadose zone from 4 to 9 ft	Building 20749 Samples from the leach field area and one background borehole	5/4 One replicate and four normal samples	VOCs SVOCs Metals TPH Soil pH Soil moisture	Level III Pkg Level III Pkg Level III Pkg Level III Pkg Level III Pkg Level III Pkg
10-21	ST-304 Investigated potential release of contaminants in the near-surface vadose zone from 4 to 9 ft	Building 20797 Samples from the leach field area and one background borehole	5/4 One replicate and four normal samples	VOCs SVOCs Metals TPH Soil pH Soil moisture	Level III Pkg Level III Pkg Level III Pkg Level III Pkg Level III Pkg Level III Pkg
10-21	ST-305 Investigated potential release of contaminants in the near-surface vadose zone from 3 to 8 ft	Building 28054 Samples from the leach field area and one background borehole	5/4 One replicate and four normal samples	VOCs SVOCs Metals TPH Soil pH Soil moisture	Level III Pkg Level III Pkg Level III Pkg Level III Pkg Level III Pkg Level III Pkg
10-21	ST-306 Investigated potential release of contaminants in the near-surface vadose zone from 3 to 8 ft	Building 28054 Samples from the leach field area and one background borehole	Use results of ST-305	N/A	N/A

Table 8-2. Investigative Matrix - Septic Tanks, Leach Fields, and Lines (Continued)

SWMU No.	Kirtland AFB No./ Data Needs	Location	Number of *Samples/ Boreholes	Analyses	Selected Analytical Option
10-21	ST-307 Investigated potential release of contaminants in the near-surface vadose zone from 3 to 8 ft	Building 30101 Samples from the leach field area and one background borehole	5/4 One replicate and four normal samples	VOCs SVOCs Metals TPH Soil pH Soil moisture	Level III Pkg Level III Pkg Level III Pkg Level III Pkg Level III Pkg Level III Pkg
10-21	ST-308 Investigated potential release of contaminants in the near-surface vadose zone from 3 to 8 ft	Building 37511 Samples from the leach field area and one background borehole	4/4	VOCs SVOCs Metals TPH Soil pH Soil moisture	Level III Pkg Level III Pkg Level III Pkg Level III Pkg Level III Pkg Level III Pkg
10-21	ST-309 Investigated potential release of contaminants in the near-surface vadose zone from4 to 9 ft, but due to poor soil recovery, some samples were pushed to 10 ft	Building 37504 Samples from the leach field area and one background borehole	4/4	VOCs SVOCs Metals TPH Soil pH Soil moisture	Level III Pkg Level III Pkg Level III Pkg Level III Pkg Level III Pkg Level III Pkg
10-21	ST-310 Investigated potential release of contaminants in the near-surface vadose zone from 4 to 9 ft	Buildings 37507/37508/37513 Samples from the leach field area and one background borehole	4/4	VOCs SVOCs Metals TPH Soil pH Soil moisture	Level III Pkg Level III Pkg Level III Pkg Level III Pkg Level III Pkg Level III Pkg
10-21	ST-311 Investigated potential release of contaminants in the near-surface vadose zone from 3 to 8 ft	Building 37501 and Bunker 37404 Samples from the leach field area and one background borehole	4/4	VOCs SVOCs Metals TPH Soil pH Soil moisture	Level III Pkg Level III Pkg Level III Pkg Level III Pkg Level III Pkg Level III Pkg
10-21	ST-312 Investigated potential release of contaminants in the near-surface vadose zone from 3 to 8 ft, but because of poor soil recoveries the sample depths varied	Building 37503 and Bunker 37410 Samples from the leach field area and one background borehole	4/4	VOCs SVOCs Metals TPH Soil pH Soil moisture	Level III Pkg Level III Pkg Level III Pkg Level III Pkg Level III Pkg Level III Pkg
10-21	ST-313 Investigated potential release of contaminants in the near-surface vadose zone from 3 to 8 ft	Buildings 37529/37530 Samples from the leach field area and one background borehole	4/4	VOCs SVOCs Metals TPH Soil pH Soil moisture	Level III Pkg Level III Pkg Level III Pkg Level III Pkg Level III Pkg Level III Pkg

Table 8-2. Investigative Matrix - Septic Tanks, Leach Fields, and Lines (Continued)

SWMU No.	Kirtland AFB No./ Data Needs	Location	Number of *Samples/ Boreholes	Analyses	Selected Analytical Option
10-21	ST-314 Investigated potential release of contaminants in the near-surface vadose zone from 3 to 8 ft in some and 15 to 20 ft in the others	Buildings 48056/48057/48059 Samples from adjacent to the leach pit and inside the leach pit area	10/7 Two replicates and eight normal samples	VOCs SVOCs Metals TPH Soil pH Soil moisture Gross β & α Radium-226 & 228	Level III Pkg Level III Pkg Level III Pkg Level III Pkg Level III Pkg Level III Pkg
10-21	ST-315 Investigated potential release of contaminants in the near-surface vadose zone from 3 to 8 ft	No building designation Sample collected adjacent to the septic tank and one background borehole	3/3	VOCs SVOCs Metals TPH Soil pH Soil moisture	Level III Pkg Level III Pkg Level III Pkg Level III Pkg Level III Pkg Level III Pkg
10-21	ST-316 Investigated potential release of contaminants in the near-surface vadose zone from 5 to 10 ft	Buildings 57003 & 57012 Samples from the leach field area and one background borehole	4/4	VOCs SVOCs Metals TPH Soil pH Soil moisture	Level III Pkg Level III Pkg Level III Pkg Level III Pkg Level III Pkg Level III Pkg
10-21	ST-317 Investigated potential release of contaminants in the near-surface vadose zone from 2 to 7 ft, but due to poor soil recovery, some samples were pushed to 9 ft	Building 57011 Samples from the leach field area and one background borehole	5/4 One replicate and four normal samples	VOCs SVOCs Metals TPH Soil pH Soil moisture	Level III Pkg Level III Pkg Level III Pkg Level III Pkg Level III Pkg Level III Pkg
10-21	ST-318 Investigated potential release of contaminants in the near-surface vadose zone from 3 to 8 ft	Building 37200 Samples from the leach field area and one background borehole	5/4 One replicate and four normal samples	VOCs SVOCs Metals TPH Soil pH Soil moisture	Level III Pkg Level III Pkg Level III Pkg Level III Pkg Level III Pkg Level III Pkg
10-21	ST-319 Investigated potential release of contaminants in the near-surface vadose zone from3 to 6.5 ft	Building 37541 Samples from the leach field area and one background borehole	4/4	VOCs SVOCs Metals TPH Soil pH Soil moisture	Level III Pkg Level III Pkg Level III Pkg Level III Pkg Level III Pkg Level III Pkg
10-21	ST-320 Investigated potential release of contaminants in the near-surface vadose zone from 3 to 8 ft	Buildings Samples from the leach field area and one background borehole	4/4	VOCs SVOCs Metals TPH Soil pH Soil moisture	Level III Pkg Level III Pkg Level III Pkg Level III Pkg Level III Pkg Level III Pkg

Table 8-2. Investigative Matrix - Septic Tanks, Leach Fields, and Lines (Concluded)

SWMU No.	Kirtland AFB No./ Data Needs	Location	Number of *Samples/ Boreholes	Analyses	Selected Analytical Option
10-21	ST-322 Investigated potential release of contaminants in the near-surface vadose zone from 4 to 9 ft	Buildings 37507/37508/37513 Samples from the leach field area and one background borehole	5/4 One replicate and four normal samples	VOCs SVOCs Metals TPH Soil pH Soil moisture	Level III Pkg Level III Pkg Level III Pkg Level III Pkg Level III Pkg Level III Pkg
10-21	ST-323 Investigated potential release of contaminants in the near-surface vadose zone from 5 to 10 ft	Building 29042 Samples from the leach field area and one background borehole	4/4	VOCs SVOCs Metals TPH Soil pH Soil moisture	Level III Pkg Level III Pkg Level III Pkg Level III Pkg Level III Pkg Level III Pkg
10-21	ST-324 Investigated potential release of contaminants in the near-surface vadose zone from 3 to 8 ft	Building 29051 Samples from the leach field area and one background borehole	4/4	VOCs SVOCs Metals TPH Soil pH Soil moisture	Level III Pkg Level III Pkg Level III Pkg Level III Pkg Level III Pkg Level III Pkg
10-21	ST-330 Investigated potential release of contaminants in the near-surface vadose zone from 3 to 8 ft	Building 1032 Samples from the leach field area	4/3 One replicate and three normal samples	VOCs SVOCs Metals TPH Soil pH Soil moisture	Level III Pkg Level III Pkg Level III Pkg Level III Pkg Level III Pkg Level III Pkg
10-21	ST-333 Investigated potential release of contaminants in the near-surface vadose zone from 2 to 4 ft	Building 66001 Samples from the leach field area and one background borehole	5/4 One replicate and four normal samples	VOCs SVOCs Metals TPH Soil pH Soil moisture	Level III Pkg Level III Pkg Level III Pkg Level III Pkg Level III Pkg Level III Pkg
ST-340	ST-340 Investigated potential release of contaminants in the near-surface vadose zone from 2 to 7 ft	Buildings 57001/57002 Samples from the leach field area and one background borehole	4/3 One replicate and three normal samples	VOCs SVOCs Metals TPH Soil pH Soil moisture	Level III Pkg Level III Pkg Level III Pkg Level III Pkg Level III Pkg Level III Pkg

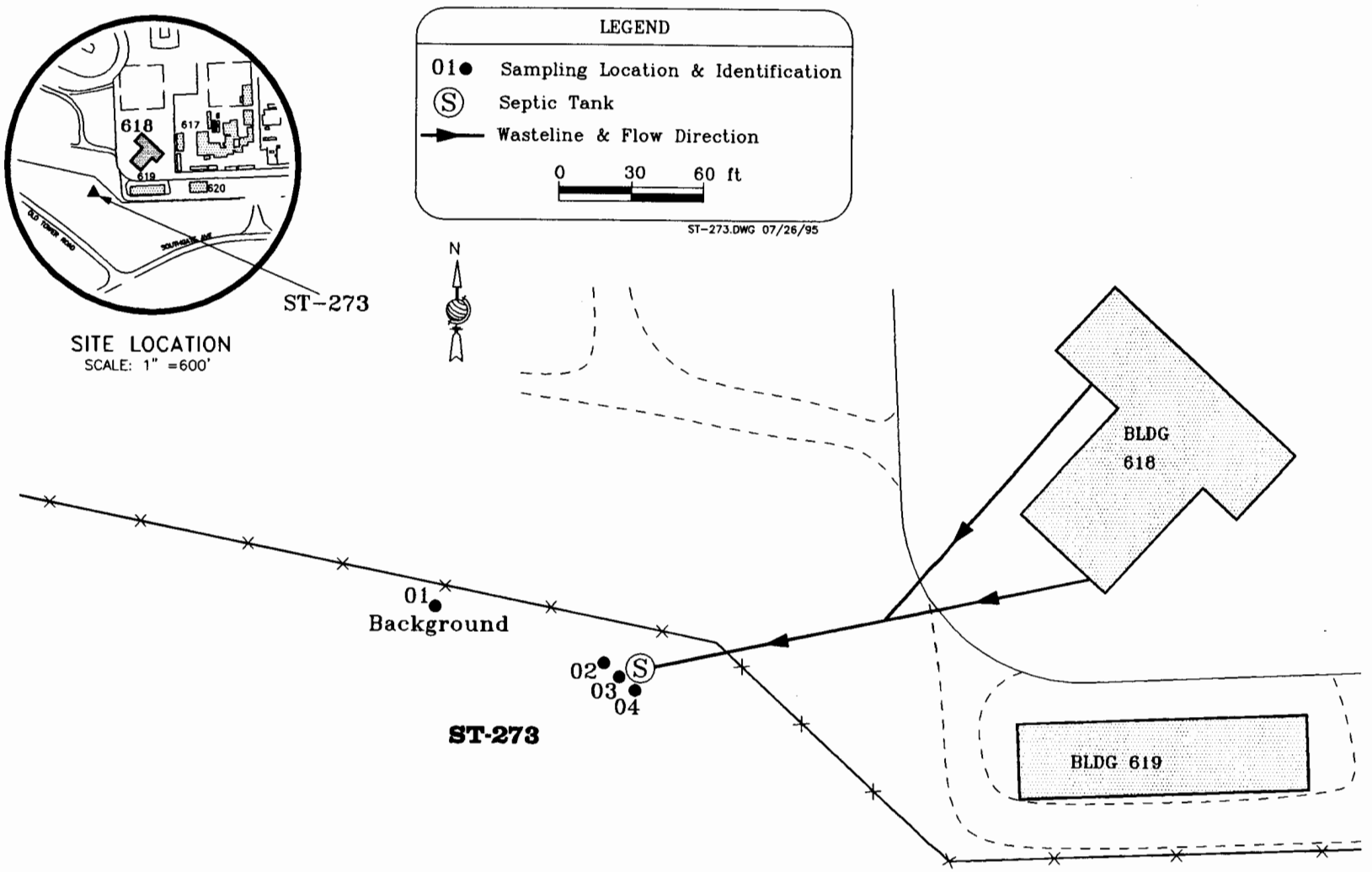


Figure 8-2. Soil Sampling Locations at SWMU ST-273, Building 618, Septic Tank and Lines (ST-273)

SWMU ST-273 is located in the urban/industrial zone, which is discussed in Section 2.0. Two production wells are located in this area of Kirtland AFB: KAFB-2 is 4,500 ft east-northeast and KAFB-14 is 4,100 ft north (Figure 2-11).

8.1.2 Study Area Investigation

The area of investigation was limited to the soil surrounding the septic tank at SWMU ST-273. Possible source materials in the septic tank were not investigated.

8.1.2.1 Previous Investigations

No previous investigations have been performed at this site

8.1.2.2 Data Gaps

Neither available engineering drawings nor field conditions indicated the location of a leach field associated with SWMU ST-273. No information related to the past use of SWMU ST-273 was available for review. No data were available to determine the presence or absence of contaminants in the subsurface soil surrounding the septic tank.

8.1.2.3 RFI Field Investigation

The objective of this investigation was to determine if contamination is present in the subsurface soil adjacent to the septic tank. On February 16, 1995, four boreholes were drilled and sampled at this site using a Geoprobe. Borehole ST-273C-01 was drilled west-northwest of the septic tank to collect background concentration data. This borehole was assumed to be in an area away from any known or suspected contamination. Since there was no field evidence or engineering drawings identifying a leach field location, all boreholes were drilled as close as possible to the septic tank. Based on engineering drawings and observed field conditions, the inflow line to the septic tank was determined to be 3 ft below grade. The sample interval at each borehole extended from the depth of the septic tank to 5 ft below the septic tank. From this interval, two samples were collected: one at a depth equal to the base of the septic tank, the other from 3 ft below the base of the septic tank.

Sampling operations and sample handling procedures are described in Section 3.0. Borehole locations and depths of the samples that were sent to the laboratory are listed in Table 8-3. Borehole logs are in Appendix C.

Table 8-3. Boreholes and Samples Analyzed from SWMU ST-273, Building 618, Septic Tank and Lines (ST-273)

Borehole	Borehole Location	Sample Depth
01	Background borehole	3–5
02	Adjacent to septic tank	3–5
03	Adjacent to septic tank	3–5
04	Adjacent to septic tank	3–5

8.1.2.4 Laboratory Analysis

Four soil samples were analyzed for VOCs, SVOCs, TPH as GRO and DRO, metals, mercury (the expected contaminants associated with normal operations at this building), soil pH, and soil moisture. The four brass tubes in each 2-ft sample interval were field-screened for possible contamination using a beta-gamma meter and a FID. No elevated readings were measured with these instruments.

8.1.3 Site Characteristics

8.1.3.1 Geology

The SWMU ST-273 area is underlain by unconsolidated alluvial sediment that is predominantly fine-grained to very fine-grained sand. Four 8-ft boreholes were drilled at SWMU ST-273. No boreholes penetrated into the Santa Fe Group sediments that presumably underlie this area. A discussion of the general geology at Kirtland AFB is presented in Section 2.4.

As a result of septic tank installation, it is probable that backfill material is present adjacent to the tank to a depth equal to the unit's depth. Borehole logs for this area are presented in Appendix C.

8.1.3.2 Hydrogeology

Groundwater beneath this area is found within the Upper Santa Fe sediments and is generally thought to be unconfined in the upper portion of the aquifer. This area is within the HR1 saturated zone setting as defined by SNL studies (Figure 2-9) (SNL, 1994). Hydrogeologic characterization in this portion of Kirtland AFB is complicated by the presence of numerous production wells (Figure 2-11). It is probable that uniform groundwater conditions do not exist in this region. Local cones of depression associated with groundwater withdrawal have altered the groundwater flow direction in the vicinity of the well fields (Figure 2-7).

The gradient is probably northeast at this site. Two production wells are located in this area of Kirtland AFB: KAFB-2 is 4,500 ft downgradient east-northeast and KAFB-14 is 4,100 ft cross-gradient north (Figures 2-7 and 2-11). Depth to groundwater is estimated to be about 350 ft below grade (Figure 2-10); however, shallower perched water zones may occur. Hydraulic conductivity within HR1 is estimated at

2 to 171 ft/day (SNL, 1994). A general discussion of the hydrogeology at Kirtland AFB is presented in Section 2.5.

8.1.4 Nature and Extent of Contamination

The following section describes the extent of contamination based on sampling results. Analytical results for soil samples collected at septic tank SWMU ST-273 and submitted for analysis are summarized in Table 8-4; only the reportable concentrations of detected analytes are listed. Full analytical results are presented in Appendix F. Laboratory validation reports are in Appendix K.

Organic Compounds

The VOC analytes methylene chloride and acetone were detected in ST-273C-01, the background sample submitted for analysis, at concentration levels below the HHRB action levels (Table 8-4). None of the other analyzed soil samples had any VOC analytes detected.

Di-n-butylphthalate was the only SVOC analyte detected in the soil samples submitted for analysis, ranging from 0.57 to 1.3 mg/kg. All concentrations were below the HHRB action level of 7,800 mg/kg.

Petroleum Hydrocarbons

No gasoline or diesel range hydrocarbons were detected in any of the soil samples submitted for analysis at SWMU ST-273.

Metals

Arsenic and beryllium were the only metals detected at concentrations above the HHRB action levels in soil samples submitted for analysis from SWMU ST-273 (Table 8-4). Arsenic (2.5 to 3.9 mg/kg) was detected in all of the samples collected. All concentrations were above the HHRB action level of 0.37 mg/kg, but were below the UTL (6.5 mg/kg). Beryllium (0.31 to 0.66 mg/kg) was detected in all samples submitted for analysis at ST-288 above the HHRB action level of 0.15 mg/kg, but was below the UTL (0.84 mg/kg). Beryllium and arsenic concentrations exceeding HHRB action levels appear to be naturally occurring throughout Kirtland AFB.

Soil pH and Moisture

Soil pH ranged from 8.3 to 8.7 in these samples. Soil moisture values ranged from 4.6 to 10.6 percent (Table 8-4).

8.1.5 Conclusions and Recommendations

Conclusions

- Up to two VOCs and one SVOC were detected in the soil samples submitted for analysis from this site. All concentrations were below HHRB action levels.

Table 8-4. Summary of Reportable Concentrations for Soil Analyses at SWMU ST-273, Building 618, Septic Tank and Lines (ST-273)[1] (Concentrations mg/kg)

Chemical Class	Analyte	HHRB Action Level[2]	PQL UTL	Borehole Number and Sample Depth Interval (ft)			
				ST273C-01	*ST273C-02*	*ST273C-03*	*ST273C-04*
				3–5	3–5	3–5	3–5
VOC	Acetone	7,800	0.10	0.059	ND	ND	ND
	Methylene chloride	85.0	0.005	0.01	ND	ND	ND
SVOC	Di-n-butylphthalate	7,800	0.70	1.3	1.1	0.75	0.57
METALS	Aluminum	78,000	14,700	14,600	11,100	6,330	9,460
	Arsenic	0.37	6.5	3.9	3.4	2.5	2.8
	Barium	5,500	735	215	206	165	630
	Beryllium	0.15	0.84	0.66	0.56	0.31	0.43
	Cadmium	39.0	N/A	1.1	0.78	ND	ND
	Calcium	N/A	121,000	104,000	68,200	46,400	45,300
	Chromium, total	390	21.6	9.9	8.7	5.9	6.1
	Cobalt	4,700	15.4	6.5	5.8	3.5	5.5
	Copper	2,900	223	54.8	19.4	15.2	44.8
	Iron	N/A	23,800	13,500	11,700	8,390	10,000
	Lead	400	17.5	5.1	4.3	3.9	4.0
	Magnesium	N/A	10,400	5,970	4,580	2,780	4,300
	Manganese	390	549	140	147	93.1	116
	Nickel	1,600	188	6.8	6.2	ND	8.2
	Potassium	N/A	3,590	2,400	1,900	1,100	1,340
	Sodium	N/A	787	193	293	351	131
	Thallium	N/A	N/A	0.12	ND	ND	ND
	Vanadium	550	55.3	37.2	33.8	20.8	32.6
	Zinc	23,000	114	49.3	36.9	21.3	32.3
OTHER	pH			8.5	8.7	8.3	8.6
	Moisture (%)			9.2	10.6	4.6	6.1

FOOTNOTES

1	Complete laboratory analytical results and method detection limits are presented in Appendix K.
2	Action level of RCRA Proposed Rule Subpart S (55 *FR* 30814, 7/27/90).
*	TPH action level is 100 mg/kg adopted from NMED UST regulations (NMED, 1990). SW-8015 analyzes volatile and semivolatile petroleum hydrocarbon fractions separately. The total concentration of the two fractions analyzed under SW-8015 will be used to assess compliance with stipulated action levels for the purpose of this RFI.
#	Denotes TCLP analysis, results in mg/l.
--	No Data.
FR	Field Replicate.
HHRB	Human health risk based.
J	Estimated value.
N/A	Not Applicable.
NA	Not Analyzed.
ND	Not detected above the method detection limit.
pCi/g	picocuries per gram.
PQL	Practical quantitation limits (defines VOC, SVOC, and TPH).
R	Reject NDs due to interference.
RAD	Radionuclides.
RE	Resample.
SVOC	Semivolatile organic compounds.
TPH	Total petroleum hydrocarbons.
U	Accept data (positive results may be influenced by lab contamination).
UJ	Estimated nondetect.
UTL	Upper tolerance limits (defines metals).
VOC	Volatile organic compounds.

- No gasoline or diesel range hydrocarbons were detected.
- Arsenic and beryllium were the only metals detected at concentrations exceeding HHRB action levels. These beryllium and arsenic concentrations appear to be naturally occurring throughout Kirtland AFB.
- The analytical results at SWMU ST-273 are not indicative of a contaminant release from this site.

Recommendations

- Based on the findings of the RFI, no further action is necessary; therefore, SWMU ST-273 does not require further investigation. A No Further Action proposal should be prepared.

8.2 SWMU 10-21, Building 525, Septic Tank, Leach Field, and Lines (ST-287)

8.2.1 Site Background and Environmental Setting

Septic tank ST-287 is located approximately 10 ft south of Building 525, a restroom facility adjacent to a softball field, in the northwest portion of Kirtland AFB (Figure 8-3). SWMU ST-287 was investigated on February 9, 1995.

Based on engineering drawings and observed site conditions, inflow and outflow line lengths are approximately 10 ft and 15 ft, respectively. This tank discharges to a leach field to the south with a drainage area approximately 50 ft x 20 ft. Potentially, the septic tank could have received contaminants from Building 525 and, due to the leach field's design, waste from ST-287 can be expected to have entered the surrounding soil.

ST-287 is located in the urban/industrial zone, which is discussed in Section 2.0. The nearest production wells to this site are KAFB-12, 3,500 ft west-northwest, and KAFB-14, 2,000 ft southwest (Figure 2-11).

8.2.2 Study Area Investigation

The area of investigation was limited to the leach field at ST-287. Possible source materials in the septic tank were not investigated.

8.2.2.1 Previous Investigations

No previous investigations have been performed at this site.

8.2.2.2 Data Gaps

No information related to the past use of ST-287 was available for review. No data were available to determine the presence or absence of contaminants in the subsurface soil in the leach field.

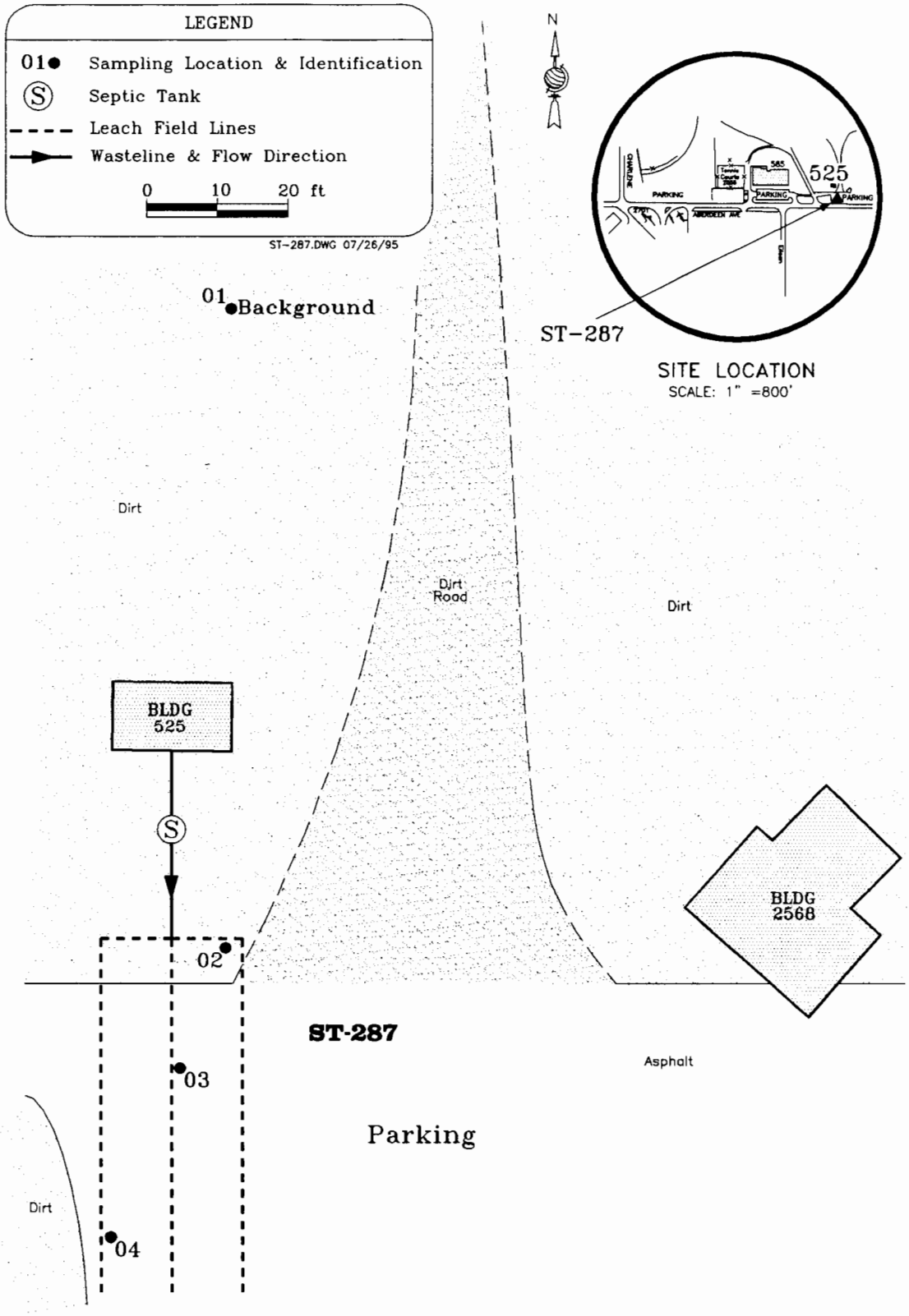


Figure 8-3. Soil Sampling Locations at SWMU 10-21, Building 525, Septic Tank, Leach Field, and Lines (ST-287)

8.2.2.3 RFI Field Investigation

The objective of this investigation was to determine if contamination is present in the subsurface soil in the leach field area. On February 9, 1995, four boreholes were drilled and sampled using a Geoprobe. Borehole ST-287C-01 was drilled north-northwest of ST-287 to collect background concentration data for this site. This borehole was assumed to be in an area away from any known or suspected contamination. All other boreholes were drilled in the leach field area. Based on engineering drawings and observed field conditions, leach field lines were determined to be 3 ft below grade. The sample interval at each borehole extended from the depth of the leach field to 5 ft below the leach field. From within this interval, two samples were collected: one at a depth equal to the base of the leach field line, the other from 3 ft below the base of the leach field line.

Sampling operations and sample handling procedures are described in Section 3.0. Borehole locations and depths of samples that were sent to the laboratory are listed in Table 8-5. Borehole logs are in Appendix C.

Table 8-5. Boreholes and Samples Analyzed from SWMU 10-21, Building 525, Septic Tank, Leach Field, and Lines (ST-287)

Borehole	Borehole Location	Sample Depth (ft)
01	Background borehole	3–5
02	In the leach field area	3–5
03	In the leach field area	3–5
04	In the leach field area	3–5

8.2.2.4 Laboratory Analysis

Four soil samples were analyzed for VOCs, SVOCs, TPH as GRO and DRO, metals, mercury (the expected contaminants associated with normal operations at this building), soil pH, and soil moisture. The four brass tubes in each 2-ft sample interval were field-screened for possible contamination using a beta-gamma meter and a FID. No elevated readings were measured with these instruments.

8.2.3 Site Characteristics

8.2.3.1 Geology

The ST-287 area is underlain by unconsolidated alluvial sediment that is predominantly very fine-grained to fine-grained sand with some gravel. Four 8-ft boreholes were drilled at ST-287. No boreholes penetrated into the Santa Fe Group sediments that presumably underlie this area. A discussion of the general geology at Kirtland AFB is presented in Section 2.4.

As a result of leach field installation, it is probable that backfill material (pea gravel immediately adjacent to the leach field lines) is present in the leach field area. Borehole logs for this area are presented in Appendix C.

8.2.3.2 Hydrogeology

Groundwater beneath this area is found within the Upper Santa Fe sediments and is generally thought to be unconfined in the upper portion of the aquifer. This area is within the HR1 saturated zone setting as defined by SNL studies (Figure 2-9) (SNL, 1994). Hydrogeologic characterization in this portion of Kirtland AFB is complicated by the presence of numerous production wells (Figure 2-11). It is probable that uniform groundwater conditions do not exist in this region. Local cones of depression associated with groundwater withdrawal have altered the groundwater flow direction in the vicinity of the well fields (Figure 2-7).

The gradient is probably northeast at this site. Two production wells are located near this septic tank and leach field area: KAFB-14, 2,000 ft upgradient southwest, and KAFB-12, 3,500 ft cross-gradient west-northwest (Figures 2-7 and 2-11). Depth to groundwater is estimated to be about 350 ft below grade (Figure 2-10); however, shallower perched water zones may occur. Hydraulic conductivity within HR1 is estimated at 2 to 171 ft/day (SNL, 1994). A general discussion of the hydrogeology at Kirtland AFB is presented in Section 2.5.

8.2.4 Nature and Extent of Contamination

The following section describes the extent of contamination based on sampling results. Analytical results for soil samples collected and submitted for analysis from septic tank ST-287 are summarized in Table 8-6, where only the reportable concentrations of detected analytes are listed. Full analytical results are presented in Appendix F. Laboratory validation reports are in Appendix K.

Organic Compounds

Methylene chloride (0.006 to 0.007 mg/kg) was the only VOC detected. The compound was found in ST-287C-02, ST-287C-03, and ST-287C-04 at concentrations below the HHRB action level of 85 mg/kg (Table 8-6).

Bis(2-ethylhexyl)phthalate was the only SVOC analyte detected in soil sample ST-287C-01, background borehole, at 0.44 mg/kg. The concentration was below the HHRB action level of 46 mg/kg.

Petroleum Hydrocarbons

No gasoline or diesel range hydrocarbons were detected in any of the soil samples submitted for analysis at ST-287.

Table 8-6. Summary of Reportable Concentrations for Soil Analyses at SWMU 10-21, Building 525, Septic Tank, Leach Field, and Lines (ST-287)[1] (Concentrations mg/kg)

Chemical Class	Analyte	HHRB Action Level[2]	PQL UTL	Borehole Number and Sample Depth Interval (ft)			
				ST287C-01	*ST287C-02*	*ST287C-03*	*ST287C-04*
				3–5	3–5	3–5	3–5
VOC	Methylene chloride	85.0	0.005	ND	0.006	0.007	0.007
SVOC	Bis(2-ethylhexyl)phthalate	46.0	0.70	0.44	ND	ND	ND
METALS	Aluminum	78,000	14,700	7,070	4,930	6,030	7,670
	Arsenic	0.37	6.5	3.5	4.2	3.0	5.2
	Barium	5,500	735	253	1,150	310	307
	Beryllium	0.15	0.84	0.43	ND	ND	0.36
	Calcium	N/A	121,000	49,500	103,000	218,000	123,000
	Chromium, total	390	21.6	5.6	4.6	5.0	6.7
	Cobalt	4,700	15.4	5.9	3.1	3.2	5.4
	Copper	2,900	223	40.5	16.3	27.9	13.3
	Iron	N/A	23,800	9,290	5,670	6,520	9,160
	Lead	400	17.5	4.3	2.8	3.3	5.3
	Magnesium	N/A	10,400	5,020	5,930	7,490	7,300
	Manganese	390	549	147	56.4	109	150
	Mercury	23.0	N/A	ND	0.18	0.25	ND
	Nickel	1,600	188	4.7	13.8	4.9	5.1
	Potassium	N/A	3,590	844	536	693	819
	Sodium	N/A	787	296	88.3	151	93.7
	Thallium	N/A	N/A	0.15	ND	ND	ND
	Vanadium	550	55.3	28.0	27.2	21.1	35.0
	Zinc	23,000	114	34.4	16.1	22.9	25.2
OTHER	pH			8.9	8.7	8.6	8.7
	Moisture (%)			6.1	11.1	19.1	16.4

FOOTNOTES

1	Complete laboratory analytical results and method detection limits are presented in Appendix K.
2	Action level of RCRA Proposed Rule Subpart S (55 FR 30814, 7/27/90).
*	TPH action level is 100 mg/kg adopted from NMED UST regulations (NMED, 1990). SW-8015 analyzes volatile and semivolatile petroleum hydrocarbon fractions separately. The total concentration of the two fractions analyzed under SW-8015 will be used to assess compliance with stipulated action levels for the purpose of this RFI.
#	Denotes TCLP analysis, results in mg/l.
--	No Data.
FR	Field Replicate.
HHRB	Human health risk based.
J	Estimated value.
N/A	Not Applicable.
NA	Not Analyzed.
ND	Not detected above the method detection limit.
pCi/g	picocuries per gram.
PQL	Practical quantitation limits (defines VOC, SVOC, and TPH).
R	Reject NDs due to interference.
RAD	Radionuclides.
RE	Resample.
SVOC	Semivolatile organic compounds.
TPH	Total petroleum hydrocarbons.
U	Accept data (positive results may be influenced by lab contamination).
UJ	Estimated nondetect.
UTL	Upper tolerance limits (defines metals).
VOC	Volatile organic compounds.

Metals

Arsenic and beryllium were the only metals detected at concentrations above the HHRB action levels in soil samples from ST-287 (Table 8-6). Arsenic (3.0 to 5.2 mg/kg) was detected in all the samples collected. All concentrations were above the HHRB action level of 0.37 mg/kg, but were below the 6.5 mg/kg UTL. Beryllium (0.36 to 0.43 mg/kg) was detected in two out of the four samples collected at ST-288 above the HHRB action level of 0.15 mg/kg, but in each of these samples concentrations were less than the 0.84 mg/kg UTL. Beryllium and arsenic concentrations exceeding HHRB action levels appear to be naturally occurring throughout Kirtland AFB as discussed in Section 4.2.2.

Soil pH and Moisture

Soil pH ranged from 8.6 to 8.9 in these samples. Soil moisture values ranged from 6.1 to 19.1 percent (Table 8-6).

8.2.5 Conclusions and Recommendations

Conclusions

- One VOC and SVOC were detected in the soil samples collected from this site. All concentrations were below HHRB action levels.
- No gasoline or diesel range hydrocarbons were detected.
- Arsenic and beryllium were the only metals detected at concentrations exceeding HHRB action levels. These beryllium and arsenic concentrations appear to be naturally occurring throughout Kirtland AFB.
- The analytical results at ST-287 are not indicative of a contaminant release from this site.

Recommendations

- Based on the findings of the RFI, no further action is necessary; therefore, ST-287 does not require further investigation. A No Further Action proposal should be prepared.

8.3 SWMU 10-21, Building 614, Septic Tank, Leach Field, and Lines (ST-288)

8.3.1 Site Background and Environmental Setting

ST-288 is identified to serve Building 614, a physics science laboratory, in the northwest portion of Kirtland AFB (Figure 8-4). ST-288 was investigated on February 14, 1995.

Based on engineering drawings and observed site conditions, the outflow line length to the leach field is approximately 90 ft. The leach field drainage area is approximately 20 ft x 20 ft. The septic tank could not be verified by field inspection or engineering drawings. Potentially, the septic tank could have received contaminants from Building 614 and, due to the leach field's design, waste from ST-288 can be expected to have entered the surrounding soil.

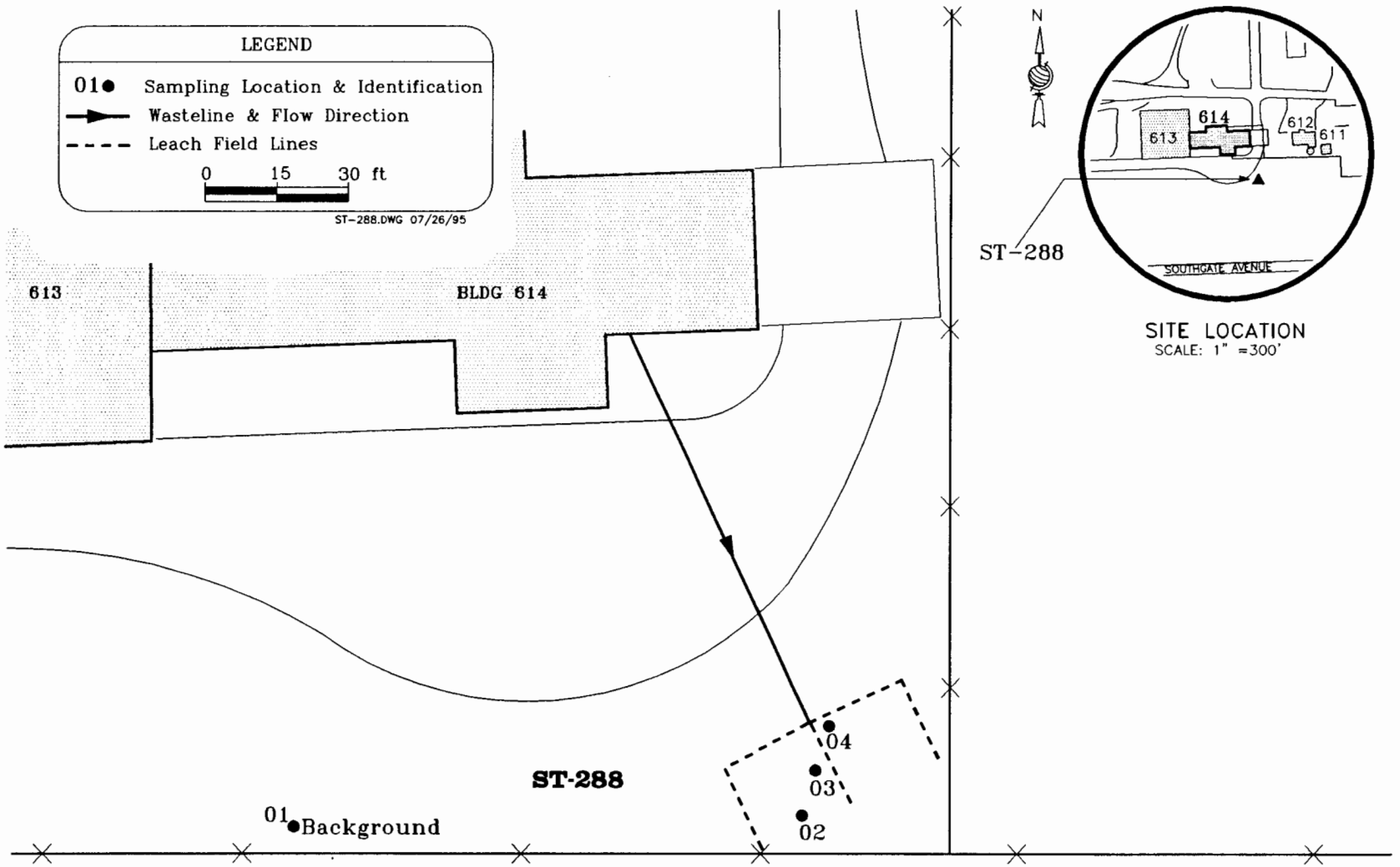


Figure 8-4. Soil Sampling Locations at SWMU 10-21, Building 614, Septic Tank, Leach Field, and Lines (ST-288)

ST-288 is located in the urban/industrial zone, which is discussed in Section 2.0. The nearest production wells to this site are KAFB-2, 3,500 ft east-northeast, and KAFB-14, 3,800 ft north (Figure 2-11).

8.3.2 Study Area Investigation

The area of investigation was limited to the leach field at ST-288. Possible source materials in the septic tank were not investigated.

8.3.2.1 Previous Investigations

No previous investigations have been performed at this site.

8.3.2.2 Data Gaps

Neither available engineering drawings nor present site conditions indicate the location of septic tank ST-288. No information related to the past use of ST-288 was available for review. No data were available to determine the presence or absence of contaminants in the subsurface soil in the leach field.

8.3.2.3 RFI Field Investigation

The objective of this investigation was to determine if contamination is present in the subsurface soil in the leach field area. On February 14, 1995, four boreholes were drilled and sampled using a Geoprobe. Borehole ST-288C-01 was drilled west of the leach field area to collect background concentration data for this site. This borehole was assumed to be in an area away from any known or suspected contamination. All other boreholes were drilled in the leach field area. Based on engineering drawings and observed field conditions, leach field lines were determined to be 3 ft below grade. The sample interval at each borehole extended from the depth of the septic tank to 5 ft below the leach field line. From this interval, two samples were collected: one at a depth equal to the base of the leach field line, the other from 3 ft below the base of the leach field line.

Sampling operations and sample handling procedures are described in Section 3.0. Borehole locations and depths of samples that were sent to the laboratory are in Table 8-7. Borehole logs are in Appendix C.

Table 8-7. Boreholes and Samples Analyzed from SWMU 10-21, Building 614, Septic Tank, Leach Field, and Lines (ST-288)

Borehole	Borehole Location	Sample Depth (ft)
01	Background borehole	3–5
02	In the leach field area	3–8[a]
03	In the leach field area	3–8[b]
04	In the leach field area	3–5

a. MS/MSD sample also collected at this depth interval.

b. Replicate sample also collected at this depth interval.

8.3.2.4 Laboratory Analysis

Five soil samples, four normal and one replicate, were analyzed for VOCs, SVOCs, TPH as GRO and DRO, metals, mercury (the expected contaminants associated with normal operations at this building), soil pH, and soil moisture. The four brass tubes in each 2-ft sample interval were field-screened for possible contamination using a beta-gamma meter and a FID (as per health and safety requirements). No elevated readings were measured with these instruments.

8.3.3 Site Characteristics

8.3.3.1 Geology

The ST-288 area is underlain by unconsolidated alluvial sediment that is predominantly very fine-grained sand with some gravel. Four 8-ft boreholes were drilled at ST-288. No boreholes penetrated into the Santa Fe Group sediments that presumably underlie this area. A discussion of the general geology at Kirtland AFB is presented in Section 2.4.

As a result of leach field installation, it is probable that backfill material is present in the leach field area. Borehole logs for this area are presented in Appendix C.

8.3.3.2 Hydrogeology

Groundwater beneath this area is found within the Upper Santa Fe sediments and is generally thought to be unconfined in the upper portion of the aquifer. This area is within the HR1 saturated zone setting as defined by SNL studies (Figure 2-9) (SNL, 1994). Hydrogeologic characterization in this portion of Kirtland AFB is complicated by the presence of numerous production wells (Figure 2-11). It is probable that uniform groundwater conditions do not exist in this region. Local cones of depression associated with groundwater withdrawal have altered the groundwater flow direction in the vicinity of the well fields (Figure 2-7).

The gradient is probably north at this site. Two production wells are located in this area of Kirtland AFB: KAFB-2, 3,500 ft downgradient east-northeast, and KAFB-14, 3,800 ft cross-gradient north (Figures 2-7 and 2-11). Depth to groundwater is estimated to be about 350 ft below grade (Figure 2-10); however, shallower perched water zones may occur. Hydraulic conductivity within HR1 is estimated at 2 to 171 ft/day (SNL, 1994). A general discussion of the hydrogeology at Kirtland AFB is presented in Section 2.5.

8.3.4 Nature and Extent of Contamination

The following section describes the extent of contamination based on sampling results. Analytical results for soil samples collected and analyzed from ST-288 are summarized in Table 8-8; only the reportable concentrations of detected analytes are listed. Full analytical results are presented in Appendix F. Laboratory validation reports are in Appendix K.

Organic Compounds

No VOC or SVOC analytes were detected in any of the soil samples submitted for analysis at ST-288.

Table 8-8. Summary of Reportable Concentrations for Soil Analyses at SWMU 10-21, Building 614, Septic Tank, Leach Field, and Lines (ST-288)[1] (Concentrations mg/kg)

Chemical Class	Analyte	HHRB Action Level[2]	PQL UTL	Borehole Number and Sample Depth Interval (ft)				
				ST288C-01	*ST288C-02*	*ST288C-03*		*ST288C-04*
				3–5	3–8	3–8 FR	3–8	3–5
TPH	Diesel fraction	100	10.0	8.7	6.5	9.3	9.8	7.6
METALS	Aluminum	78,000	14,700	6,640	5,440	5,450	4,940	4,980
	Arsenic	0.37	6.5	2.6	2.6	2.5	2.7	2.2
	Barium	5,500	735	174	118	85.7	333	153
	Beryllium	0.15	0.84	0.32	0.31	0.31	ND	0.31
	Calcium	N/A	121,000	140,000	87,200	72,900	34,300	37,700
	Chromium, total	390	21.6	6.8	5.3	5.5	7.3	5.1
	Cobalt	4,700	15.4	4.7	4.5	2.8	3.2	3.3
	Copper	2,900	223	54.4	80.1	88.3	125	148
	Iron	N/A	23,800	7,970	6,710	7,010	6,930	6,620
	Lead	400	17.5	3.7	2.4	2.6	3.4	3.1
	Magnesium	N/A	10,400	5,190	3,210	2,930	2,550	2,100
	Manganese	390	549	140	77.5	76.3	79.8	73.7
	Nickel	1,600	188	6.3	4.6	14.2	24.7	3.6
	Potassium	N/A	3,590	868	804	841	838	841
	Sodium	N/A	787	217	239	231	144	188
	Thallium	N/A	N/A	ND	ND	0.10	ND	ND
	Vanadium	550	55.3	21.1	16.8	17.3	18.3	14.9
	Zinc	23,000	114	32.1	36.2	40.0	52.3	56.8
OTHER	pH			8.8	8.8	8.8	8.7	8.7
	Moisture (%)			5.1	3.5	4.6	3.3	4.3

FOOTNOTES

1	Complete laboratory analytical results and method detection limits are presented in Appendix K.
2	Action level of RCRA Proposed Rule Subpart S (55 *FR* 30814, 7/27/90).
*	TPH action level is 100 mg/kg adopted from NMED UST regulations (NMED, 1990). SW-8015 analyzes volatile and semivolatile petroleum hydrocarbon fractions separately. The total concentration of the two fractions analyzed under SW-8015 will be used to assess compliance with stipulated action levels for the purpose of this RFI.
#	Denotes TCLP analysis, results in mg/l.
--	No Data.
FR	Field Replicate.
HHRB	Human health risk based.
J	Estimated value.
N/A	Not Applicable.
NA	Not Analyzed.
ND	Not detected above the method detection limit.
pCi/g	picocuries per gram.
PQL	Practical quantitation limits (defines VOC, SVOC, and TPH).
R	Reject NDs due to interference.
RAD	Radionuclides.
RE	Resample.
SVOC	Semivolatile organic compounds.
TPH	Total petroleum hydrocarbons.
U	Accept data (positive results may be influenced by lab contamination).
UJ	Estimated nondetect.
UTL	Upper tolerance limits (defines metals).
VOC	Volatile organic compounds.

Petroleum Hydrocarbons

No gasoline range hydrocarbons were detected in any of the soil samples submitted for analysis at ST-288. Diesel range hydrocarbons (6.5 to 9.8 mg/kg) were detected in all of the soil samples at ST-288. These concentrations were below the NMED action level of 100 mg/kg.

Metals

Arsenic and beryllium were the only metals detected at concentrations above the HHRB action levels in soil samples submitted for analysis from ST-288 (Table 8-8). Arsenic (2.2 to 2.7 mg/kg) was detected in the four normal and one replicate samples collected. All concentrations were above the HHRB action level of 0.37 mg/kg, but were below the 6.5 mg/kg UTL. Beryllium (0.31 to 0.32 mg/kg) was detected in all normal samples collected at ST-288 above the HHRB action level of 0.15 mg/kg, but below the 0.84 mg/kg UTL. Beryllium and arsenic concentrations exceeding HHRB action levels appear to be naturally occurring throughout Kirtland AFB as discussed in Section 4.2.2.

Soil pH and Moisture

Soil pH ranged from 8.7 to 8.8 in these samples. Soil moisture values ranged from 3.3 to 5.1 percent (Table 8-8).

8.3.5 Conclusions and Recommendations

Conclusions

- No VOCs or SVOCs were detected in the soil samples submitted for analysis from this site.
- No gasoline range hydrocarbons were detected. Diesel range hydrocarbons were detected in all samples at this site. No concentrations exceeded the NMED action level of 100 mg/kg. The diesel range hydrocarbon concentrations (6.5 to 9.8 mg/kg) in all of the samples collected and submitted for analysis from ST-288 are similar to the detected concentrations in background samples analyzed during the Appendix III RFI, and are not conclusive evidence that a release has occurred. Without the presence of other release indicators (VOCs, SVOCs, and metals), it is probable the diesel range hydrocarbon concentrations are not attributable to a release from the unit.
- Arsenic and beryllium were the only metals detected at concentrations exceeding HHRB action levels. These concentrations appear to be naturally occurring throughout Kirtland AFB.
- The analytical results at ST-288 are not indicative of a contaminant release from this site.

Recommendations

- Based on the findings of the RFI, no further action is necessary; therefore, ST-288 does not require further investigation. A No Further Action proposal should be prepared.

8.4 SWMU 10-21, Buildings 617/620, Septic Tanks, Leach Field, and Lines (ST-289)

8.4.1 Site Background and Environmental Setting

Septic tank ST-289 is located south of Building 617, the Chemical Laser Facility for Phillips Laboratory, in the northwest portion of Kirtland AFB (Figure 8-5). ST-289 was investigated on February 15 and 16, 1995.

Based on engineering drawings and observed site conditions, there are two leach fields, one to the south of Building 617 (45 ft x 20 ft) and the other underneath Building 620 (25 ft x 30 ft). The total inflow and outflow line lengths to the two leach fields are estimated at 370 ft. Potentially, the septic tanks could have received contaminants from Buildings 617 and 620. Due to the leach field's design, waste from ST-289 can be expected to have entered the surrounding soil.

ST-289 is located in the urban/industrial zone, which is discussed in Section 2.0. The nearest production wells to this site are KAFB-2, 3,700 ft east-northeast, and KAFB-14, 3,800 ft north (Figure 2-11).

8.4.2 Study Area Investigation

The area of investigation was limited to two leachfields at ST-289. Possible source materials in the septic tanks were not investigated.

8.4.2.1 Previous Investigations

No previous investigations have been performed at this site.

8.4.2.2 Data Gaps

No information related to the past use of ST-289 was available for review. No data were available to determine the presence or absence of contaminants in the subsurface soil in the leach field area.

8.4.2.3 RFI Field Investigation

The objective of this investigation was to determine if contamination is present in the subsurface soil in the leach field area. On February 15 and 16, 1995, seven boreholes were drilled and sampled using a Geoprobe. Borehole ST-289C-01 was drilled southwest of Building 617 to collect background concentration data for this site. This borehole was assumed to be in an area away from any known or suspected contamination. All other boreholes were drilled in the leach field areas. Based on engineering drawings and observed field conditions, leach field lines were determined to be 4 ft below grade under Building 620 and 3 ft below grade to the south of Building 617. The sample interval at each borehole extended from the depth of the leach field lines to 5 ft below the leach field lines. From this interval, two samples were collected: one at a depth equal to the base of the leach field line, the other from 3 ft below the base of the line.

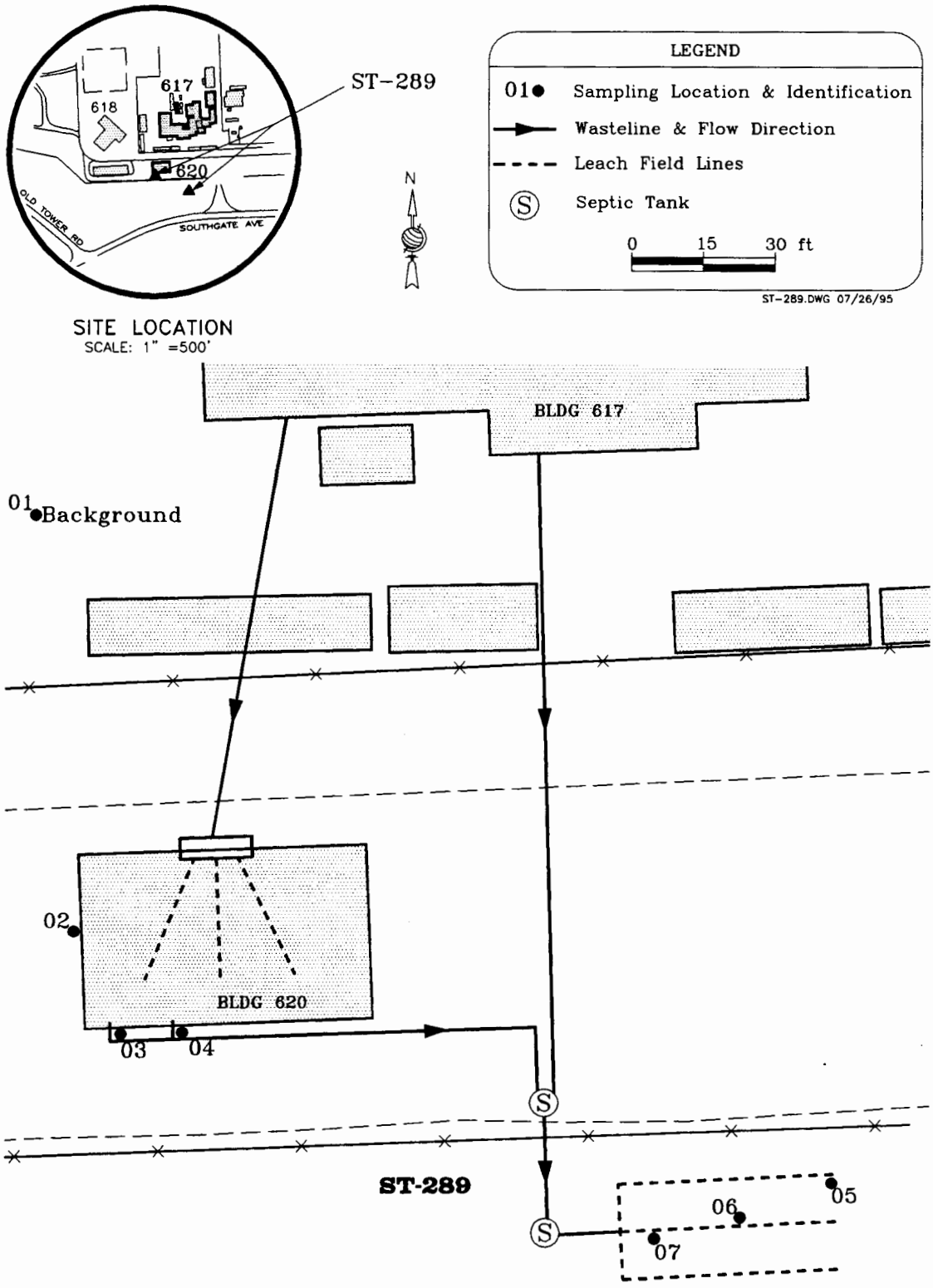


Figure 8-5. Soil Sampling Locations at SWMU 10-21, Buildings 617/620, Septic Tanks, Leach Field, and Lines (ST-289)

Sampling operations and sample handling procedures are described in Section 3.0. Borehole locations and depths of samples that were sent to the laboratory are listed in Table 8-9. Borehole logs are in Appendix C.

8.4.2.4 Laboratory Analysis

Eight soil samples, seven normal and one replicate, were analyzed for VOCs, SVOCs, TPH as GRO and DRO, metals, mercury (the expected contaminants associated with normal operations at this building), soil pH, and soil moisture. The four brass tubes in each 2-ft sample interval were field-screened for possible contamination using a beta-gamma meter and a FID (as per health and safety requirements). Beta-gamma measurements were at background; elevated FID readings were measured in samples collected for laboratory analysis at ST-289C-06 and ST-289C-07. The brass tube with the highest FID reading measured in the sample interval was submitted for VOC analysis. The highest reading measured for the sample interval is listed in Table 8-9.

Table 8-9. Boreholes and Samples Analyzed from SWMU 10-21, Buildings 617/620, Septic Tanks, Leach Field, and Lines (ST-289)

Borehole	Borehole Location	Sample Depth (ft)	FID (ppm_v)
01	Background borehole	3–5	0
02	In the leach field area	7–9[a]	0
03	In the leach field area	4–6	0
04	In the leach field area	4–6	0
05	In the leach field area	3–8[b]	0
06	In the leach field area	4–7[c]	2
07	In the leach field area	6–8	2

FID readings are values above background values recorded in ppm_v (parts-per-million volume (ml/L) as methane).
a. Due to poor sample recovery, the second 2-ft section of the 5-ft interval was used for a sample.
b. Both 2-ft sections of the 5-ft interval were used due to the collection of a replicate sample.
c. Due to poor sample recovery, both the first 2-ft section and the second 2-ft section were used to make up one sample.

8.4.3 Site Characteristics

8.4.3.1 Geology

The ST-289 area is underlain by unconsolidated alluvial sediment that is predominantly very fine-grained to fine-grained silty sand. Four 8-ft boreholes and three 9-ft boreholes were drilled at ST-289. No boreholes penetrated into the Santa Fe Group sediments that presumably underlie this area. A discussion of the general geology at Kirtland AFB is presented in Section 2.4.

As a result of leach field installation, it is probable that backfill material (pea gravel immediately adjacent to the leach field lines) is present in the leach field area. Borehole logs for this area are presented in Appendix C.

8.4.3.2 Hydrogeology

Groundwater beneath this area is found within the Upper Santa Fe sediments and is generally thought to be unconfined in the upper portion of the aquifer. This area is within the HR1 saturated zone setting as defined by SNL studies (Figure 2-9) (SNL, 1994). Hydrogeologic characterization in this portion of Kirtland AFB is complicated by the presence of numerous production wells (Figure 2-11). It is probable that uniform groundwater conditions do not exist in this region. Local cones of depression associated with groundwater withdrawal have altered the groundwater flow direction in the vicinity of the well fields (Figure 2-7).

The gradient is probably north at this site. Two production wells are located in this area of Kirtland AFB: KAFB-2 is downgradient 3,700 ft east-northeast and KAFB-14 is cross-gradient 3,800 ft north (Figures 2-7 and 2-11). Depth to groundwater is estimated to be about 350 ft below grade (Figure 2-10); however, shallower perched water zones may occur. Hydraulic conductivity within HR1 is estimated at 2 to 171 ft/day (SNL, 1994). A general discussion of the hydrogeology at Kirtland AFB is presented in Section 2.5.

8.4.4 Nature and Extent of Contamination

The following section describes the extent of contamination based on sampling results. Analytical results for soil samples collected and analyzed from ST-289 are summarized in Table 8-10; only the reportable concentrations of detected analytes are listed. Full analytical results are presented in Appendix F. Laboratory validation reports are in Appendix K.

Organic Compounds

No VOC analytes were detected in any of the soil samples submitted for analysis at ST-289.

Di-n-butylphthalate was the only SVOC analyte detected in soil samples ST-289C-05, ST-289C-06, and ST-289C-07, ranging from 2.0 to 2.7 mg/kg. All concentrations were below the HHRB action level of 7,800 mg/kg.

Petroleum Hydrocarbons

No gasoline range hydrocarbons were detected in any of the soil samples submitted for analysis at ST-289. Diesel range hydrocarbons (4.8 to 6.0 mg/kg) were detected in boreholes ST-289C-01 (background borehole), ST-289C-02, ST-289C-03, ST-289C-04. These concentrations were below the NMED action level of 100 mg/kg.

Table 8-10. Summary of Reportable Concentrations for Soil Analyses at SWMU 10-21, Buildings 617/620, Septic Tank, Leach Field, and Lines (ST-289)[1] (Concentrations mg/kg)

Chemical Class	Analyte	HHRB Action Level[2]	PQL UTL	Borehole Number and Sample Depth Interval (ft)							
				ST289C-01	*ST289C-02*	*ST289C-03*	*ST289C-04*	*ST289C-05*		*ST289C-06*	*ST289C-07*
				3–5	7–9	4–6	4–6	3–8 FR	3–8	4–7	6–8
SVOC	Di-n-butylphthalate	7,800	0.70	ND	ND	ND	ND	2.0	2.7	2.6	2.5
TPH	Diesel fraction	100	10.0	5.8	4.8	6.0	5.9	ND	ND	ND	ND
METALS	Aluminum	78,000	14,700	5,750	9,120	3,770	4,260	5,420	5,490	6,120	6,270
	Arsenic	0.37	6.5	3.0	2.4	1.7	2.2	3.2	3.2	3.0	2.7
	Barium	5,500	735	182	1,230	194	163	177	196	271	173
	Beryllium	0.15	0.84	0.35	0.47	ND	0.31	0.35	ND	0.39	0.37
	Calcium	N/A	121,000	124,000	101,000	73,000	34,200	108,000	90,800	77,100	31,600
	Chromium, total	390	21.6	5.2	7.3	3.5	4.3	4.7	4.6	4.4	5.4
	Cobalt	4,700	15.4	3.8	5.0	2.6	3.6	2.7	2.1	4.2	3.3
	Copper	2,900	223	29.9	24.8	18.2	25.6	15.9	33.3	26.2	42.7
	Iron	N/A	23,800	6,110	10,700	4,960	6,450	6,010	6,090	6,720	7,990
	Lead	400	17.5	3.5	5.2	3.0	3.2	4.0	3.7	4.1	3.7
	Magnesium	N/A	10,400	4,210	4,870	1,990	1,960	3,380	3,260	3,120	2,760
	Manganese	390	549	73.4	189	57.0	78.3	73.7	63.7	159	80.7
	Nickel	1,600	188	4.7	7.0	3.6	3.7	3.6	3.6	3.9	7.3
	Potassium	N/A	3,590	704	1,710	580	744	678	750	1,050	1,120
	Sodium	N/A	787	74.4	101	65.8	74.6	122	98.5	83.8	109
	Vanadium	550	55.3	18.7	25.5	12.3	15.7	18.5	19.9	18.2	19.9
	Zinc	23,000	114	21.2	32.1	15.1	20.8	19.4	24.6	25.9	32.4
OTHER	pH			8.6	8.5	8.6	8.5	8.5	8.3	8.2	8.0
	Moisture (%)			15.0	14.6	5.6	3.9	14.0	14.1	22.1	18.1

FOOTNOTES

1	Complete laboratory analytical results and method detection limits are presented in Appendix K.
2	Action level of RCRA Proposed Rule Subpart S (55 *FR* 30814, 7/27/90).
*	TPH action level is 100 mg/kg adopted from NMED UST regulations (NMED, 1990). SW-8015 analyzes volatile and semivolatile petroleum hydrocarbon fractions separately. The total concentration of the two fractions analyzed under SW-8015 will be used to assess compliance with stipulated action levels for the purpose of this RFI.
#	Denotes TCLP analysis, results in mg/l.
--	No Data.
FR	Field Replicate.
HHRB	Human health risk based.
J	Estimated value.
N/A	Not Applicable.
NA	Not Analyzed.
ND	Not detected above the method detection limit.
pCi/g	picocuries per gram.
PQL	Practical quantitation limits (defines VOC, SVOC, and TPH).
R	Reject NDs due to interference.
RAD	Radionuclides.
RE	Resample.
SVOC	Semivolatile organic compounds.
TPH	Total petroleum hydrocarbons.
U	Accept data (positive results may be influenced by lab contamination).
UJ	Estimated nondetect.
UTL	Upper tolerance limits (defines metals).
VOC	Volatile organic compounds.

Metals

Arsenic and beryllium were the only metals detected at concentrations above the HHRB action levels in soil samples submitted for analysis from ST-289 (Table 8-10). Arsenic (1.7 to 3.2 mg/kg) was detected in all the samples collected. All concentrations were above the HHRB action level of 0.37 mg/kg, but were below the 6.5 mg/kg UTL. Beryllium (0.31 to 0.47 mg/kg) was detected in most of the samples collected at ST-289 above the HHRB action level of 0.15 mg/kg, but were below the 0.84 mg/kg UTL. Beryllium and arsenic concentrations exceeding HHRB action levels appear to be naturally occurring throughout Kirtland AFB as discussed in Section 4.2.2.

Soil pH and Moisture

Soil pH ranged from 8.0 to 8.6 in these samples. Soil moisture values ranged from 5.4 to 22.1 percent (Table 8-10).

8.4.5 Conclusions and Recommendations

Conclusions

- No VOCs were detected and one SVOC was detected in the soil samples submitted for analysis collected from this site. All concentrations were below HHRB action levels.
- No gasoline range hydrocarbons were detected in the samples submitted for analysis from this site. Diesel range hydrocarbons were detected in some of the samples at this site. No concentrations exceeded the NMED action level of 100 mg/kg. The diesel range hydrocarbons (4.8 to 6.0 mg/kg) detected in four of the samples submitted for analysis from this site are similar to the detected concentrations in background samples analyzed during the Appendix III RFI, and are not conclusive evidence that a release has occurred. Without the presence of other release indicators (VOCs, SVOCs, and metals), it is probable that the diesel range hydrocarbon concentrations are not attributable to a release from the unit.
- Arsenic and beryllium were the only metals detected at concentrations exceeding HHRB action levels; these concentrations appear to be naturally occurring throughout Kirtland AFB.
- The analytical results at ST-289 are not indicative of a contaminant release from this site.

Recommendations

- Based on the findings of the RFI, no further action is necessary; therefore, ST-289 does not require further investigation. A No Further Action proposal should be prepared.

8.5 SWMU 10-21, Building 619, Septic Tank, Leach Field, and Lines (ST-290)

8.5.1 Site Background and Environmental Setting

Septic tank ST-290 is located 15 ft south of Building 619 in the northwest portion of Kirtland AFB (Figure 8-6). ST-290 was investigated on February 20, 1995.

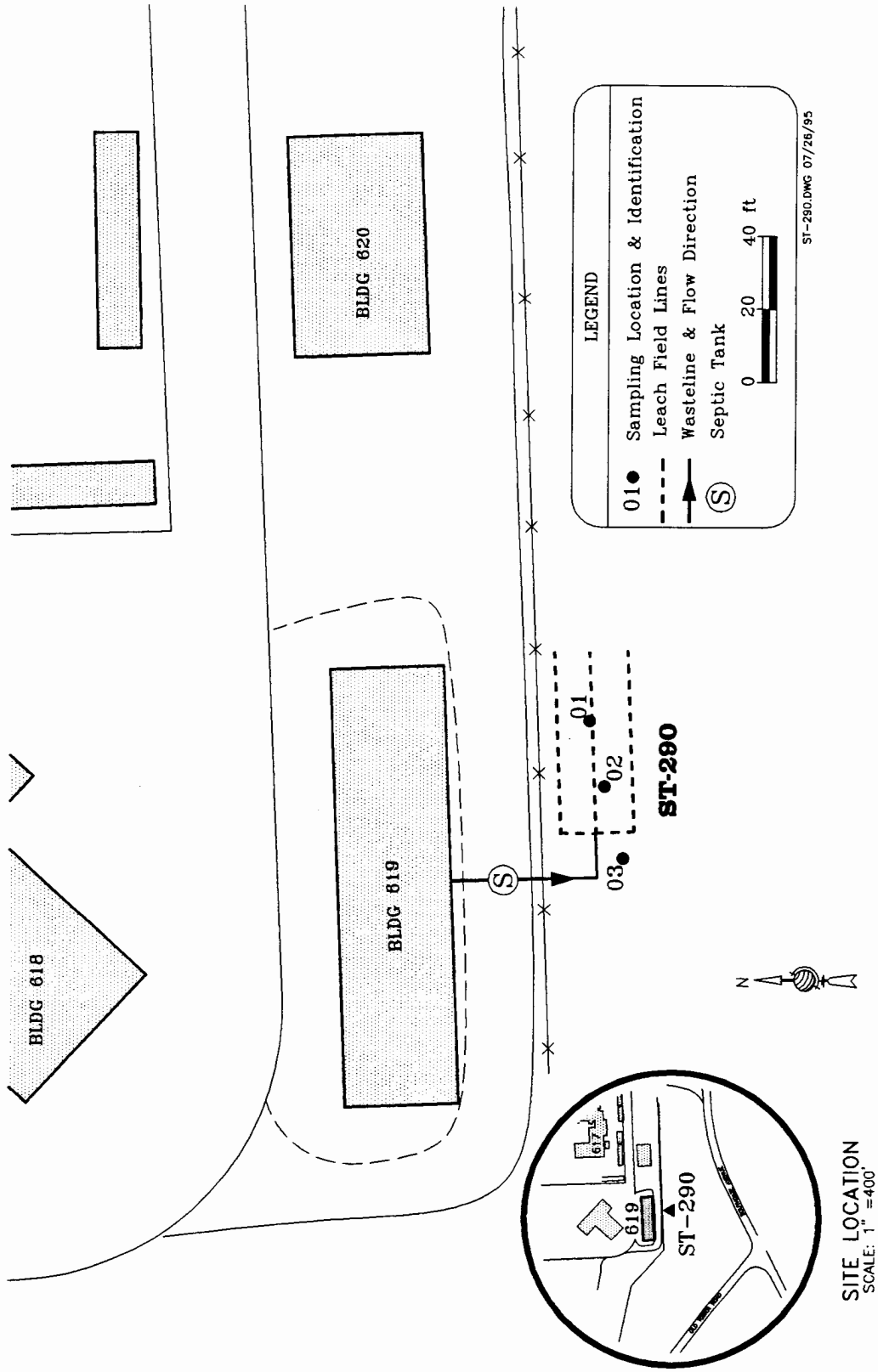


Figure 8-6. Soil Sampling Locations at SWMU 10-21, Building 619, Septic Tank, Leach Field, and Lines (ST-290)

Based on engineering drawings and observed site conditions, inflow and outflow line lengths are approximately 15 ft and 40 ft, respectively. This tank discharges to a leach field to the southeast with a drainage area of approximately 50 ft x 20 ft. Potentially, the septic tank could have received contaminants from Building 619 and, due to the leach field's design, waste from ST-290 can be expected to have entered the surrounding soil.

ST-290 is located in the urban/industrial zone, which is discussed in Section 2.0. The nearest production wells to this site are KAFB-2, 3,600 ft east-northeast, and KAFB-14, 3,800 ft north (Figure 2-11).

8.5.2 Study Area Investigation

The area of investigation was limited to the leach field at ST-290. Possible source materials in the septic tank were not investigated.

8.5.2.1 Previous Investigations

No previous investigations have been performed at this site.

8.5.2.2 Data Gaps

No information related to the past use of ST-290 was available for review. No data were available to determine the presence or absence of contaminants in the subsurface soil in the leach field area.

8.5.2.3 RFI Field Investigation

The objective of this investigation was to determine if contamination is present in the subsurface soil in the leach field area. Samples collected at ST-289C-01 were used to determine background concentrations for septic tank ST-290. Borehole ST-289C-01 was drilled southwest of Building 617 and assumed to be in an area away from any known or suspected contamination.

On February 20, 1995, three boreholes were drilled and sampled using a Geoprobe. All boreholes were drilled in the leach field area. Based on engineering drawings and observed field conditions, leach field lines were determined to be 3 ft below grade. The sample interval at each borehole extended from the depth of the leach field line to 5 ft below the leach field line. From this interval, two samples were collected: one at a depth equal to the base of the leach field line, the other from 3 ft below the base of the leach field line.

Sampling operations and sample handling procedures are described in Section 3.0. Borehole locations and depths of samples that were sent to the laboratory are listed in Table 8-11. Borehole logs are in Appendix C.

Table 8-11. Boreholes and Samples Analyzed from SWMU 10-21, Building 619, Septic Tank, Leach Field, and Lines (ST-290)

Borehole	Borehole Location	Sample Depth (ft)
01	In the leach field area	3–5
02	In the leach field area	3–5
03	In the leach field area	3–5

8.5.2.4 Laboratory Analysis

Three soil samples were analyzed for VOCs, SVOCs, TPH as GRO and DRO, metals, mercury (the expected contaminants associated with normal operations at this building), soil pH, and soil moisture. The four brass tubes in each 2-ft sample interval were field-screened for possible contamination using a beta-gamma meter and a FID (as per health and safety requirements). No elevated readings were measured with these instruments.

8.5.3 Site Characteristics

8.5.3.1 Geology

The ST-290 area is underlain by unconsolidated alluvial sediment that is predominantly very fine-grained to fine-grained sand. Three 8-ft boreholes were drilled at ST-290. No boreholes penetrated into the Santa Fe Group sediments that presumably underlie this area. A discussion of the general geology at Kirtland AFB is presented in Section 2.4.

As a result of leach field installation, it is probable that backfill material is present in the leach field area. Borehole logs for this area are presented in Appendix C.

8.5.3.2 Hydrogeology

Groundwater beneath this area is found within the Upper Santa Fe sediments and is generally thought to be unconfined in the upper portion of the aquifer. This area is within the HR1 saturated zone setting as defined by SNL studies (Figure 2-9) (SNL, 1994). Hydrogeologic characterization in this portion of Kirtland AFB is complicated by the presence of numerous production wells (Figure 2-11). It is probable that uniform groundwater conditions do not exist in this region. Local cones of depression associated with groundwater withdrawal have altered the groundwater flow direction in the vicinity of the well fields (Figure 2-7).

The gradient is probably north at this site. Two production wells are located in this area of Kirtland AFB: KAFB-2 is downgradient 3,600 ft east-northeast, and KAFB-14 is cross-gradient 3,800 ft north (Figures 2-7 and 2-11). Depth to groundwater is estimated to be about 350 ft below grade (Figure 2-10); however, shallower perched water zones may occur. Hydraulic conductivity within HR1 is estimated at

2 to 171 ft/day (SNL, 1994). A general discussion of the hydrogeology at Kirtland AFB is presented in Section 2.5.

8.5.4 Nature and Extent of Contamination

The following section describes the extent of contamination based on sampling results. Analytical results for soil samples collected and analyzed from ST-290 are summarized in Table 8-12; only the reportable concentrations of detected analytes are listed. Full analytical results are presented in Appendix F. Laboratory validation reports are in Appendix K.

Organic Compounds

No VOC or SVOC analytes were detected in any of the soil samples submitted for analysis at ST-290.

Petroleum Hydrocarbons

No gasoline or diesel range hydrocarbons were detected in any of the soil samples at ST-290.

Metals

Arsenic and beryllium were the only metals detected at concentrations above the HHRB action levels (Table 8-12). Arsenic (3.1 to 3.7 mg/kg) was detected in all samples submitted for analysis. All concentrations were above the HHRB action level of 0.37 mg/kg, but were below the 6.5 mg/kg UTL. Beryllium (0.32 to 0.44 mg/kg) was detected in all samples collected at ST-290 above the HHRB action level of 0.15 mg/kg, but below the 0.84 mg/kg UTL. Beryllium and arsenic concentrations exceeding HHRB action levels appear to be naturally occurring throughout Kirtland AFB as discussed in Section 4.2.2.

Soil pH and Moisture

Soil pH ranged from 8.3 to 8.6 in these samples. Soil moisture values ranged from 7.2 to 10.5 percent (Table 8-12).

8.5.5 Conclusions and Recommendations

Conclusions

- No VOCs or SVOCs were detected in the soil samples submitted for analysis collected from this site.
- No gasoline or diesel range hydrocarbons were detected.
- Arsenic and beryllium were the only metals detected at concentrations exceeding HHRB action levels. The beryllium concentrations appear to be naturally occurring throughout Kirtland AFB.
- The analytical results at ST-290 are not indicative of a contaminant release from this site.

Table 8-12. Summary of Reportable Concentrations for Soil Analyses at SWMU 10-21, Building 619, Septic Tank, Leach Field, and Lines (ST-290)[1] (Concentrations mg/kg)

Chemical Class	Analyte	HHRB Action Level[2]	UTL	Borehole Number and Sample Depth Interval (ft)		
				ST290C-01	*ST290C-02*	*ST290C-03*
				3–5	3–5	3–5
METALS	Aluminum	78,000	14,700	7,470	8,290	10,600
	Arsenic	0.37	6.5	3.1	3.7	3.1
	Barium	5,500	735	117	238	134
	Beryllium	0.15	0.84	0.32	0.34	0.44
	Cadmium	39.0	N/A	ND	0.89	ND
	Calcium	N/A	121,000	33,900	40,400	133,000
	Chromium, total	390	21.6	7.8	8.9	9.8
	Cobalt	4,700	15.4	4.4	5.5	5.4
	Copper	2,900	223	12.6	32.0	31.6
	Iron	N/A	23,800	8,690	9,120	9,080
	Lead	400	17.5	3.4	4.3	4.7
	Magnesium	N/A	10,400	2,980	3,270	4,980
	Manganese	390	549	112	114	125
	Nickel	1,600	188	5.9	4.8	5.1
	Potassium	N/A	3,590	1,280	1,310	1,790
	Sodium	N/A	787	127	132	253
	Thallium	N/A	N/A	ND	0.21	0.17
	Vanadium	550	55.3	27.2	27.9	27.7
	Zinc	23,000	114	20.5	35.0	30.5
OTHER	pH			8.6	8.6	8.3
	Moisture (%)			7.2	10.5	9.8

FOOTNOTES

1	Complete laboratory analytical results and method detection limits are presented in Appendix K.
2	Action level of RCRA Proposed Rule Subpart S (55 *FR* 30814, 7/27/90).
*	TPH action level is 100 mg/kg adopted from NMED UST regulations (NMED, 1990). SW-8015 analyzes volatile and semivolatile petroleum hydrocarbon fractions separately. The total concentration of the two fractions analyzed under SW-8015 will be used to assess compliance with stipulated action levels for the purpose of this RFI.
#	Denotes TCLP analysis, results in mg/l.
--	No Data.
FR	Field Replicate.
HHRB	Human health risk based.
J	Estimated value.
N/A	Not Applicable.
NA	Not Analyzed.
ND	Not detected above the method detection limit.
pCi/g	picocuries per gram.
PQL	Practical quantitation limits (defines VOC, SVOC, and TPH).
R	Reject NDs due to interference.
RAD	Radionuclides.
RE	Resample.
SVOC	Semivolatile organic compounds.
TPH	Total petroleum hydrocarbons.
U	Accept data (positive results may be influenced by lab contamination).
UJ	Estimated nondetect.
UTL	Upper tolerance limits (defines metals).
VOC	Volatile organic compounds.

Recommendations

- Based on the findings of the RFI, no further action is necessary; therefore, ST-290 does not require further investigation. A No Further Action proposal should be prepared.

8.6 SWMU 10-21, Building 617, Septic Tank, Leach Field, and Lines (ST-291)

8.6.1 Site Background and Environmental Setting

Septic tank ST-291 is located in an alcove on the north side of Building 617, the Chemical Laser Facility for Phillips Laboratory, in the northwest portion of Kirtland AFB (Figure 8-7). ST-291 was investigated on February 15, 1995.

Based on engineering drawings and observed site conditions, inflow and outflow line lengths are approximately 40 ft and 4 ft, respectively. This tank discharges to a leach field to the southeast with a drainage area of approximately 25 ft x 15 ft. Potentially, the septic tank could have received contaminants from Building 617 and, due to the leach field's design, waste from ST-291 can be expected to have entered the surrounding soil.

ST-291 is located in the urban/industrial zone, which is discussed in Section 2.0. The nearest production wells to this site are KAFB-2, 3,700 ft east-northeast, and KAFB-14, 3,800 ft north (Figure 2-11).

8.6.2 Study Area Investigation

The area of investigation was limited to the leach field at ST-291. Possible source materials in the septic tank were not investigated.

8.6.2.1 Previous Investigations

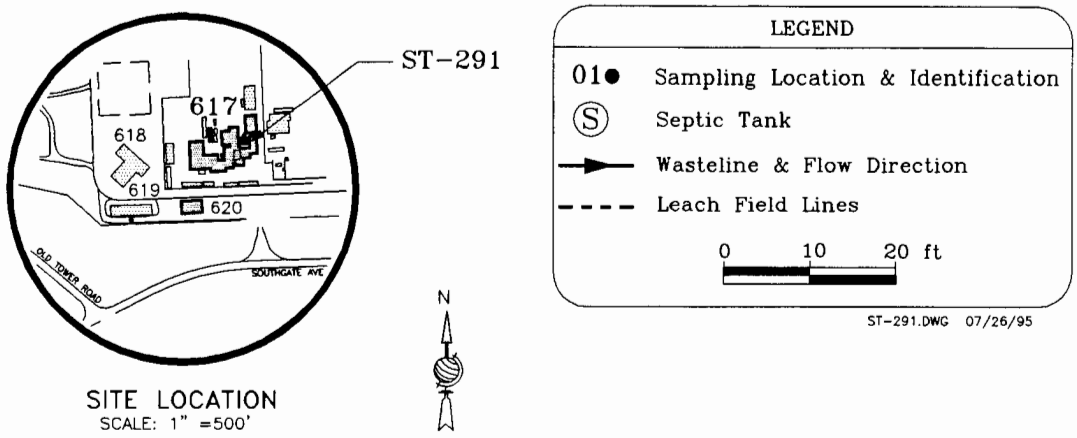
No previous investigations have been performed at this site.

8.6.2.2 Data Gaps

No information related to the past use of ST-291 was available for review. No data were available to determine the presence or absence of contaminants in the subsurface soil in this leach field area.

8.6.2.3 RFI Field Investigation

The objective of this investigation was to determine if contamination is present in the subsurface soil in the leach field area. Samples collected at ST-289C-01 were used to determine background concentrations for septic tank ST-291. Borehole ST-289C-01 was drilled southwest of Building 617 and assumed to be in an area away from any known or suspected contamination.



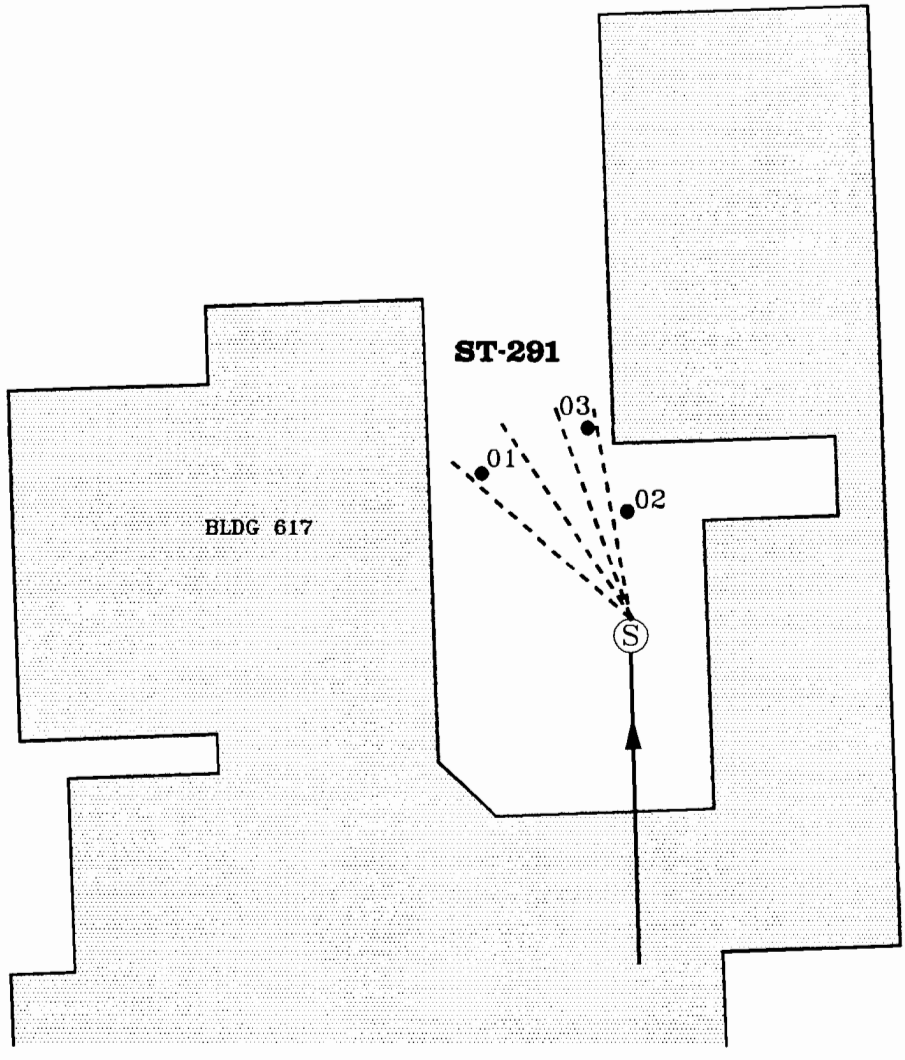


Figure 8-7. Soil Sampling Locations at SWMU 10-21, Building 617, Septic Tank, Leach Field, and Lines (ST-291)

On February 15, 1995, three boreholes were drilled and sampled using a Geoprobe. All boreholes were drilled in the leach field area. Based on engineering drawings and observed field conditions, the leach field lines were determined to be 3 ft below grade. The sample interval at each borehole extended from the depth of the leach field line to 5 ft below the leach field line. From this interval, two samples were collected: one at a depth equal to the base of the leach field line, the other from 3 ft below the base of the leach field line.

Sampling operations and sample handling procedures are described in Section 3.0. Borehole locations and depths of samples that were sent to the laboratory are listed in Table 8-13. Borehole logs are in Appendix C.

Table 8-13. Boreholes and Samples Analyzed from SWMU 10-21, Building 617, Septic Tank, Leach Field, and Lines (ST-291)

Borehole	Borehole Location	Sample Depth (ft)
01	In the leach field area	3–5
02	In the leach field area	3–5
03	In the leach field area	3–5

8.6.2.4 Laboratory Analysis

Three soil samples were analyzed for VOCs, SVOCs, TPH GRO and DRO, metals, mercury (the expected contaminants associated with normal operations at this building), soil pH, and soil moisture. The four brass tubes in each 2-ft sample interval were field-screened for possible contamination using a beta-gamma meter and a FID (as per health and safety requirements). No elevated readings were measured with these instruments.

8.6.3 Site Characteristics

8.6.3.1 Geology

The ST-291 area is underlain by unconsolidated alluvial sediment that is predominantly silty sand. Three 8-ft boreholes were drilled at ST-291. No boreholes penetrated into the Santa Fe Group sediments that presumably underlie this area. A discussion of the general geology at Kirtland AFB is presented in Section 2.4.

As a result of leach field installation, it is probable that backfill material is present in the leach field area. Borehole logs for this area are presented in Appendix C.

8.6.3.2 Hydrogeology

Groundwater beneath this area is found within the Upper Santa Fe sediments and is generally thought to be unconfined in the upper portion of the aquifer. This area is within the HR1 saturated zone setting as defined by SNL studies (Figure 2-9) (SNL, 1994). Hydrogeologic characterization in this portion of Kirtland AFB is complicated by the presence of numerous production wells (Figure 2-11). It is probable that uniform groundwater conditions do not exist in this region. Local cones of depression associated with groundwater withdrawal have altered the groundwater flow direction in the vicinity of the well fields (Figure 2-7).

The gradient is probably north at this site. Two production wells are located in this area of Kirtland AFB: KAFB-2 is downgradient 3,700 ft east-northeast, while KAFB-14 is cross-gradient 3,800 ft north (Figures 2-7 and 2-11). Depth to groundwater is estimated to be about 350 ft below grade (Figure 2-10); however, shallower perched water zones may occur. Hydraulic conductivity within HR1 is estimated at 2 to 171 ft/day (SNL, 1994). A general discussion of the hydrogeology at Kirtland AFB is presented in Section 2.5.

8.6.4 Nature and Extent of Contamination

The following section describes the extent of contamination based on sampling results. Analytical results for soil samples collected and analyzed from ST-291 are summarized in Table 8-14; only the reportable concentrations of detected analytes are listed. Full analytical results are presented in Appendix F. Laboratory validation reports are in Appendix K.

Organic Compounds

No VOC analytes were detected in any of the soil samples submitted for analysis at ST-291. Di-n-butylphthalate was the only SVOC analyte detected in soil sample ST-291C-03 at a concentration of 0.80 mg/kg. This concentration was below the HHRB action level of 7,800 mg/kg.

Petroleum Hydrocarbons

No gasoline range hydrocarbons were detected in any of the soil samples submitted for analysis from ST-291. Diesel range hydrocarbons were detected in all soil samples submitted for analysis ranging from 5.5 to 8.1 mg/kg. These concentrations were below the NMED action level of 100 mg/kg.

Metals

Arsenic and beryllium were the only metals detected at concentrations above the HHRB action levels in soil samples submitted for analysis from ST-291 (Table 8-14). Arsenic (2.2 to 2.7 mg/kg) was detected in all of the samples collected. All concentrations were above the HHRB action level of 0.37 mg/kg, but were below the 6.5 mg/kg UTL. Beryllium (0.33 to 0.36 mg/kg) was detected in all samples collected at ST-291 above the HHRB action level of 0.15 mg/kg, but were below the 0.84 mg/kg UTL. Beryllium and arsenic concentrations exceeding HHRB action levels appear to be naturally occurring throughout Kirtland AFB as discussed in Section 4.2.2.

Table 8-14. Summary of Reportable Concentrations for Soil Analyses at SWMU 10-21, Building 617, Septic Tank, Leach Field, and Lines (ST-291)[1] (Concentrations mg/kg)

Chemical Class	Analyte	HHRB Action Level[2]	PQL UTL	Borehole Number and Sample Depth Interval (ft)		
				ST291C-01	*ST291C-02*	*ST291C-03*
				3–5	3–5	3–5
SVOC	Di-n-butylphthalate	7,800	0.70	ND	ND	0.80
TPH	Diesel fraction	100	10.0	8.1	6.5	5.5
METALS	Aluminum	78,000	14,700	4,790	4,630	4,840
	Arsenic	0.37	6.5	2.3	2.2	2.7
	Barium	5,500	735	110	192	163
	Beryllium	0.15	0.84	0.33	0.36	0.34
	Calcium	N/A	121,000	56,700	163,000	86,100
	Chromium, total	390	21.6	5.4	4.9	3.5
	Cobalt	4,700	15.4	4.8	3.0	2.5
	Copper	2,900	223	10.9	21.0	5.6
	Iron	N/A	23,800	6,140	5,010	5,710
	Lead	400	17.5	4.2	2.8	3.2
	Magnesium	N/A	10,400	2,500	3,010	3,170
	Manganese	390	549	76.7	55.0	67.4
	Nickel	1,600	188	3.3	4.4	3.4
	Potassium	N/A	3,590	775	809	725
	Sodium	N/A	787	70.4	103	81.9
	Vanadium	550	55.3	14.1	13.7	15.6
	Zinc	23,000	114	16.1	17.2	13.1
OTHER	pH			8.6	8.5	8.5
	Moisture (%)			8.5	15.6	12.2

FOOTNOTES

1	Complete laboratory analytical results and method detection limits are presented in Appendix K.
2	Action level of RCRA Proposed Rule Subpart S (55 *FR* 30814, 7/27/90).
*	TPH action level is 100 mg/kg adopted from NMED UST regulations (NMED, 1990). SW-8015 analyzes volatile and semivolatile petroleum hydrocarbon fractions separately. The total concentration of the two fractions analyzed under SW-8015 will be used to assess compliance with stipulated action levels for the purpose of this RFI.
#	Denotes TCLP analysis, results in mg/l.
--	No Data.
FR	Field Replicate.
HHRB	Human health risk based.
J	Estimated value.
N/A	Not Applicable.
NA	Not Analyzed.
ND	Not detected above the method detection limit.
pCi/g	picocuries per gram.
PQL	Practical quantitation limits (defines VOC, SVOC, and TPH).
R	Reject NDs due to interference.
RAD	Radionuclides.
RE	Resample.
SVOC	Semivolatile organic compounds.
TPH	Total petroleum hydrocarbons.
U	Accept data (positive results may be influenced by lab contamination).
UJ	Estimated nondetect.
UTL	Upper tolerance limits (defines metals).
VOC	Volatile organic compounds.

Soil pH and Moisture

Soil pH ranged from 8.5 to 8.6 in these samples. Soil moisture values ranged from 8.5 to 15.6 percent (Table 8-14).

8.6.5 Conclusions and Recommendations

Conclusions

- No VOCs were detected and one SVOC was detected in the soil samples submitted for analysis collected from this site. The concentration was below HHRB action levels.

- No gasoline range hydrocarbons were detected. Diesel range hydrocarbons were detected in some of the samples at this site. No concentrations exceeded the NMED action level of 100 mg/kg. The diesel range hydrocarbon concentrations are similar to the detected concentrations in background samples analyzed during the Appendix III RFI, and are not conclusive evidence that a release has occurred. Without the presence of other release indicators (VOCs, SVOCs, and metals), it is probable that the diesel range hydrocarbon concentrations are not attributable to release from the unit.

- Arsenic and beryllium were the only metals detected at concentrations exceeding HHRB action levels; these concentrations appear to be naturally occurring throughout Kirtland AFB.

- The analytical results at ST-291 are not indicative of a contaminant release from this site.

Recommendations

- Based on the findings of the RFI, no further action is necessary; therefore, ST-291 does not require further investigation. A No Further Action proposal should be prepared.

8.7 SWMU 10-21, Building 622, Septic Tank, Leach Field, and Lines (ST-292)

8.7.1 Site Background and Environmental Setting

Septic tank ST-292 is located 45 ft east of Building 622, a physics science laboratory, in the northwest portion of Kirtland AFB (Figure 8-8). ST-292 was investigated on February 13, 1995.

Based on engineering drawings and observed site conditions, inflow and outflow line lengths are approximately 52 ft and 8 ft, respectively. This tank discharges to a leach field to the southeast with a drainage area of approximately 60 ft x 20 ft. Potentially, the septic tank could have received contaminants from Building 622 and, due to the leach field's design, waste from ST-292 can be expected to have entered the surrounding soil.

ST-292 is located in the urban/industrial zone, which is discussed in Section 2.0. The nearest production wells to this site are KAFB-2, 3,500 ft east-northeast, and KAFB-14, 3,500 ft north (Figure 2-11).

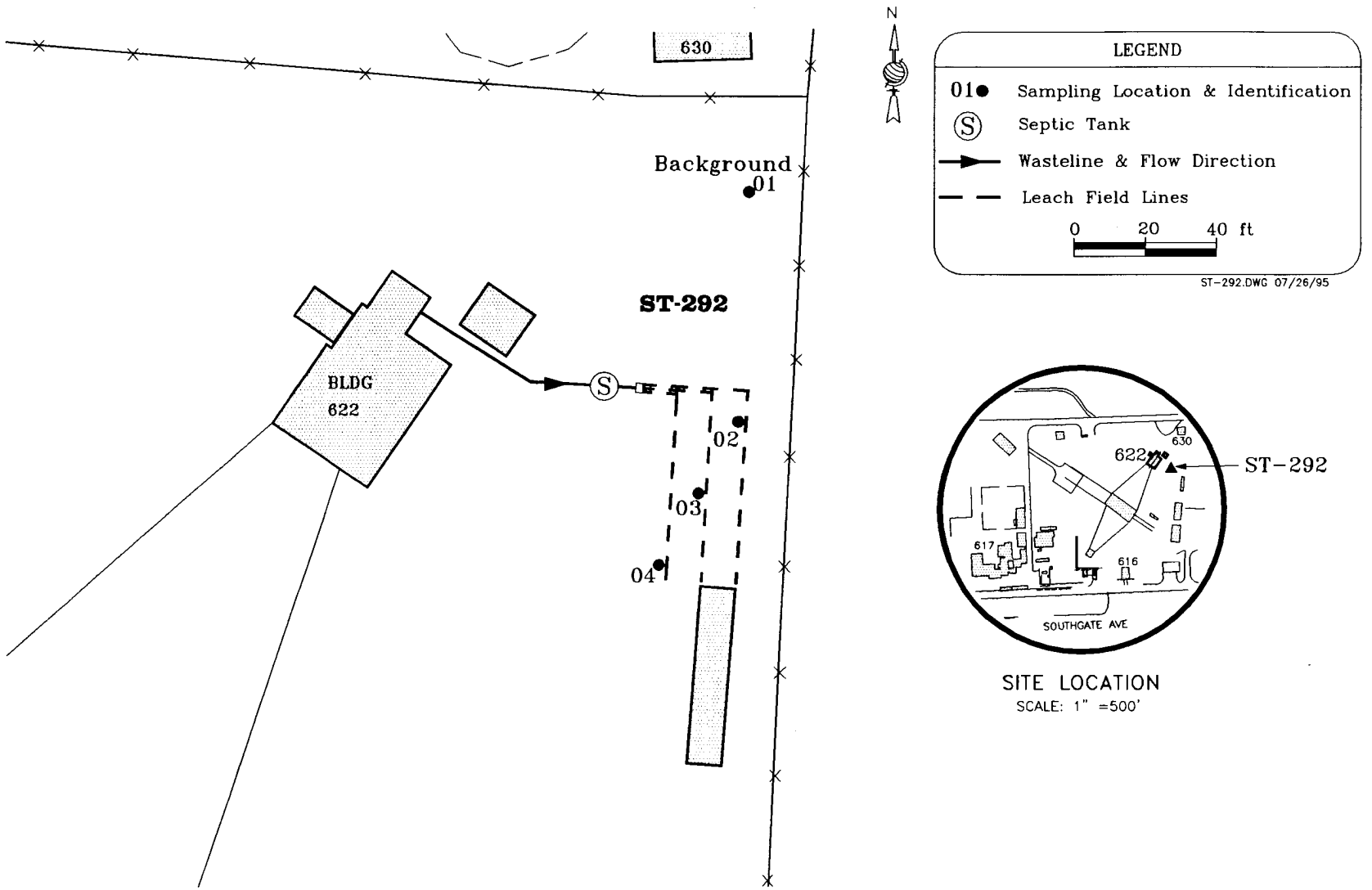


Figure 8-8. Soil Sampling Locations at SWMU 10-21, Building 622, Septic Tank, Leach Field, and Lines (ST-292)

8.7.2 Study Area Investigation

The area of investigation was limited to the leach field at ST-292. Possible source materials in the septic tank were not investigated.

8.7.2.1 Previous Investigations

No previous investigations have been performed at this site.

8.7.2.2 Data Gaps

No information related to the past use of ST-292 was available for review. No data were available to determine the presence or absence of contaminants in the subsurface soil in the leach field.

8.7.2.3 RFI Field Investigation

The objective of this investigation was to determine if contamination is present in the subsurface soil in the leach field area. On February 13, 1995, four boreholes were drilled and sampled using a Geoprobe. Borehole ST-292C-01 was drilled west of the leach field area to collect background concentration data for this site. This borehole was assumed to be in an area away from any known or suspected contamination. All other boreholes were drilled in the leach field area. Based on engineering drawings and observed field conditions, the leach field lines were determined to be 4 ft below grade. The sample interval at each borehole extended from the depth of the leach field line to 5 ft below the leach field line.

From this interval, two samples were collected: one at a depth equal to the base of the leach field line, the other from 3 ft below the base of the leach field line.

Sampling operations and sample handling procedures are described in Section 3.0. Borehole locations and depths of samples that were sent to the laboratory are listed in Table 8-15. Borehole logs are in Appendix C.

Table 8-15. Boreholes and Samples Analyzed from SWMU 10-21, Building 622, Septic Tank, Leach Field, and Lines (ST-292)

Borehole	Borehole Location	Sample Depth (ft)
01	Background borehole	4–6
02	In the leach field area	4–6
03	In the leach field area	4–6
04	In the leach field area	4–6

8.7.2.4 Laboratory Analysis

Four soil samples were analyzed for VOCs, SVOCs, TPH as GRO and DRO, metals, mercury (the expected contaminants associated with normal operations at this building), soil pH, and soil moisture. The four brass tubes in each 2-ft sample interval were field-screened for possible contamination using a beta-gamma meter and a FID (as per health and safety requirements). No elevated readings were measured with these instruments.

8.7.3 Site Characteristics

8.7.3.1 Geology

The ST-292 area is underlain by unconsolidated alluvial sediment that is predominantly fine-grained to very fine-grained sand. Four 9-ft boreholes were drilled at ST-292. No boreholes penetrated into the Santa Fe Group sediments that presumably underlie this area. A discussion of the general geology at Kirtland AFB is presented in Section 2.4. As a result of leach field installation, it is probable that backfill material is present in the leach field area. Borehole logs for this area are presented in Appendix C.

8.7.3.2 Hydrogeology

Groundwater beneath this area is found within the Upper Santa Fe sediments and is generally thought to be unconfined in the upper portion of the aquifer. This area is within the HR1 saturated zone setting as defined by SNL studies (Figure 2-9) (SNL, 1994). Hydrogeologic characterization in this portion of Kirtland AFB is complicated by the presence of numerous production wells (Figure 2-11). It is probable that uniform groundwater conditions do not exist in this region. Local cones of depression associated with groundwater withdrawal have altered the groundwater flow direction in the vicinity of the well fields (Figure 2-7).

The gradient is probably north at this site. Two production wells are located in this area of Kirtland AFB: KAFB-2 is downgradient 3,500 ft west-northwest and KAFB-14 is cross-gradient 3,500 ft north (Figures 2-7 and 2-11). Depth to groundwater is estimated to be about 350 ft below grade (Figure 2-10); however, shallower perched water zones may occur. Hydraulic conductivity within HR1 is estimated at 2 to 171 ft/day (SNL, 1994). A general discussion of the hydrogeology at Kirtland AFB is presented in Section 2.5.

8.7.4 Nature and Extent of Contamination

The following section describes the extent of contamination based on sampling results. Analytical results for soil samples collected and analyzed from ST-292 are summarized in Table 8-16; only the reportable concentrations of detected analytes are listed. Full analytical results are presented in Appendix F. Laboratory validation reports are in Appendix K.

Organic Compounds

No VOC or SVOC analytes were detected in any of the soil samples submitted for analysis at ST-292.

Table 8-16. Summary of Reportable Concentrations for Soil Analyses at SWMU 10-21, Building 622, Septic Tank, Leach Field, and Lines (ST-292)[1] (Concentrations mg/kg)

Chemical Class	Analyte	HHRB Action Level[2]	UTL	Borehole Number and Sample Depth Interval (ft)			
				ST292C-01	*ST292C-02*	*ST292C-03*	*ST292C-04*
				4–6	4–6	4–6	4–6
TPH	Diesel fraction	100	10.0	ND	ND	ND	8.2
METALS	Aluminum	78,000	14,700	5,350	6,150	6,190	4,960
	Antimony	31.0	N/A	ND	0.56	ND	ND
	Arsenic	0.37	6.5	2.0	2.2	4.3	2.5
	Barium	5,500	735	75.8	269	273	118
	Beryllium	0.15	0.84	0.32	0.33	0.33	0.33
	Calcium	N/A	121,000	42,400	89,300	73,300	50,400
	Chromium, total	390	21.6	5.4	5.8	6.8	5.0
	Cobalt	4,700	15.4	3.9	2.6	3.2	2.4
	Copper	2,900	223	20.1	26.5	21.0	7.8
	Iron	N/A	23,800	6,860	7,040	6,540	5,680
	Lead	400	17.5	3.0	3.4	4.0	3.0
	Magnesium	N/A	10,400	2,120	3,050	3,590	2,740
	Manganese	390	549	80.6	80.6	83.4	79.8
	Nickel	1,600	188	3.6	3.2	3.7	3.1
	Potassium	N/A	3,590	951	927	911	775
	Sodium	N/A	787	66.1	80.6	108	88.2
	Vanadium	550	55.3	16.6	18.6	18.1	14.7
	Zinc	23,000	114	20.8	21.0	20.3	14.1
OTHER	pH			8.5	8.5	8.2	8.5
	Moisture (%)			6.8	10.1	10.0	7.7

FOOTNOTES

1	Complete laboratory analytical results and method detection limits are presented in Appendix K.
2	Action level of RCRA Proposed Rule Subpart S (55 *FR* 30814, 7/27/90).
*	TPH action level is 100 mg/kg adopted from NMED UST regulations (NMED, 1990). SW-8015 analyzes volatile and semivolatile petroleum hydrocarbon fractions separately. The total concentration of the two fractions analyzed under SW-8015 will be used to assess compliance with stipulated action levels for the purpose of this RFI.
#	Denotes TCLP analysis, results in mg/l.
--	No Data.
FR	Field Replicate.
HHRB	Human health risk based.
J	Estimated value.
N/A	Not Applicable.
NA	Not Analyzed.
ND	Not detected above the method detection limit.
pCi/g	picocuries per gram.
PQL	Practical quantitation limits (defines VOC, SVOC, and TPH).
R	Reject NDs due to interference.
RAD	Radionuclides.
RE	Resample.
SVOC	Semivolatile organic compounds.
TPH	Total petroleum hydrocarbons.
U	Accept data (positive results may be influenced by lab contamination).
UJ	Estimated nondetect.
UTL	Upper tolerance limits (defines metals).
VOC	Volatile organic compounds.

Petroleum Hydrocarbons

No gasoline range hydrocarbons were detected in any of the soil samples at ST-292. ST-292C-04 was the only soil sample with any diesel range hydrocarbons detected (8.2 mg/kg). This concentration was below the NMED action level of 100 mg/kg.

Metals

Arsenic and beryllium were the only metals detected at concentrations above the HHRB action levels in soil samples submitted for analysis from ST-292 (Table 8-16). Arsenic (2.0 to 4.3 mg/kg) was detected in all samples collected. All concentrations were above the HHRB action level of 0.37 mg/kg. Beryllium (0.32 to 0.33 mg/kg) was detected in all samples collected at ST-292 above the HHRB action level of 0.15 mg/kg. Beryllium and arsenic concentrations exceeding HHRB action levels appear to be naturally occurring throughout Kirtland AFB as discussed in Section 4.2.2.

Soil pH and Moisture

Soil pH ranged from 8.2 to 8.5 in these samples. Soil moisture values ranged from 6.8 to 10.1 percent (Table 8-16).

8.7.5 Conclusions and Recommendations

Conclusions

- No VOCs or SVOCs were detected in the soil samples submitted for analysis from this site.
- No gasoline range hydrocarbons were detected. Diesel range hydrocarbons were detected in one of the samples at this site. The concentration did not exceed the NMED action level of 100 mg/kg. The diesel range hydrocarbon concentration (8.2 mg/kg) detected in the one sample from ST-292 is similar to the concentrations detected in background samples analyzed during the Appendix III RFI and is not conclusive evidence that a release has occurred. Without the presence of other release indicators (VOCs, SVOCs, and metals), it is probable that the diesel range hydrocarbon concentration is not attributable to a release from the unit.
- Arsenic and beryllium were the only metals detected at concentrations exceeding HHRB action levels; these concentrations appear to be naturally occurring throughout Kirtland AFB.
- The analytical results at ST-292 are not indicative of a release from this site.

Recommendations

- Based on the findings of the RFI, no further action is necessary; therefore, ST-292 does not require further investigation. A No Further Action proposal should be prepared.

8.8 SWMU 10-21, Building 37570, Septic Tank, Leach Pit, and Lines (ST-293)

8.8.1 Site Background and Environmental Setting

Septic tank ST-293 is located 75 ft west of Building 37570, a research and testing facility, on the MWSA (Figure 8-9). ST-293 was investigated on March 21, 1995.

Based on engineering drawings and observed site conditions, inflow and outflow line lengths are approximately 75 ft and 20 ft, respectively. This tank discharges to a leach pit (8 ft in diameter) to the west. Potentially, the septic tank could have received contaminants from Building 37570 and due to the leach pit's design, waste from ST-293 can be expected to have entered the surrounding soil.

Building 37570 is located on the MWSA. This site is isolated from the urban/industrial environmental zone located at the foot of the Manzano Mountains on the eastern boundary of the Albuquerque-Belen Basin. No production wells exist near this site (Figure 2-11).

8.8.2 Study Area Investigation

The area of investigation was limited to the pit at ST-293. Possible source materials in the septic tank were not investigated.

8.8.2.1 Previous Investigations

No previous investigations have been performed at this site

8.8.2.2 Data Gaps

No information related to the past use of ST-293 was available for review. No data were available to determine the presence or absence of contaminants in the subsurface soil in the leach pit area.

8.8.2.3 RFI Field Investigation

The objective of this investigation was to determine if contamination is present in the subsurface soil in the seepage pit area. On February 9, 1995, three boreholes were drilled and sampled using a Geoprobe. Borehole ST-293C-01 was drilled south of the leach area to collect background concentration data for this site. This borehole was assumed to be in an area away from any known or suspected contamination. All other boreholes were drilled near the leach area. Based on engineering drawings and observed field conditions, the leach pit inflow depth was determined to be 3 ft below grade. The sample interval at each borehole extended from the depth of the leach pit to 5 ft below the leach pit. From this interval, two samples were collected: one at a depth equal to the base of the leach pit, the other from 3 ft below the base of the leach pit.

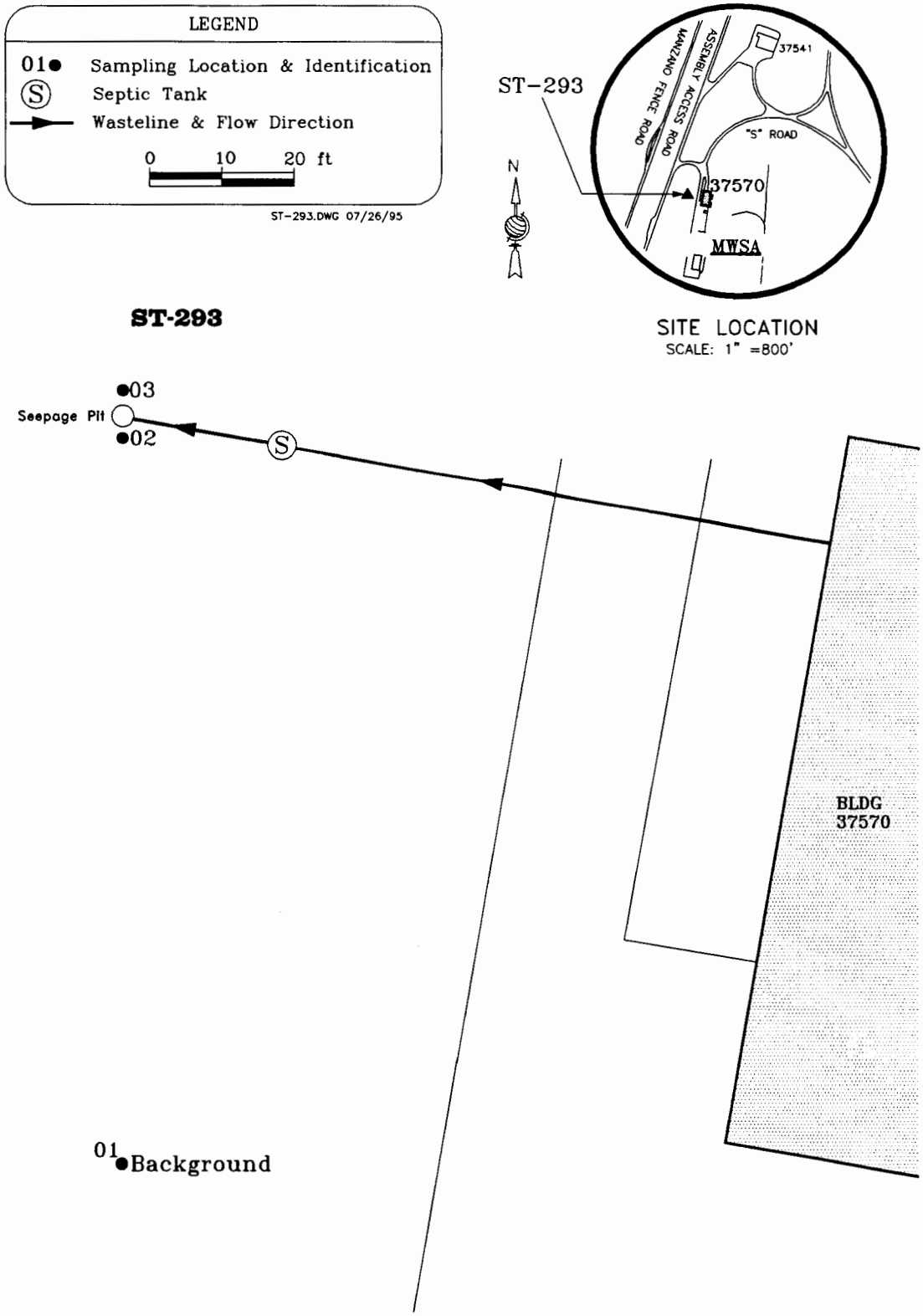


Figure 8-9. Soil Sampling Locations at SWMU 10-21, Building 37570, Septic Tank, Leach Pit, and Lines (ST-293)

Sampling operations and sample handling procedures are described in Section 3.0. Borehole locations and depths of samples that were sent to the laboratory are listed in Table 8-17. Borehole logs are in Appendix C.

Table 8-17. Boreholes and Samples Analyzed from SWMU 10-21, Building 37570, Septic Tank, Leach Pit, and Lines (ST-293)

Borehole	Borehole Location	Sample Depth (ft)
01	Background borehole	3-8[a]
02	In the leach pit area	3-5
03	In the leach pit area	6-8[b]

a. Replicate sample also collected at this depth interval.

b. Due to poor sample recovery, the second 2-ft section of the 5-ft interval was used for sample analysis.

8.8.2.4 Laboratory Analysis

Four soil samples, one replicate and three normal, were analyzed for VOCs, SVOCs, TPH as GRO and DRO, metals, mercury (the expected contaminants associated with normal operations at this building), soil pH, and soil moisture. The four brass tubes in each 2-ft sample interval were field-screened for possible contamination using a beta-gamma meter and a FID (as per health and safety requirements). No elevated readings were measured with these instruments.

8.8.3 Site Characteristics

8.8.3.1 Geology

The ST-293 area is underlain by unconsolidated alluvial sediment and weathered granite. The sediment is predominantly well-graded sand in the 3- to 5-ft zone and fine gravel with some sand in the 6- to 8-ft sample. Three 8-ft boreholes were drilled at ST-293. A discussion of the general geology at Kirtland AFB is presented in Section 2.4.

As a result of seepage pit installation, it is probable that backfill material is present in the seepage pit area. Borehole logs for this area are presented in Appendix C.

8.8.3.2 Hydrogeology

This site is in the HR2 saturated zone setting as defined by SNL studies (Figure 2-9) (SNL, 1994). HR2 straddles the Tijeras/Hubbell Springs/Sandia Fault complex. The saturated zone hydrogeology is characterized by the juxtaposition of higher permeability Santa Fe Group sediments against low permeability Paleozoic and Precambrian bedrock (Thorn *et al.*, 1993). Santa Fe Group sediments are faulted down to the west across the faults. Very little is known about groundwater flow in this region

except that a steep gradient exists across the fault zone. East of the fault zone, the static water elevation is estimated at 5,710 ft amsl.

Groundwater beneath ST-293 is estimated to be approximately 320 ft below grade (Figure 2-10). This area may serve as a recharge area for the Albuquerque basin aquifer with groundwater movement west across the fault (SNL, 1994). A general discussion of the hydrogeology at Kirtland AFB is presented in Section 2.5.

8.8.4 Nature and Extent of Contamination

The following section describes the extent of contamination based on sampling results. Analytical results for soil samples collected and analyzed from ST-293 are summarized in Table 8-18, where only the reportable concentrations of detected analytes are listed. Full analytical results are presented in Appendix F. Laboratory validation reports are in Appendix K.

Organic Compounds

No VOC analytes were detected in any of the soil samples submitted for analysis at ST-293. Bis(2-ethylhexyl)phthalate was the only SVOC analyte detected. This was present in soil sample ST-293C-01, the background borehole replicate soil sample, at a concentration below the HHRB action level of 50 mg/kg.

Petroleum Hydrocarbons

No gasoline or diesel range hydrocarbons were detected in any of the soil samples submitted for analysis at ST-293.

Metals

Arsenic, beryllium, and manganese were the only metals detected at concentrations above the HHRB action levels in the soil samples submitted for analysis from ST-293 (Table 8-18). Arsenic (0.97 to 2.2 mg/kg) was detected in three of the four samples submitted. All concentrations were above the HHRB action level of 0.37 mg/kg, but were below the 6.5 mg/kg UTL. Beryllium (0.43 to 0.54 mg/kg) was detected in all samples collected at ST-293 above the HHRB action level of 0.15 mg/kg, but below the 0.84 mg/kg UTL. Beryllium and arsenic concentrations exceeding HHRB action levels appear to be naturally occurring throughout Kirtland AFB as discussed in Section 4.2.2.

Manganese (381 to 481 mg/kg) was detected in three of the four samples above the HHRB action level of 390 mg/kg, but below the 549 mg/kg UTL. These manganese concentrations are believed to be naturally occurring and are probably related to the underlying geology, which is predominantly weathered granite.

Table 8-18. Summary of Reportable Concentrations for Soil Analyses at SWMU 10-21, Building 37570, Septic Tank, Leach Pit, and Lines (ST-293)[1] (Concentrations mg/kg)

Chemical Class	Analyte	HHRB Action Level[2]	PQL UTL	Borehole Number and Sample Depth Interval (ft)			
				ST293C-01		*ST293C-02*	*ST293C-03*
				3–8 FR	3–8	3–5	6–8
SVOC	Bis(2-ethylhexyl)phthalate	50.0	0.70	0.41	ND	ND	ND
METALS	Aluminum	78,000	14,700	8,710	10,000	9,760	9,650
	Arsenic	0.37	6.5	2.2	1.5	ND	0.97
	Barium	5,500	735	157	246	142	146
	Beryllium	0.15	0.84	0.43	0.54	0.53	0.51
	Cadmium	39.0	N/A	0.86	0.86	ND	0.91
	Calcium	N/A	121,000	17,600	45,700	14,800	15,700
	Chromium, total	390	21.6	13.4	6.5	9.3	7.9
	Cobalt	4,700	15.4	12.0	11.1	12.9	11.4
	Copper	2,900	223	53.9	22.6	21.7	26.7
	Iron	N/A	23,800	20,900	19,700	23,200	23,000
	Lead	400	17.5	9.3	8.3	10.8	8.7
	Magnesium	N/A	10,400	7,150	6,320	6,430	6,740
	Manganese	390	549	439	381	481	468
	Nickel	1,600	188	11.8	7.5	7.5	6.9
	Potassium	N/A	3,590	2,110	2,150	2,660	2,200
	Sodium	N/A	787	85.4	147	69.9	69.3
	Thallium	N/A	N/A	0.20	ND	0.22	0.16
	Vanadium	550	55.3	38.0	36.9	41.9	39.5
	Zinc	24,000	114	63.4	53.4	58.6	63.7
OTHER	pH			8.2	8.4	8.3	7.5
	Moisture (%)			6.6	7.5	5.6	1.3

FOOTNOTES

1	Complete laboratory analytical results and method detection limits are presented in Appendix K.
2	Action level of RCRA Proposed Rule Subpart S (55 *FR* 30814, 7/27/90).
*	TPH action level is 100 mg/kg adopted from NMED UST regulations (NMED, 1990). SW-8015 analyzes volatile and semivolatile petroleum hydrocarbon fractions separately. The total concentration of the two fractions analyzed under SW-8015 will be used to assess compliance with stipulated action levels for the purpose of this RFI.
#	Denotes TCLP analysis, results in mg/l.
--	No Data.
FR	Field Replicate.
HHRB	Human health risk based.
J	Estimated value.
N/A	Not Applicable.
NA	Not Analyzed.
ND	Not detected above the method detection limit.
pCi/g	picocuries per gram.
PQL	Practical quantitation limits (defines VOC, SVOC, and TPH).
R	Reject NDs due to interference.
RAD	Radionuclides.
RE	Resample.
SVOC	Semivolatile organic compounds.
TPH	Total petroleum hydrocarbons.
U	Accept data (positive results may be influenced by lab contamination).
UJ	Estimated nondetect.
UTL	Upper tolerance limits (defines metals).
VOC	Volatile organic compounds.

Soil pH and Moisture

Soil pH ranged from 7.5 to 8.4 in these samples. Soil moisture values ranged from 1.3 to 7.5 percent (Table 8-18).

8.8.5 Conclusions and Recommendations

Conclusions

- No VOCs were detected in the soil samples submitted for analysis from this site.
- One SVOC was detected in the soil samples submitted for analysis at ST-293, but below the HHRB action level.
- No diesel or gasoline range hydrocarbons were detected.
- Arsenic, beryllium, and manganese were the only metals detected at concentrations exceeding HHRB action levels. The beryllium and arsenic concentrations appear to be naturally occurring throughout Kirtland AFB; manganese concentrations appear to be naturally occurring at this site.
- The analytical results at ST-293 are not indicative of a contaminant release from this site.

Recommendations

- Based on the findings of the RFI, no further action is necessary; therefore, ST-293 does not require further investigation. A No Further Action proposal should be prepared.

8.9 SWMU 10-21, Building 633, Septic Tank, Leach Field, and Lines (ST-294)

8.9.1 Site Background and Environmental Setting

Septic tank ST-294 is located 190 ft south-southwest of Building 633, a control tower, in the northwest portion of Kirtland AFB (Figure 8-10). ST-294 was investigated on February 22, 1995.

Based on engineering drawings and observed site conditions, inflow and outflow line lengths are approximately 190 ft and 15 ft, respectively. This tank discharges to a leach field to the south with a drainage area of approximately 200 ft x 40 ft. Potentially, the septic tank could have received contaminants from Building 633 and, due to the leach field's design, waste from ST-294 can be expected to have entered the surrounding soil.

ST-294 is located in the urban/industrial zone, which is discussed in Section 2.0. The nearest production wells to this site are KAFB-2, 5,700 ft east-northeast, and KAFB-14, 4,600 ft north-northeast (Figure 2-11).

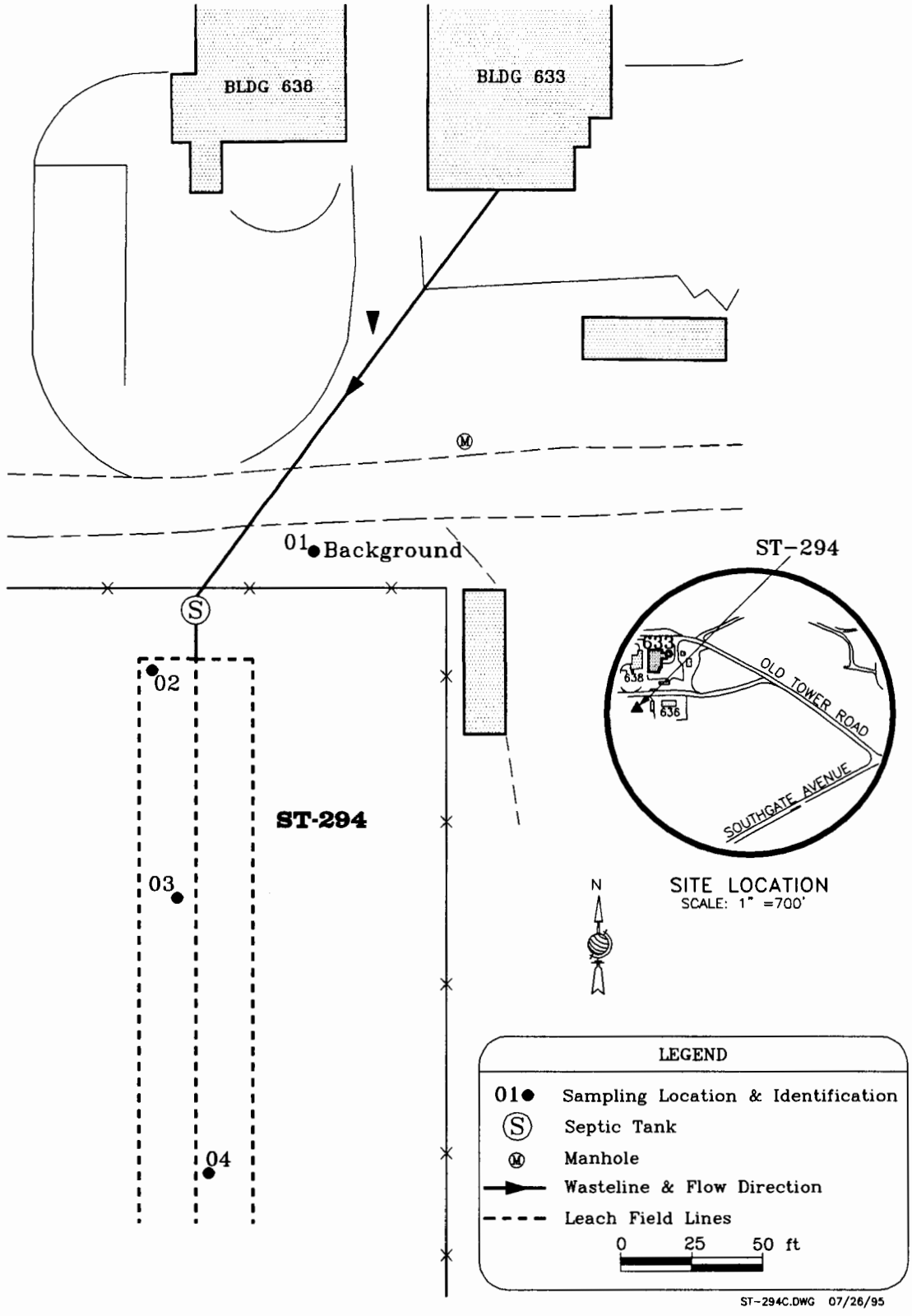


Figure 8-10. Soil Sampling Locations at SWMU 10-21, Building 633, Septic Tank, Leach Field, and Lines (ST-294)

8.9.2 Study Area Investigation

The area of investigation was limited to the leach field at ST-294. Possible source materials in the septic tank were not investigated.

8.9.2.1 Previous Investigations

No previous investigations have been performed at this site.

8.9.2.2 Data Gaps

No information on the past use of ST-294 was available for review. No data were available to determine the presence or absence of contaminants in the subsurface soil in the leach field area.

8.9.2.3 RFI Field Investigation

The objective of this investigation was to determine if contamination is present in the subsurface soil in the leach field area. On February 22, 1995, four boreholes were drilled and sampled using a Geoprobe. Borehole ST-294C-01 was drilled northeast of the leach field area to collect background concentration data for this site. This borehole was assumed to be in an area away from any known or suspected contamination. All other boreholes were drilled in the leach field area. Based on engineering drawings and observed field conditions, the leach field lines were determined to be 3 ft below grade. The sample interval at each borehole extended from the depth of the leach field line to 5 ft below the leach field line. From this interval, two samples were collected: one at a depth equal to the base of the leach field line, the other from 3 ft below the base of the leach field line.

Sampling operations and sample handling procedures are described in Section 3.0. Borehole locations and depths of samples that were sent to the laboratory are listed in Table 8-19. Borehole logs are in Appendix C.

Table 8-19. Boreholes and Samples Analyzed from SWMU 10-21, Building 633, Septic Tank, Leach Field, and Lines (ST-294)

Borehole	Borehole Location	Sample Depth (ft)
01	Background borehole	3–5
02	In the leach field area	3–5
03	In the leach field area	3–5
04	In the leach field area	3–5

8.9.2.4 Laboratory Analysis

Four soil samples were analyzed for VOCs, SVOCs, TPH as GRO and DRO, metals, mercury (the expected contaminants associated with normal operations at this building), soil pH, and soil moisture. The four brass tubes in each 2-ft sample interval were field-screened for possible contamination using a beta-gamma meter and a FID (as per health and safety requirements). No elevated readings were measured with these instruments.

8.9.3 Site Characteristics

8.9.3.1 Geology

The ST-294 area is underlain by unconsolidated alluvial sediment that is predominantly very fine-grained to fine-grained sand with some silty sand at the 3- to 5-ft sample intervals. Four 8-ft boreholes were drilled at ST-294. No boreholes penetrated into the Santa Fe Group sediments that presumably underlie this area. A discussion of the general geology at Kirtland AFB is presented in Section 2.4.

As a result of leach field installation, it is probable that backfill material (pea gravel immediately adjacent to the leach field lines) is present in the leach field area. Borehole logs for this area are presented in Appendix C.

8.9.3.2 Hydrogeology

Groundwater beneath this area is found within the Upper Santa Fe sediments and is generally thought to be unconfined in the upper portion of the aquifer. This area is within the HR1 saturated zone setting as defined by SNL studies (Figure 2-9) (SNL, 1994). Hydrogeologic characterization in this portion of Kirtland AFB is complicated by the presence of numerous production wells (Figure 2-11). It is probable that uniform groundwater conditions do not exist in this region. Local cones of depression associated with groundwater withdrawal have altered the groundwater flow direction in the vicinity of the well fields (Figure 2-7).

The gradient is probably northeast at this site. Two production wells are located in this area of Kirtland AFB: KAFB-2 is cross-gradient 5,700 ft east-northeast and KAFB-14 is downgradient 4,600 ft north-northeast (Figures 2-7 and 2-11). Depth to groundwater is estimated to be about 350 ft below grade (Figure 2-10); however, shallower perched water zones may occur. Hydraulic conductivity within HR1 is estimated at 2 to 171 ft/day (SNL, 1994). A general discussion of the hydrogeology at Kirtland AFB is presented in Section 2.5.

8.9.4 Nature and Extent of Contamination

The following section describes the extent of contamination based on sampling results. Analytical results for soil samples collected and analyzed from ST-294 are summarized in Table 8-20, only the reportable concentrations of detected analytes are listed. Full analytical results are presented in Appendix F. Laboratory validation reports are in Appendix K.

Organic Compounds

No VOC analytes were detected in any of the soil samples submitted for analysis at ST-294.

Di-n-butylphthalate was the only SVOC analyte detected in the soil samples submitted for analysis, ranging from 2.0 to 3.6 mg/kg. All concentrations were below the HHRB action level of 7,800 mg/kg.

Petroleum Hydrocarbons

No gasoline or diesel range hydrocarbons were detected in any of the soil samples at ST-294.

Metals

Arsenic and beryllium were the only metals detected at concentrations above the HHRB action levels in soil samples submitted for analysis from ST-294 (Table 8-20). Arsenic (2.6 to 6.5 mg/kg) was detected in all samples collected. All concentrations were above the HHRB action level of 0.37 mg/kg; all but the sample at ST-294C-04 were below the 6.5 mg/kg UTL. Beryllium (0.43 to 0.65 mg/kg) was detected in three of the four samples collected at ST-294 above the HHRB action level of 0.15 mg/kg, but was below the 0.84 mg/kg UTL. Beryllium and arsenic concentrations exceeding HHRB action levels appear to be naturally occurring throughout Kirtland AFB as discussed in Section 4.2.2.

Soil pH and Moisture

Soil pH ranged from 7.9 to 8.4 in these samples. Soil moisture values ranged from 3.8 to 13.1 percent (Table 8-20).

8.9.5 Conclusions and Recommendations

Conclusions

- No VOCs were detected and one SVOC was detected in the soil samples submitted for analysis from this site. All concentrations were below HHRB action levels.
- No gasoline or diesel range hydrocarbons were detected.
- Arsenic and beryllium were the only metals detected at concentrations exceeding HHRB action levels; these concentrations appear to be naturally occurring throughout Kirtland AFB.
- The analytical results at ST-294 are not indicative of a contaminant release from this site.

Recommendations

- Based on the findings of the RFI, no further action is necessary; therefore, ST-294 does not require further investigation. A No Further Action proposal should be prepared.

Table 8-20. Summary of Reportable Concentrations for Soil Analyses at SWMU 10-21, Building 633, Septic Tank, Leach Field, and Lines (ST-294)[1] (Concentrations mg/kg)

Chemical Class	Analyte	HHRB Action Level[2]	PQL UTL	Borehole Number and Sample Depth Interval (ft)			
				ST294C-01	*ST294C-02*	*ST294C-03*	*ST294C-04*
				3–5	3–5	3–5	3–5
SVOC	Di-n-butylphthalate	7,800	0.70	3.0	3.6	2.6	2.0
METALS	Aluminum	78,000	14,700	9,220	4,000	6,380	11,700
	Arsenic	0.37	6.5	3.3	2.6	3.0	6.5
	Barium	5,500	735	1,170	195	70.9	69.6
	Beryllium	0.15	0.84	0.46	ND	0.43	0.65
	Cadmium	39.0	N/A	ND	ND	0.53	ND
	Calcium	N/A	121,000	109,000	45,300	23,200	21,700
	Chromium, total	390	21.6	8.6	4.9	6.7	11.3
	Cobalt	4,700	15.4	5.1	2.1	2.7	6.5
	Copper	2,900	223	21.6	33.4	101	103
	Iron	N/A	23,800	9,230	5,190	8,340	13,800
	Lead	400	17.5	5.0	2.8	4.7	8.2
	Magnesium	N/A	10,400	5,950	2,350	3,040	4,500
	Manganese	390	549	119	55.5	111	228
	Nickel	1,600	188	3.1	ND	13.0	34.7
	Potassium	N/A	3,590	1,260	599	1,200	2,500
	Sodium	N/A	787	290	220	83.8	116
	Vanadium	550	55.3	31.8	14.8	21.8	40.2
	Zinc	23,000	114	28.9	19.3	49.1	52.9
OTHER	pH			8.4	7.9	8.0	8.2
	Moisture (%)			13.1	3.8	6.3	7.8

FOOTNOTES

1	Complete laboratory analytical results and method detection limits are presented in Appendix K.
2	Action level of RCRA Proposed Rule Subpart S (55 *FR* 30814, 7/27/90).
*	TPH action level is 100 mg/kg adopted from NMED UST regulations (NMED, 1990). SW-8015 analyzes volatile and semivolatile petroleum hydrocarbon fractions separately. The total concentration of the two fractions analyzed under SW-8015 will be used to assess compliance with stipulated action levels for the purpose of this RFI.
#	Denotes TCLP analysis, results in mg/l.
--	No Data.
FR	Field Replicate.
HHRB	Human health risk based.
J	Estimated value.
N/A	Not Applicable.
NA	Not Analyzed.
ND	Not detected above the method detection limit.
pCi/g	picocuries per gram.
PQL	Practical quantitation limits (defines VOC, SVOC, and TPH).
R	Reject NDs due to interference.
RAD	Radionuclides.
RE	Resample.
SVOC	Semivolatile organic compounds.
TPH	Total petroleum hydrocarbons.
U	Accept data (positive results may be influenced by lab contamination).
UJ	Estimated nondetect.
UTL	Upper tolerance limits (defines metals).
VOC	Volatile organic compounds.

8.10 SWMU 10-21, Building 638, Septic Tank, Leach Field, and Lines (ST-295)

8.10.1 Site Background and Environmental Setting

Septic tank ST-295 is located 160 ft south-southeast of Building 638, a fire station, in the northwest portion of Kirtland AFB (Figure 8-11). ST-295 was investigated on February 22, 1995.

Based on engineering drawings and observed site conditions, inflow and outflow line lengths are approximately 230 ft and 15 ft, respectively. This tank discharges to a leach field to the south with a drainage area of approximately 100 ft x 40 ft. Potentially, the septic tank could have received contaminants from Building 638 and due to the leach field's design, waste from ST-295 can be expected to have entered the surrounding soil.

ST-295 is located in the urban/industrial zone, which is discussed in Section 2.0. The nearest production wells to this site are KAFB-2, 5,700 ft east-northeast, and KAFB-14, 4,600 ft north-northeast (Figure 2-11).

8.10.2 Study Area Investigation

The area of investigation was limited to the leach field at ST-295. Possible source materials in the septic tank were not investigated.

8.10.2.1 Previous Investigations

No previous investigations have been performed at this site

8.10.2.2 Data Gaps

No information related to the past use of ST-295 was available for review. No data were available to determine the presence or absence of contaminants in the subsurface soil in the leach field.

8.10.2.3 RFI Field Investigation

The objective of this investigation was to determine if contamination is present in the subsurface soil in the leach field area. On February 22, 1995, four boreholes were drilled and sampled using a Geoprobe. Borehole ST-294C-01 was drilled north of the leach field area to collect background concentration data for ST-294 and ST-295 (Figure 8-10). This borehole was assumed to be in an area away from any known or suspected contamination. All other boreholes were drilled in the leach field area. Based on engineering drawings and observed field conditions, the leach field lines were determined to be 3 ft below grade. The sample interval at each borehole extended from the depth of the leach field line to 5 ft below the leach field line. From this interval, two samples were collected: one at a depth equal to the base of the leach field line, the other from 3 ft below the base of the leach field line.

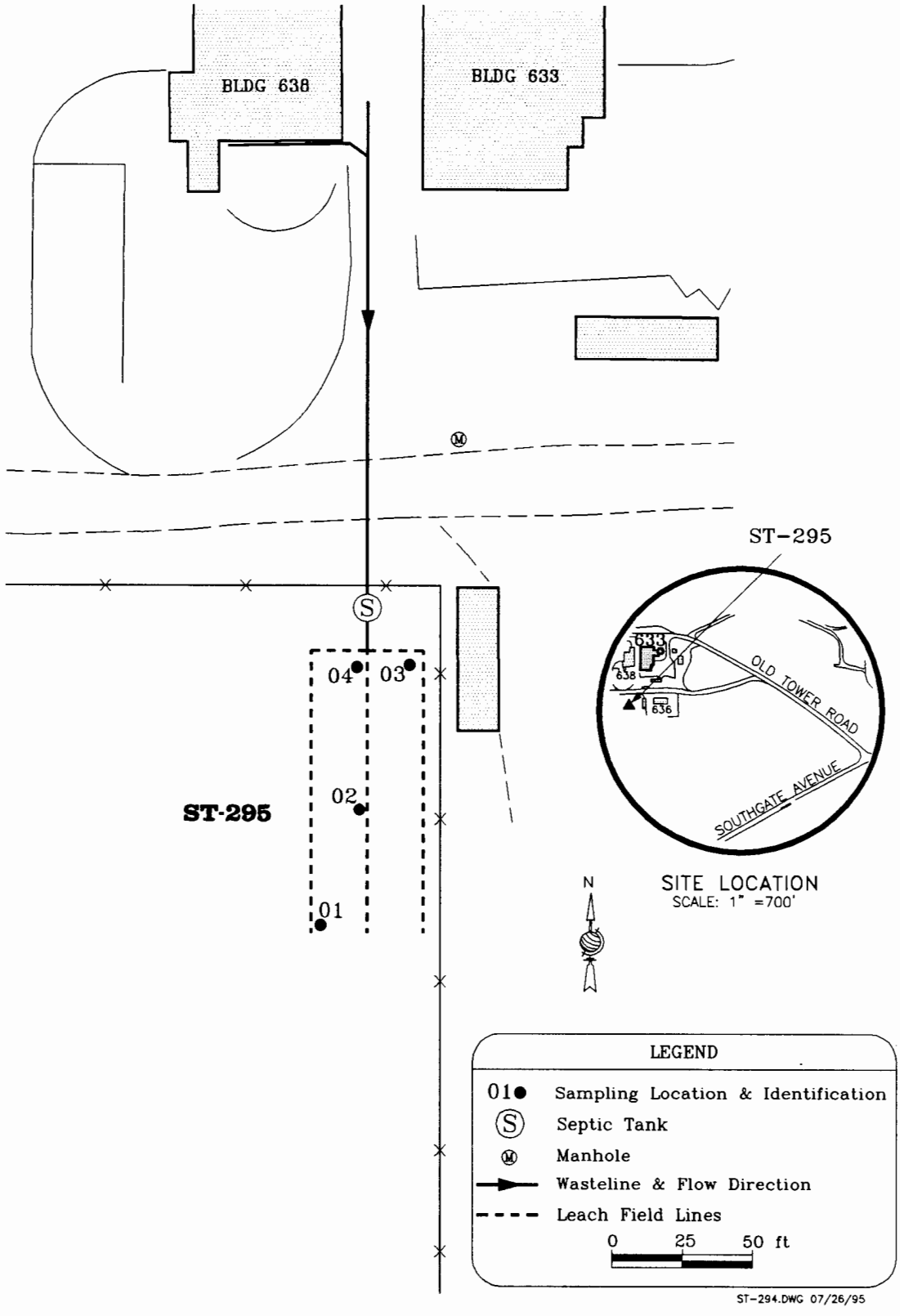


Figure 8-11. Soil Sampling Locations at SWMU 10-21, Building 638, Septic Tank, Leach Field, and Lines (ST-295)

Sampling operations and sample handling procedures are described in Section 3.0. Borehole locations and sample depths that were sent to the laboratory are listed in Table 8-21. Borehole logs are in Appendix C.

Table 8-21. Boreholes and Samples Analyzed from SWMU 10-21, Building 638, Septic Tank, Leach Field, and Lines (ST-295)

Borehole	Borehole Location	Sample Depth (ft)
01	In the leach field area	3–5
02	In the leach field area	3–5
03	In the leach field area	6–8[a]
04	In the leach field area	3–5

a. Due to poor sample recovery, the second 2-ft section from the 5-ft interval was used for analysis.

8.10.3 Site Characteristics

8.10.2.4 Laboratory Analysis

Four soil samples were analyzed for VOCs, SVOCs, TPH as DRO and GRO, metals, mercury (the expected contaminants associated with normal operations at this building), soil pH, and soil moisture. The four brass tubes in each 2-ft sample interval were field-screened for possible contamination using a beta-gamma meter and a FID (as per health and safety requirements). No elevated readings were measured with these instruments.

8.10.3.1 Geology

The ST-295 area is underlain by unconsolidated alluvial sediment that is predominantly very fine-grained to fine-grained sand with some silt. Four 8-ft boreholes were drilled at ST-295. No boreholes penetrated into the Santa Fe Group sediments that presumably underlie this area. A discussion of the general geology at Kirtland AFB is presented in Section 2.4.

As a result of leach field installation, it is probable that backfill material (pea gravel immediately adjacent to the leach field lines) is present in the leach field area. Borehole logs for this area are presented in Appendix C.

8.10.3.2 Hydrogeology

Groundwater beneath this area is found within the Upper Santa Fe sediments and is generally thought to be unconfined in the upper portion of the aquifer. This area is within the HR1 saturated zone setting as

defined by SNL studies (Figure 2-9) (SNL, 1994). Hydrogeologic characterization in this portion of Kirtland AFB is complicated by the presence of numerous production wells (Figure 2-11). It is probable that uniform groundwater conditions do not exist in this region. Local cones of depression associated with groundwater withdrawal have altered the groundwater flow direction in the vicinity of the well fields (Figure 2-7).

The gradient is probably northeast at this site. Two production wells are located in this area of Kirtland AFB: KAFB-2 is cross-gradient 5,700 ft east-northeast and KAFB-14 is downgradient 4,600 ft north-northeast (Figures 2-7 and 2-11). Depth to groundwater is estimated to be about 350 ft below grade (Figure 2-10); however, shallower perched water zones may occur. Hydraulic conductivity within HR1 is estimated at 2 to 171 ft/day (SNL, 1994). A general discussion of the hydrogeology at Kirtland AFB is presented in Section 2.5.

8.10.4 Nature and Extent of Contamination

The following section describes the extent of contamination based on sampling results. Analytical results for soil samples collected and analyzed from ST-295 are summarized in Table 8-22; only the reportable concentrations of detected analytes are listed. Full analytical results are presented in Appendix F. Laboratory validation reports are in Appendix K.

Organic Compounds

No VOC analytes were detected in any of the soil samples submitted for analysis at ST-295.

The following SVOC analytes were detected in one or more of the soil samples submitted for analysis at ST-295C-02: benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene dibenz(a,h)anthracene, and indeno(1,2,3-c,d)pyrene, all above the HHRB action level; acenaphthene, anthracene, benzo(g,h,i)perylene, chrysene, dibenzofuran, fluoranthene, fluorene, naphthalene, 2-methylnaphthalene, phenanthrene, and pyrene are below the HHRB action levels, as applicable (Table 8-22). Di-n-butylphthalate was detected in the other three soil samples below the HHRB action level of 7,800 mg/kg.

Petroleum Hydrocarbons

No gasoline range hydrocarbons were detected in any of the soil samples submitted for analysis. Diesel range hydrocarbons were detected in the 3- to 5-ft sample from borehole ST-295C-02 at a concentration of 1,100 mg/kg, above the NMED action level of 100 mg/kg (Table 8-22).

Metals

Arsenic and beryllium were the only metals detected at concentrations above the HHRB action levels in the soil samples submitted for analysis from ST-295 (Table 8-22). Arsenic (1.8 to 3.7 mg/kg) was detected in all the samples collected. Both concentrations were above the HHRB action level of 0.37 mg/kg, but were below the 6.5 mg/kg UTL. Beryllium (0.32 mg/kg) was detected in two of the four samples collected at ST-295 above the HHRB action level of 0.15 mg/kg, but concentrations were below the 0.84 mg/kg UTL. Beryllium and arsenic concentrations exceeding HHRB action levels appear to be naturally occurring throughout Kirtland AFB as discussed in Section 4.2.2.

Table 8-22. Summary of Reportable Concentrations for Soil Analyses at SWMU 10-21, Building 638, Septic Tank, Leach Field, and Lines (ST-295)[1] (Concentrations mg/kg)

Chemical Class	Analyte	HHRB Action Level[2]	PQL UTL	Borehole Number and Sample Depth Interval (ft)			
				ST295C-01	*ST295C-02*	*ST295C-03*	*ST295C-04*
				3–5	3–5	6–8	3–5
SVOC	Acenapthene	4,700	0.70	ND	24.0	ND	ND
	Anthracene	23,000	0.10	ND	24.0	ND	ND
	Benzo(a)anthracene	0.88	0.70	ND	44.0	ND	ND
	Benzo(a)pyrene	0.088	0.70	ND	41.0	ND	ND
	Benzo(b)fluoranthene	0.88	0.70	ND	46.0	ND	ND
	Benzo(g,h,i)perylene	N/A	0.70	ND	29.0	ND	ND
	Benzo(k)fluoranthene	8.8	0.70	ND	21.0	ND	ND
	Chrysene	88.0	0.70	ND	46.0	ND	ND
	Di-n-butylphthalate	7,800	0.70	1.5	ND	1.1	1.2
	Dibenz(a,h)anthracene	0.088	0.70	ND	8.2	ND	ND
	Dibenzofuran	310	0.70	ND	12.0	ND	ND
	Fluoranthane	3,100	0.005	ND	130	ND	ND
	Fluorene	3,100	0.70	ND	20.0	ND	ND
	Indeno(1,2,3-c,d)pyrene	0.88	0.70	ND	26.0	ND	ND
	2-Methylnaphthalene	N/A	0.70	ND	7,400	ND	ND
	Naphthalene	3,100	0.70	ND	18.0	ND	ND
	Phenanthrene	N/A	0.70	ND	140	ND	ND
	Pyrene	2,300	0.70	ND	110	ND	ND
TPH	Diesel fraction	100	10.0	ND	1,100	ND	ND
METALS	Aluminum	78,000	14,700	6,900	4,090	7,890	5,720
	Arsenic	0.37	6.5	2.9	1.8	2.4	3.7
	Barium	5,500	735	358	99.6	231	191
	Beryllium	0.15	0.84	0.32	ND	0.32	ND
	Calcium	N/A	121,000	60,100	30,300	75,000	191,000
	Chromium, total	390	21.6	5.4	4.3	4.6	4.2
	Cobalt	4,700	15.4	3.4	4.0	3.6	3.5
	Copper	2,900	223	59.4	24.3	51.2	24.3
	Iron	N/A	23,800	7,790	5,640	8,540	4,860
	Lead	400	17.5	3.7	13.4	3.8	2.7
	Magnesium	N/A	10,400	3,620	1,910	3,950	5,100
	Manganese	390	549	102	82.6	118	48.1
	Nickel	1,600	188	4.6	2.3	6.0	3.1
	Potassium	N/A	3,590	1,000	721	1,300	648
	Selenium	390	N/A	ND	0.48	ND	ND
	Sodium	N/A	787	139	123	338	608
	Vanadium	550	55.3	22.8	13.6	23.2	18.5
	Zinc	23,000	114	34.7	26.7	36.7	20.0
OTHER	pH			8.2	8.0	8.2	7.9
	Moisture (%)			4.9	9.0	6.7	17.2

FOOTNOTES

1	Complete laboratory analytical results and method detection limits are presented in Appendix K.
2	Action level of RCRA Proposed Rule Subpart S (55 *FR* 30814, 7/27/90).
*	TPH action level is 100 mg/kg adopted from NMED UST regulations (NMED, 1990). SW-8015 analyzes volatile and semivolatile petroleum hydrocarbon fractions separately. The total concentration of the two fractions analyzed under SW-8015 will be used to assess compliance with stipulated action levels for the purpose of this RFI.
#	Denotes TCLP analysis, results in mg/l.
--	No Data.
FR	Field Replicate.
HHRB	Human health risk based.
J	Estimated value.
N/A	Not Applicable.
NA	Not Analyzed.
ND	Not detected above the method detection limit.
pCi/g	picocuries per gram.
PQL	Practical quantitation limits (defines VOC, SVOC, and TPH).
R	Reject NDs due to interference.
RAD	Radionuclides.
RE	Resample.
SVOC	Semivolatile organic compounds.
TPH	Total petroleum hydrocarbons.
U	Accept data (positive results may be influenced by lab contamination).
UJ	Estimated nondetect.
UTL	Upper tolerance limits (defines metals).
VOC	Volatile organic compounds.

Soil pH and Moisture

Soil pH ranged from 7.9 to 8.2 in these samples. Soil moisture ranged from 4.9 to 17.2 percent (Table 8-22).

8.10.5 Conclusions and Recommendations

Conclusions

- No VOCs were detected in the soil samples submitted for analysis from this site.
- Eighteen SVOCs were detected. Six of the analytes were above the HHRB action levels.
- No gasoline range hydrocarbons were detected. Diesel range hydrocarbons were detected in one soil sample, ST-295C-02, above the NMED action level of 100 mg/kg. That concentration (1,100 mg/kg) may indicate a release at the site.
- Arsenic and beryllium were the only metals detected at concentrations exceeding HHRB action levels; these concentrations appear to be naturally occurring throughout Kirtland AFB.
- Analytical results indicate a release may have occurred at this site.

Recommendations

- Additional soil sampling should be performed at ST-295 in the vicinity of borehole ST-295C-02 to define the lateral and vertical extent of potential soil contamination.

8.11 SWMU 10-21, Building 702, Septic Tank, Leach Field, and Lines (ST-296)

8.11.1 Site Background and Environmental Setting

Septic tank ST-296 is located 200 ft east of Building 702, the administrative office for the Aircraft Engine Test Cell Facility, in the northwest portion of Kirtland AFB (Figure 8-12). ST-296 was investigated on February 23, 1995.

Based on engineering drawings and observed site conditions, inflow and outflow line lengths are estimated to be approximately 240 ft and 10 ft, respectively. This tank discharges to a leach field to the south with a drainage area of approximately 50 ft x 40 ft. Potentially, the septic tank could have received contaminants from Building 702 and, due to the leach field's design, waste from ST-296 can be expected to have entered the surrounding soil.

ST-296 is located in the urban/industrial zone, which is discussed in Section 2.0. The nearest production wells to this site are KAFB-2, 5,700 ft northeast, and KAFB-14, 5,600 ft north-northeast (Figure 2-11).

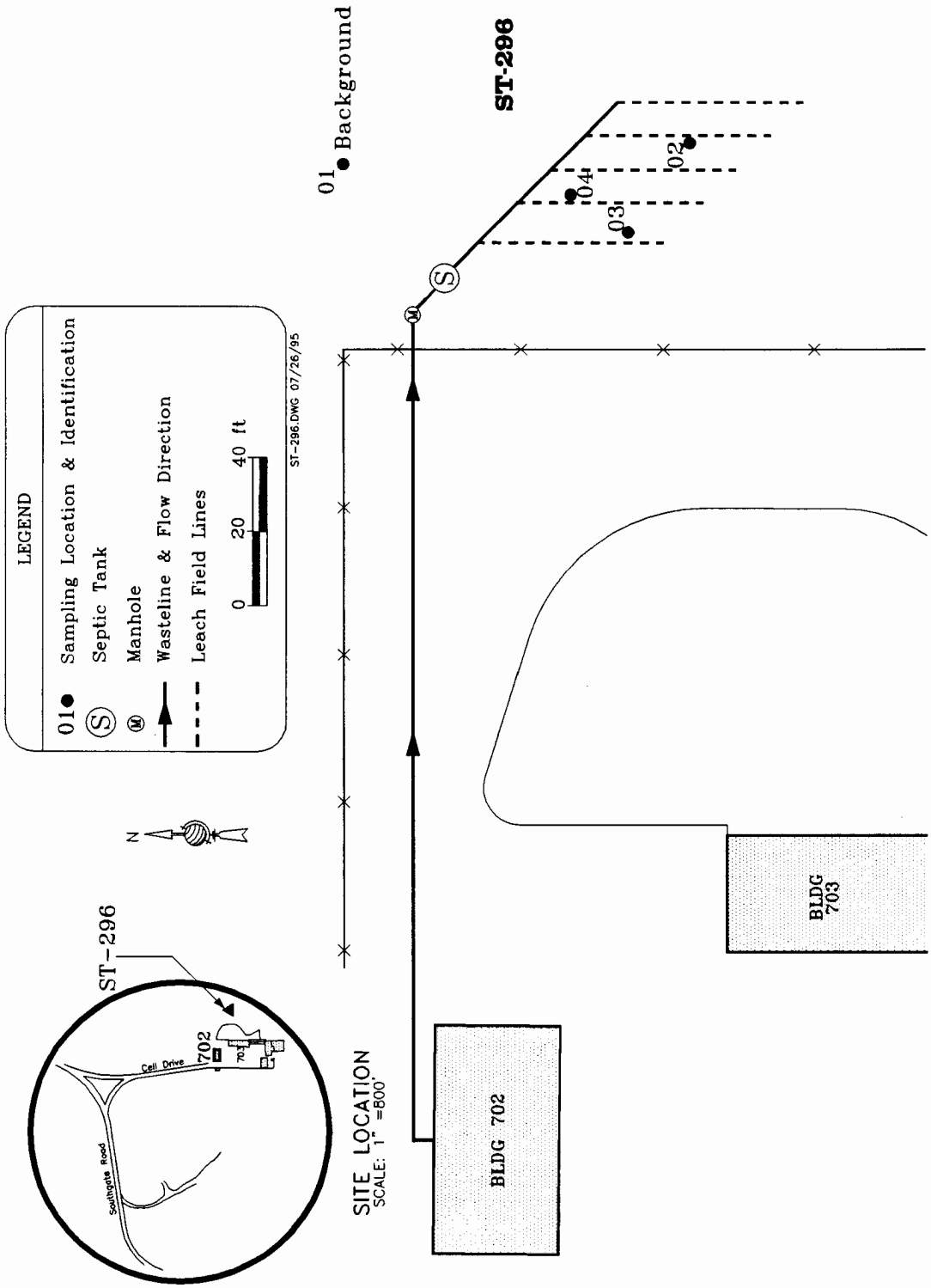


Figure 8-12. Soil Sampling Locations at SWMU 10-21, Building 702, Septic Tank, Leach Field, and Lines (ST-296)

8.11.2 Study Area Investigation

The area of investigation was limited to the leach field at ST-296. Possible source materials in the septic tank were not investigated.

8.11.2.1 Previous Investigations

No previous investigations have been performed at this site.

8.11.2.2 Data Gaps

No information related to the past use of ST-296 was available for review. No data were available to determine the presence or absence of contaminants in the subsurface soil in the leach field.

8.11.2.3 RFI Field Investigation

The objective of this investigation was to determine if contamination is present in the subsurface soil in the leach field area. On February 23, 1995, four boreholes were drilled and sampled using a Geoprobe. Borehole ST-296C-01 was drilled north of the leach field area to collect background concentration data for this site. This borehole was assumed to be in an area away from any known or suspected contamination. All other boreholes were drilled in the leach field area. Based on engineering drawings and observed field conditions, the leach field lines were determined to be 2 ft below grade. The sample interval at each borehole extended from the depth of the leach field line to 5 ft below the leach field line. From this interval, two samples were collected: one at a depth equal to the base of the leach field line, the other from 3 ft below the base of the leach field line.

Sampling operations and sample handling procedures are described in Section 3.0. Borehole locations and depths of samples that were sent to the laboratory are listed in Table 8-23. Borehole logs are in Appendix C.

Table 8-23. Boreholes and Samples Analyzed from SWMU 10-21, Building 702, Septic Tank, Leach Field, and Lines (ST-296)

Borehole	Borehole Location	Sample Depth (ft)
01	Background borehole	2–4
02	In the leach field area	2–7[a]
03	In the leach field area	2–7[b]
04	In the leach field area	2–4

a. Both 2-ft sections of the 5-ft interval were used due to the collection of an MS/MSD sample.

b. Both 2-ft sections of the 5-ft interval were used due to the collection of a replicate sample.

8.11.2.4 Laboratory Analysis

Five soil samples, one replicate and four normal, were analyzed for VOCs, SVOCs, TPH as GRO and DRO, metals, mercury (the expected contaminants associated with normal operations at this building), soil pH, and soil moisture. The four brass tubes in each 2-ft sample interval were field-screened for possible contamination using a beta-gamma meter and a FID (as per health and safety requirements). No elevated readings were measured with these instruments.

8.11.3 Site Characteristics

8.11.3.1 Geology

The ST-296 area is underlain by unconsolidated alluvial sediment that is predominantly fine-grained to coarse-grained, well-graded sand. Four 7-ft boreholes were drilled at ST-296. No boreholes penetrated into the Santa Fe Group sediments that presumably underlie this area. A discussion of the general geology at Kirtland AFB is presented in Section 2.4.

As a result of leach field installation, it is probable that backfill material is present in the leach field area. Borehole logs for this area are presented in Appendix C.

8.11.3.2 Hydrogeology

Groundwater beneath this area is found within the Upper Santa Fe sediments and is generally thought to be unconfined in the upper portion of the aquifer. This area is within the HR1 saturated zone setting as defined by SNL studies (Figure 2-9) (SNL, 1994). Hydrogeologic characterization in this portion of Kirtland AFB is complicated by the presence of numerous production wells (Figure 2-11). It is probable that uniform groundwater conditions do not exist in this region. Local cones of depression associated with groundwater withdrawal have altered the groundwater flow direction in the vicinity of the well fields (Figure 2-7).

The gradient is probably north at this site. Two production wells are located in this area of Kirtland AFB: KAFB-2 is downgradient 5,700 ft northeast and KAFB-14 is downgradient 5,600 ft north-northeast (Figures 2-7 and 2-11). Depth to groundwater is estimated to be about 350 ft below grade (Figure 2-10); however, shallower perched water zones may occur. Hydraulic conductivity within HR1 is estimated at 2 to 171 ft/day (SNL, 1994). A general discussion of the hydrogeology at Kirtland AFB is presented in Section 2.5.

8.11.4 Nature and Extent of Contamination

The following section describes the extent of contamination based on sampling results. Analytical results for soil samples collected and analyzed from ST-296 are summarized in Table 8-24; only the reportable concentrations of detected analytes are listed. Full analytical results are presented in Appendix F. Laboratory validation reports are in Appendix K.

Table 8-24. Summary of Reportable Concentrations for Soil Analyses at SWMU 10-21, Building 702, Septic Tank, Leach Field, and Lines (ST-296)[1] (Concentrations mg/kg)

Chemical Class	Analyte	HHRB Action Level[2]	PQL UTL	Borehole Number and Sample Depth Interval (ft)				
				ST296C-01	*ST296C-02*	*ST296C-03*		*ST296C-04*
				2–4	2–7	2–7 FR	2–7	2–4
SVOC	Di-n-butylphthalate	7,800	0.70	2.1	1.6	1.6	1.5	1.1
METALS	Aluminum	78,000	14,700	1,410	3,090	1,730	1,980	1,830
	Arsenic	0.37	6.5	0.58	1.1	0.71	0.96	0.99
	Barium	5,500	735	30.1	36.3	27.4	26.1	23.2
	Cadmium	39.0	N/A	ND	ND	ND	ND	0.52
	Calcium	N/A	121,000	1,160	6,570	2,370	3,670	1,230
	Chromium, total	390	21.6	1.8	3.6	2.4	1.7	1.9
	Cobalt	4,700	15.4	1.5	4.0	2.7	3.6	2.4
	Copper	2,900	223	46.3	16.4	23.9	28.4	29.5
	Iron	N/A	23,800	3,700	7,010	4,050	4,500	5,040
	Lead	400	17.5	1.8	3.4	2.5	2.4	2.1
	Magnesium	N/A	10,400	683	1,320	829	1,010	1,040
	Manganese	390	549	80.0	104	52.0	61.9	66.6
	Nickel	1,600	188	ND	2.7	ND	ND	2.2
	Potassium	N/A	3,590	269	582	283	302	365
	Sodium	N/A	787	80.6	229	195	159	119
	Vanadium	550	55.3	7.0	15.4	8.2	8.5	9.3
	Zinc	23,000	114	24.7	20.7	20.6	22.3	21.1
OTHER	pH			7.6	7.8	8.2	8.0	7.9
	Moisture (%)			2.9	3.8	4.6	6.1	3.5

FOOTNOTES

1	Complete laboratory analytical results and method detection limits are presented in Appendix K.
2	Action level of RCRA Proposed Rule Subpart S (55 *FR* 30814, 7/27/90).
*	TPH action level is 100 mg/kg adopted from NMED UST regulations (NMED, 1990). SW-8015 analyzes volatile and semivolatile petroleum hydrocarbon fractions separately. The total concentration of the two fractions analyzed under SW-8015 will be used to assess compliance with stipulated action levels for the purpose of this RFI.
#	Denotes TCLP analysis, results in mg/l.
--	No Data.
FR	Field Replicate.
HHRB	Human health risk based.
J	Estimated value.
N/A	Not Applicable.
NA	Not Analyzed.
ND	Not detected above the method detection limit.
pCi/g	picocuries per gram.
PQL	Practical quantitation limits (defines VOC, SVOC, and TPH).
R	Reject NDs due to interference.
RAD	Radionuclides.
RE	Resample.
SVOC	Semivolatile organic compounds.
TPH	Total petroleum hydrocarbons.
U	Accept data (positive results may be influenced by lab contamination).
UJ	Estimated nondetect.
UTL	Upper tolerance limits (defines metals).
VOC	Volatile organic compounds.

Organic Compounds

No VOC analytes were detected in any of the soil samples submitted for analysis at ST-296.

Di-n-butylphthalate was the only SVOC analyte detected in the soil samples submitted for analysis, ranging from 1.1 to 2.1 mg/kg. All concentrations were below the HHRB action level of 7,800 mg/kg.

Petroleum Hydrocarbons

No gasoline or diesel range hydrocarbons were detected in any of the soil samples at ST-296.

Metals

Arsenic (0.58 to 1.1 mg/kg) was the only metal detected in soil samples submitted for analysis at a concentration above the HHRB action level of 0.37 mg/kg (Table 8-24), but was below the 6.5 mg/kg UTL. These concentrations appear to be naturally occurring throughout Kirtland AFB as discussed in Section 4.2.2.

Soil pH and Moisture

Soil pH ranged from 7.6 to 8.2 in these samples. Soil moisture values ranged from 2.9 to 6.1 percent (Table 8-24).

8.11.5 Conclusions and Recommendations

Conclusions

- No VOCs were detected and one SVOC was detected in the soil samples submitted for analysis from this site. All concentrations were below HHRB action levels.
- No gasoline or diesel range hydrocarbons were detected.
- Arsenic was the only metal detected at a concentration exceeding the HHRB action level; these concentrations appear to be naturally occurring throughout Kirtland AFB.
- The analytical results at ST-296 are not indicative of a contaminant release from this site.

Recommendations

- Based on the findings of the RFI, no further action is necessary; therefore, ST-296 does not require further investigation. A No Further Action proposal should be prepared.

8.12 SWMU 10-21, Building 707, Septic Tank, Leach Field, and Lines (ST-297)

8.12.1 Site Background and Environmental Setting

Septic tank ST-297 is located 65 ft southwest of Building 707, a small-arms indoor firing range, in the northwest portion of Kirtland AFB (Figure 8-13). ST-297 was investigated on February 23, 1995.

Based on engineering drawings and observed site conditions, inflow and outflow line lengths are estimated to be approximately 65 ft and 75 ft, respectively. This tank discharges to a leach field to the south with a drainage area of approximately 50 ft x 30 ft. Potentially, the septic tank could have received contaminants from Building 707 and, due to the leach field's design, waste from ST-297 can be expected to have entered the surrounding soil.

ST-297 is located in the urban/industrial environmental zone, which is discussed in Section 2.0. The nearest production wells to this site are KAFB-2, 5,200 ft northeast, and KAFB-14, 5,100 ft north (Figure 2-11).

8.12.2 Study Area Investigation

The area of investigation was limited to the leach field at ST-297. Possible source materials in the septic tank were not investigated.

8.12.2.1 Previous Investigations

No previous investigations have been performed at this site.

8.12.2.2 Data Gaps

No information related to the past use of ST-297 was available. No data were available to determine the presence or absence of contaminants in the subsurface soil in the leach field.

8.12.2.3 RFI Field Investigation

The objective of this investigation was to determine if contamination is present in the subsurface soil in the leach field area. On February 23, 1995, four boreholes were drilled and sampled using a Geoprobe. Borehole ST-297C-01 was drilled north of the leach field area to collect background concentration data for this site. This borehole was assumed to be in an area away from any known or suspected contamination. All other boreholes were drilled in the leach field area. Based on engineering drawings and observed field conditions, the leach field lines were determined to be 3 ft below grade. The sample interval at each borehole extended from the depth of the leach field line to 5 ft below the leach field line. From this interval, two samples were collected: one at a depth equal to the base of the leach field line, the other from 3 ft below the base of the leach field line.

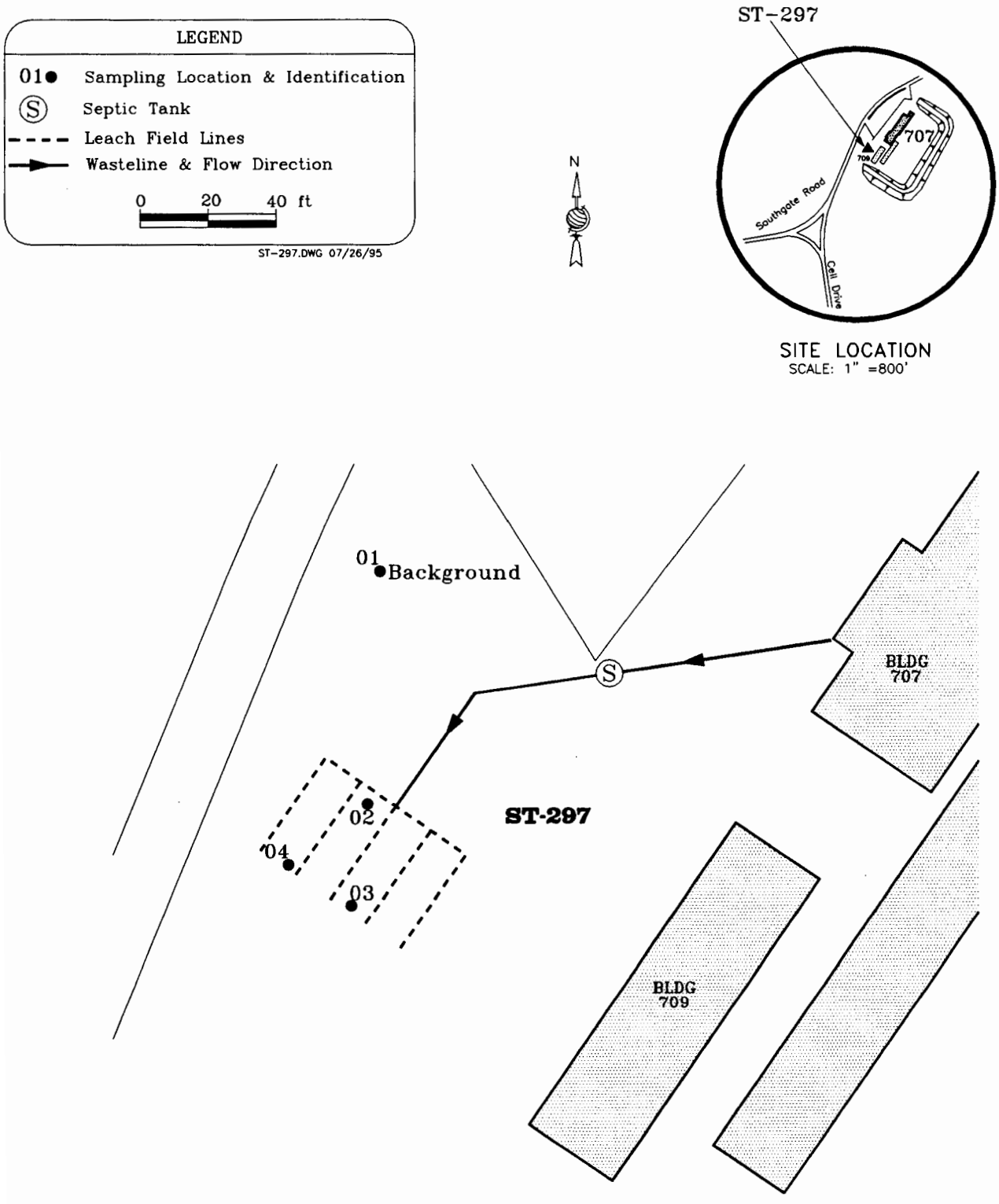


Figure 8-13. Soil Sampling Locations at SWMU 10-21, Building 707, Septic Tank, Leach Field, and Lines (ST-297)

Sampling operations and sampling handling procedures are described in Section 3.0. Borehole locations and sample depths that were sent to the laboratory are listed in Table 8-25. Borehole logs are in Appendix C.

Table 8-25. Boreholes and Samples Analyzed from SWMU 10-21, Building 707, Septic Tank, Leach Field, and Lines (ST-297)

Borehole	Borehole Location	Sample Depth (ft)
01	Background borehole	3–5
02	In the leach field area	3–5
03	In the leach field area	3–5
04	In the leach field area	3–5

8.12.2.4 Laboratory Analysis

Four soil samples were analyzed for VOCs, SVOCs, TPH as GRO and DRO, metals, mercury (the expected contaminants associated with normal operations at this building), soil pH, and soil moisture. The four brass tubes in each 2-ft sample interval were field-screened for possible contamination using a beta-gamma meter and a FID (as per health and safety requirements). No elevated readings were measured with these instruments.

8.12.3 Site Characteristics

8.12.3.1 Geology

The ST-297 area is underlain by unconsolidated alluvial sediment that is predominantly fine-grained to very coarse-grained well-graded sand. Four 8-ft boreholes were drilled at ST-297. No boreholes penetrated into the Santa Fe Group sediments that presumably underlie this area. A discussion of the general geology at Kirtland AFB is presented in Section 2.4.

As a result of leach field installation, it is probable that backfill material is present in the leach field area. Borehole logs for this area are presented in Appendix C.

8.12.3.2 Hydrogeology

Groundwater beneath this area is found within the Upper Santa Fe sediments and is generally thought to be unconfined in the upper portion of the aquifer. This area is within the HR1 saturated zone setting as defined by SNL studies (Figure 2-9) (SNL, 1994). Hydrogeologic characterization in this portion of Kirtland AFB is complicated by the presence of numerous production wells (Figure 2-11). It is probable that uniform groundwater conditions do not exist in this region. Local cones of depression associated

with groundwater withdrawal have altered the groundwater flow direction in the vicinity of the well fields (Figure 2-7).

The gradient is probably north at this site. Two production wells are located in this area of Kirtland AFB: KAFB-2 is downgradient 5,200 ft northeast and KAFB-14 is downgradient 5,100 ft north (Figures 2-7 and 2-11). Depth to groundwater is estimated to be about 350 ft below grade (Figure 2-10); however, shallower perched water zones may occur. Hydraulic conductivity within HR1 is estimated at 2 to 171 ft/day (SNL, 1994). A general discussion of the hydrogeology at Kirtland AFB is presented in Section 2.5.

8.12.4 Nature and Extent of Contamination

The following section describes the extent of contamination based on sampling results. Analytical results for soil samples collected and analyzed from ST-297 are summarized in Table 8-26, where only the reportable concentrations of detected analytes are listed. Full analytical results are presented in Appendix F. Laboratory validation reports are in Appendix K.

Organic Compounds

No VOC analytes were detected in any of the soil samples submitted for analysis at ST-297.

Di-n-butylphthalate was the only SVOC analyte detected in two of the four soil samples. From 3 to 5 ft, both ST-297C-01 and ST-297C-02 showed concentrations of 0.86 and 0.57 mg/kg. Both concentrations were below the HHRB action level of 7,800 mg/kg.

Petroleum Hydrocarbons

No gasoline or diesel range hydrocarbons were detected in any of the soil samples submitted for analysis at ST-297.

Metals

Arsenic (0.68 to 1.6 mg/kg) was the only metal detected in all soil samples submitted for analysis at a concentration above the HHRB action level of 0.37 mg/kg (Table 8-26), but was below the 6.5 mg/kg UTL. These concentrations appear to be naturally occurring throughout Kirtland AFB as discussed in Section 4.2.2.

Soil pH and Moisture

Soil pH ranged from 7.1 to 7.5 in these samples. Soil moisture values ranged from 1.8 to 6.3 percent (Table 8-26).

Table 8-26. Summary of Reportable Concentrations for Soil Analyses at SWMU 10-21, Building 707, Septic Tank, Leach Field, and Lines (ST-297)[1] (Concentrations mg/kg)

Chemical Class	Analyte	HHRB Action Level[2]	PQL UTL	Borehole Number and Sample Depth Interval (ft)			
				ST297C-01 3–5	*ST297C-02* 3–5	*ST297C-03* 3–5	*ST297C-04* 3–5
SVOC	Di-n-butylphthalate	7,800	0.70	0.86	0.57	ND	ND
METALS	Aluminum	78,000	14,700	2,750	1,050	1,600	1,060
	Arsenic	0.37	6.5	1.5	1.4	1.6	0.68
	Barium	5,500	735	58.8	35.8	75.2	30.6
	Calcium	N/A	121,000	1,200	2,160	3,310	2,300
	Chromium, total	390	21.6	2.9	2.5	1.7	1.7
	Cobalt	4,700	15.4	2.9	2.4	3.9	3.6
	Copper	2,900	223	35.8	97.2	39.9	20.6
	Iron	N/A	23,800	6,520	4,000	5,450	5,250
	Lead	400	17.5	3.2	3.7	1.8	2.1
	Magnesium	N/A	10,400	1,130	592	1,000	576
	Manganese	390	549	72.6	129	223	154
	Nickel	1,600	188	2.2	ND	3.0	ND
	Potassium	N/A	3,590	401	216	337	177
	Sodium	N/A	787	267	71.3	149	44.0
	Vanadium	550	55.3	13.0	7.5	10.3	12.1
	Zinc	23,000	114	25.1	37.3	24.4	18.8
OTHER	pH			7.4	7.5	7.1	7.5
	Moisture (%)			6.3	2.6	1.8	2.4

FOOTNOTES

1	Complete laboratory analytical results and method detection limits are presented in Appendix K.
2	Action level of RCRA Proposed Rule Subpart S (55 *FR* 30814, 7/27/90).
*	TPH action level is 100 mg/kg adopted from NMED UST regulations (NMED, 1990). SW-8015 analyzes volatile and semivolatile petroleum hydrocarbon fractions separately. The total concentration of the two fractions analyzed under SW-8015 will be used to assess compliance with stipulated action levels for the purpose of this RFI.
#	Denotes TCLP analysis, results in mg/l.
--	No Data.
FR	Field Replicate.
HHRB	Human health risk based.
J	Estimated value.
N/A	Not Applicable.
NA	Not Analyzed.
ND	Not detected above the method detection limit.
pCi/g	picocuries per gram.
PQL	Practical quantitation limits (defines VOC, SVOC, and TPH).
R	Reject NDs due to interference.
RAD	Radionuclides.
RE	Resample.
SVOC	Semivolatile organic compounds.
TPH	Total petroleum hydrocarbons.
U	Accept data (positive results may be influenced by lab contamination).
UJ	Estimated nondetect.
UTL	Upper tolerance limits (defines metals).
VOC	Volatile organic compounds.

8.12.5 Conclusions and Recommendations

Conclusions

- No VOCs were detected and one SVOC was detected in the soil samples submitted for analysis from this site. All concentrations were below HHRB action levels.
- No gasoline or diesel range hydrocarbons were detected.
- Arsenic was the only metal detected at a concentration exceeding the HHRB action level; these concentrations appear to be naturally occurring throughout Kirtland AFB.
- The analytical results at ST-297 are not indicative of a contaminant release from this site.

Recommendations

- Based on the findings of the RFI, no further action is necessary; therefore, ST-297 does not require further investigation. A No Further Action proposal should be prepared.

8.13 SWMU 10-21, Buildings 730/734, Septic Tank, Leach Field, and Lines (ST-298)

8.13.1 Site Background and Environmental Setting

Septic tank ST-298 is located 100 ft south-southeast of Building 734, an electrical and research testing facility, in the northwest portion of Kirtland AFB (Figure 8-14). ST-298 was investigated on March 8, 1995.

Based on engineering drawings and observed site conditions, inflow and outflow line lengths are approximately 310 ft and 20 ft, respectively. This tank discharges to a leach field to the southwest with a drainage area of approximately 50 ft x 50 ft. Potentially, the septic tank could have received contaminants from Building 730 and Building 734 and, due to the leach field's design, waste from ST-298 can be expected to have entered the surrounding soil.

ST-298 is located in the urban/industrial zone, which is discussed in Section 2.0. The nearest production well to this site is KAFB-14, 8,500 ft north-northeast (Figure 2-11).

8.13.2 Study Area Investigation

The area of investigation was limited to the leach field at ST-298. Possible source materials in the septic tank were not investigated.

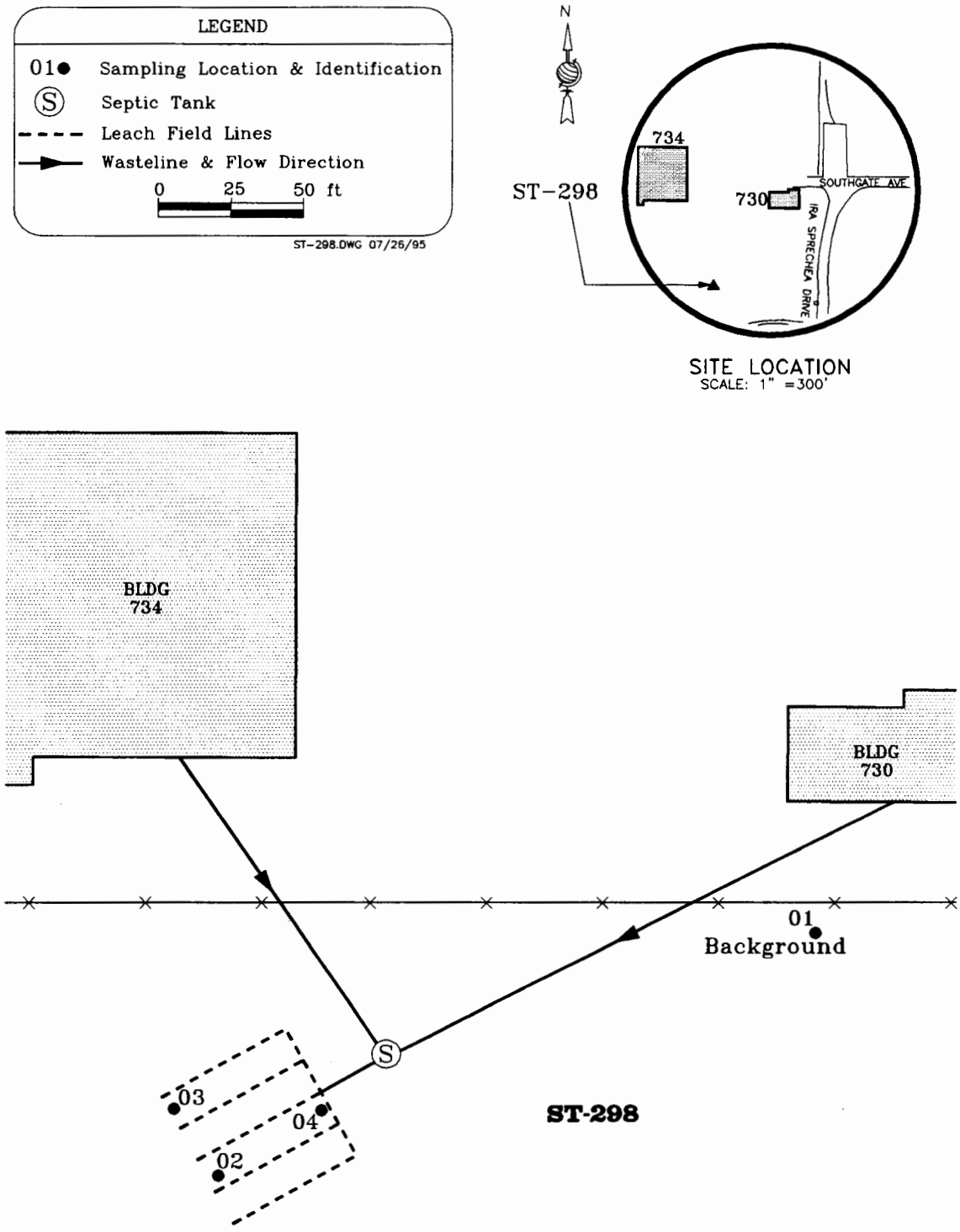


Figure 8-14. Soil Sampling Locations at SWMU 10-21, Building 730/734, Septic Tank, Leach Field, and Lines (ST-298)

8.13.2.1 Previous Investigations

No previous investigations have been performed at this site.

8.13.2.2 Data Gaps

No information related to the past use of ST-298 was available for review. No data were available to determine the presence or absence of contaminants in the subsurface soil in the leach field.

8.13.2.3 RFI Field Investigation

The objective of this investigation was to determine if contamination is present in the subsurface soil in the leach field area. On March 8, 1995, four boreholes were drilled and sampled using a Geoprobe. Borehole ST-298C-01 was drilled northeast of the leach field area to collect background concentration data for this site. This borehole was assumed to be in an area away from any known or suspected contamination. All other boreholes were drilled in the leach field area. Based on engineering drawings and observed field conditions, the leach field lines were determined to be 3 ft below grade. The sample interval at each borehole extended from the depth of the leach field line to 5 ft below the leach field line. From this interval, two samples were collected: one at a depth equal to the base of the leach field line, the other from 3 ft below the base of the leach field line.

Sampling operations and sample handling procedures are described in Section 3.0 . Borehole locations and depths of samples that were sent to the laboratory are listed in Table 8-27. Borehole logs are in Appendix C.

Table 8-27. Boreholes and Samples Analyzed from SWMU 10-21, Buildings 730/734, Septic Tank, Leach Field, and Lines (ST-298)

Borehole	Borehole Location	Sample Depth (ft)	FID (ppm_v)
01	Background borehole	3–5	0
02	In the leach field area	3–5	0
03	In the leach field area	3–5	0
04	In the leach field area	6–8[a]	2

FID readings are values above background values recorded in ppm_v (parts-per-million volume(ml/L) as methane).

a. The lower 2-ft section of the 5-ft interval was used due to the higher FID detections.

8.13.2.4 Laboratory Analysis

Four soil samples were analyzed for VOCs, SVOCs, TPH as GRO and DRO, metals, mercury (the expected contaminants associated with normal operations at this building), soil pH, and soil moisture. The four brass tubes in each 2-ft sample interval were field-screened for possible contamination using a

beta-gamma meter and a FID (as per health and safety requirements). Elevated FID readings were measured in samples collected for laboratory analysis at ST-298C-04. The brass tube with the highest FID reading measured in the sample interval was submitted for VOC analysis. The highest reading measured for the sample interval is listed in Table 8-27.

8.13.3 Site Characteristics

8.13.3.1 Geology

The ST-298 area is underlain by unconsolidated alluvial sediment that is predominantly fine-grained to very coarse well-graded sand with some fine gravel. Four 8-ft boreholes were drilled at ST-298. No boreholes penetrated into the Santa Fe Group sediments that presumably underlie this area. A discussion of the general geology at Kirtland AFB is presented in Section 2.4.

As a result of leach field installation, it is probable that backfill material is present in the leach field area. Borehole logs for this area are presented in Appendix C.

8.13.3.2 Hydrogeology

Groundwater beneath this area is found within the Upper Santa Fe sediments and is generally thought to be unconfined in the upper portion of the aquifer. This area is within the HR1 saturated zone setting as defined by SNL studies (Figure 2-9) (SNL, 1994). Hydrogeologic characterization in this portion of Kirtland AFB is complicated by the presence of numerous production wells (Figure 2-11). It is probable that uniform groundwater conditions do not exist in this region. Local cones of depression associated with groundwater withdrawal have altered the groundwater flow direction in the vicinity of the well fields (Figure 2-7).

The gradient is probably north at this site. One production well is located in this area of Kirtland AFB: KAFB-14 is downgradient 8,500 ft north-northeast (Figures 2-7 and 2-11). Depth to groundwater is estimated to be about 350 ft below grade (Figure 2-10); however, shallower perched water zones may occur. Hydraulic conductivity within HR1 is estimated at 2 to 171 ft/day (SNL, 1994). A general discussion of the hydrogeology at Kirtland AFB is presented in Section 2.5.

8.13.4 Nature and Extent of Contamination

The following section describes the extent of contamination based on sampling results. Analytical results for soil samples collected and analyzed from ST-298 are summarized in Table 8-28; only the reportable concentrations of detected analytes are listed. Full analytical results are presented in Appendix F. Laboratory validation reports are in Appendix K.

Organic Compounds

No VOC analytes were detected in any of the soil samples submitted for analysis at ST-298.

Di-n-butylphthalate was the only SVOC analyte detected in one of the four soil samples. ST-298C-01, background sample submitted for analysis, from 3 to 5 ft, had a concentration of 0.63 mg/kg. This concentration was below the HHRB action level of 7,800 mg/kg.

Table 8-28. Summary of Reportable Concentrations for Soil Analyses at SWMU 10-21, Building 730/734, Septic Tank, Leach Field, and Lines (ST-298)[1] (Concentrations mg/kg)

Chemical Class	Analyte	HHRB Action Level[2]	PQL UTL	Borehole Number and Sample Depth Interval (ft)			
				ST298C-01 3–5	*ST298C-02* 3–5	*ST298C-03* 3–5	*ST298C-04* 6–8
SVOC	Di-n-butylphthalate	7,800	0.70	0.63	ND	ND	ND
METALS	Aluminum	78,000	14,700	2,770	1,810	1,710	1,510
	Arsenic	0.37	6.5	0.65	0.52	0.70	0.50
	Barium	5,500	735	40.6	33.1	35.2	22.5
	Calcium	N/A	121,000	842	1,150	1,130	551
	Chromium, total	390	21.6	2.8	3.4	2.4	2.1
	Cobalt	4,700	15.4	2.9	1.9	1.9	1.6
	Copper	2,900	223	48.5	313	61.3	64.9
	Iron	N/A	23,800	4,880	3,040	3,520	2,820
	Lead	400	17.5	3.4	2.4	2.5	2.5
	Magnesium	N/A	10,400	1,160	736	838	524
	Manganese	390	549	84.8	43.2	46.6	36.0
	Nickel	1,600	188	2.8	ND	ND	ND
	Potassium	N/A	3,590	465	288	287	305
	Sodium	N/A	787	312	166	138	85.3
	Vanadium	550	55.3	8.3	6.3	9.5	5.1
	Zinc	23,000	114	29.6	110	31.5	33.7
OTHER	pH			8.4	8.2	8.1	5.2
	Moisture (%)			10.9	5.1	3.2	5.4

FOOTNOTES

1	Complete laboratory analytical results and method detection limits are presented in Appendix K.
2	Action level of RCRA Proposed Rule Subpart S (55 *FR* 30814, 7/27/90).
*	TPH action level is 100 mg/kg adopted from NMED UST regulations (NMED, 1990). SW-8015 analyzes volatile and semivolatile petroleum hydrocarbon fractions separately. The total concentration of the two fractions analyzed under SW-8015 will be used to assess compliance with stipulated action levels for the purpose of this RFI.
#	Denotes TCLP analysis, results in mg/l.
--	No Data.
FR	Field Replicate.
HHRB	Human health risk based.
J	Estimated value.
N/A	Not Applicable.
NA	Not Analyzed.
ND	Not detected above the method detection limit.
pCi/g	picocuries per gram.
PQL	Practical quantitation limits (defines VOC, SVOC, and TPH).
R	Reject NDs due to interference.
RAD	Radionuclides.
RE	Resample.
SVOC	Semivolatile organic compounds.
TPH	Total petroleum hydrocarbons.
U	Accept data (positive results may be influenced by lab contamination).
UJ	Estimated nondetect.
UTL	Upper tolerance limits (defines metals).
VOC	Volatile organic compounds.

Petroleum Hydrocarbons

No gasoline or diesel range hydrocarbons were detected in any of the soil samples submitted for analysis at ST-298.

Metals

Arsenic (0.50 to 0.70 mg/kg) was the only metal detected in all soil samples submitted for analysis at a concentration above the HHRB action level of 0.37 mg/kg (Table 8-28), but was below the 6.5 mg/kg UTL. The concentrations appear to be naturally occurring throughout Kirtland AFB as discussed in Section 4.2.2.

Soil pH and Moisture

Soil pH ranged from 5.2 to 8.4 in these samples. Soil moisture values ranged from 3.2 to 10.9 percent (Table 8-28).

8.13.5 Conclusions and Recommendations

Conclusions

- No VOCs were detected and one SVOC was detected in the soil samples submitted for analysis from this site. All concentrations were below HHRB action levels.
- No gasoline or diesel range hydrocarbons were detected.
- Arsenic was the only metal detected at a concentration exceeding the HHRB action level; these concentrations appear to be naturally occurring throughout Kirtland AFB.
- The analytical results at ST-298 are not indicative of a contaminant release from this site.

Recommendations

- Based on the findings of the RFI, no further action is necessary; therefore, ST-298 does not require further investigation. A No Further Action proposal should be prepared.

8.14 SWMU 10-21, Building 751, Septic Tank, Leach Field, and Lines (ST-299)

8.14.1 Site Background and Environmental Setting

Septic tank ST-299 is located 400 ft southwest of Building 751, the Ammunition Storage Facility, in the northwest portion of Kirtland AFB (Figure 8-15). ST-299 was investigated on February 21, 1995.

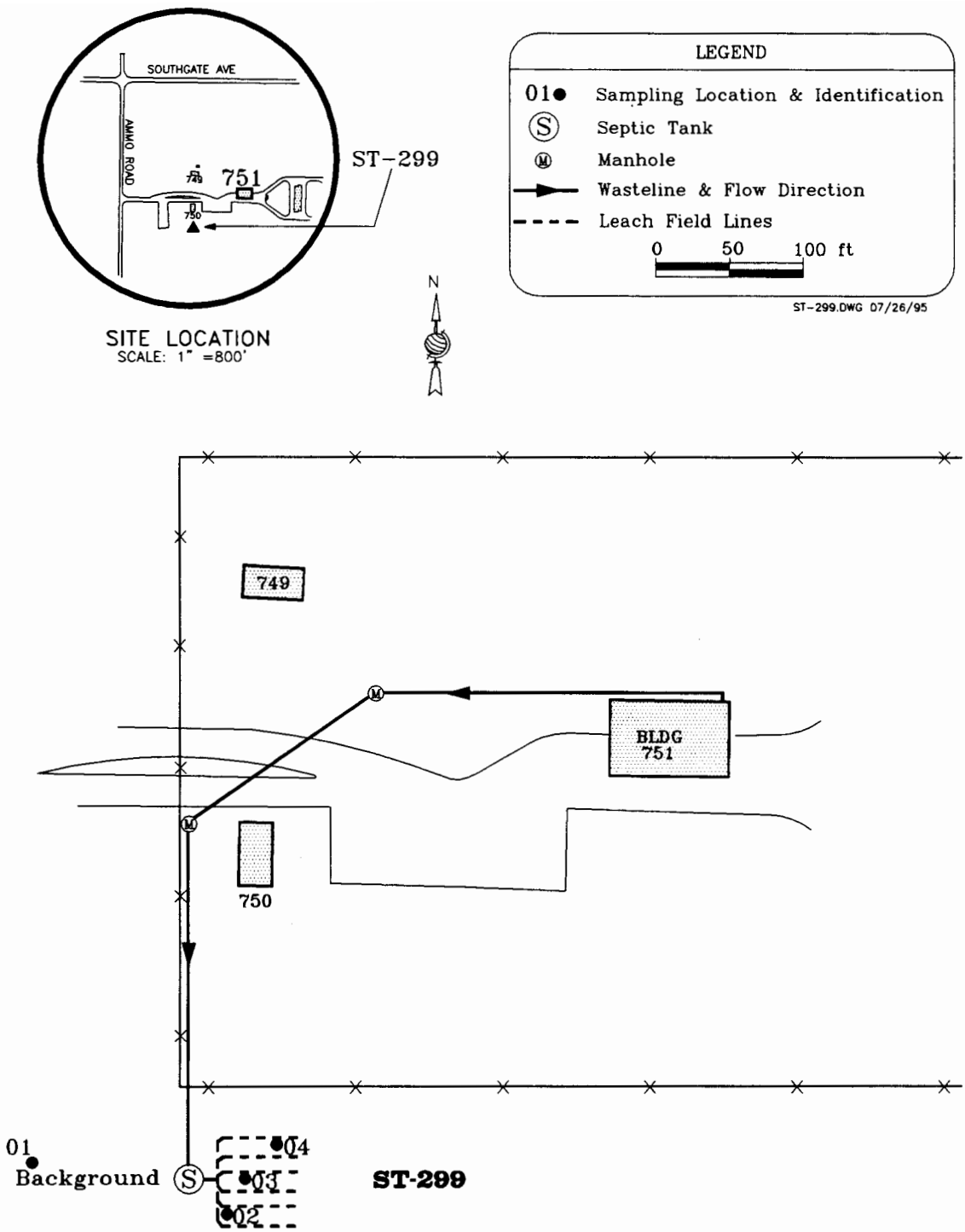


Figure 8-15. Soil Sampling Locations at SWMU 10-21, Building 751, Septic Tank, Leach Field, and Lines (ST-299)

Based on engineering drawings and observed site conditions, inflow and outflow line lengths are estimated to be approximately 650 ft and 15 ft, respectively. This tank discharges to a leach field to the east with a drainage area of approximately 50 ft x 60 ft. Potentially, the septic tank could have received contaminants from Building 751 and, due to the leach field's design, waste from ST-299 can be expected to have entered the surrounding soil.

ST-299 is located in the urban/industrial zone, which is discussed in Section 2.0. The nearest production wells to this site are KAFB-2, 1,000 ft northwest, and KAFB-7, 3,650 ft east-northeast (Figure 2-11).

8.14.2 Study Area Investigation

The area of investigation was limited to the leach field at ST-299. Possible source materials in the septic tank were not investigated.

8.14.2.1 Previous Investigations

No previous investigations have been performed at this site.

8.14.2.2 Data Gaps

No information related to the past use of ST-299 was available for review. No data were available to determine the presence or absence of contaminants in the subsurface soil in the leach field.

8.14.2.3 RFI Field Investigation

The objective of this investigation was to determine if contamination is present in the subsurface soil in the leach field area. On February 22, 1995, four boreholes were drilled and sampled using a Geoprobe. Borehole ST-299C-01 was drilled west of the leach field area to collect background concentration data for this site. This borehole was assumed to be in an area away from any known or suspected contamination. All other boreholes were drilled in the leach field area. Based on engineering drawings and observed field conditions, the leach field lines were determined to be 3 ft below grade. The sample interval at each borehole extended from the depth of the leach field line to 5 ft below the leach field line. From this interval, two samples were collected: one at a depth equal to the base of the leach field line, the other from 3 ft below the base of the leach field line.

Sampling operations and sample handling procedures are described in Section 3.0. Borehole locations and depths of samples that were sent to the laboratory are listed in Table 8-29. Borehole logs are in Appendix C.

Table 8-29. Boreholes and Samples Analyzed from SWMU 10-21, Building 751, Septic Tank, Leach Field, and Lines (ST-299)

Borehole	Borehole Location	Sample Depth (ft)
01	Background Borehole	3–5
02	In the leach field area	3–5
03	In the leach field area	3–5
04	In the leach field area	3–5

8.14.2.4 Laboratory Analysis

Four soil samples were analyzed for VOCs, SVOCs, TPH as GRO and DRO, metals, mercury (the expected contaminants associated with normal operations at this building), soil pH, and soil moisture. The four brass tubes in each 2-ft sample interval were field-screened for possible contamination using a beta-gamma meter and a FID (as per health and safety requirements). No elevated readings were measured with these instruments.

8.14.3 Site Characteristics

8.14.3.1 Geology

The ST-299 area is underlain by unconsolidated alluvial sediment that is predominantly very fine-grained sand with some gravel. Four 8-ft boreholes were drilled at ST-299. No boreholes penetrated into the Santa Fe Group sediments that presumably underlie this area. A discussion of the general geology at Kirtland AFB is presented in Section 2.4.

As a result of leach field installation, it is probable that backfill material is present in the leach field area. Borehole logs for this area are presented in Appendix C.

8.14.3.2 Hydrogeology

Groundwater beneath this area is found within the Upper Santa Fe sediments and is generally thought to be unconfined in the upper portion of the aquifer. This area is within the HR1 saturated zone setting as defined by SNL studies (Figure 2-9) (SNL, 1994). Hydrogeologic characterization in this portion of Kirtland AFB is complicated by the presence of numerous production wells (Figure 2-11). It is probable that uniform groundwater conditions do not exist in this region. Local cones of depression associated with groundwater withdrawal have altered the groundwater flow direction in the vicinity of the well fields (Figure 2-7).

The gradient is probably north at this site. Two production wells are located in this area of Kirtland AFB: KAFB-2 is downgradient 1,000 ft northwest and KAFB-7 is cross-gradient 3,650 ft east-northeast (Figures 2-7 and 2-11). Depth to groundwater is estimated to be about 350 ft below grade (Figure 2-10); however, shallower perched water zones may occur. Hydraulic conductivity within HR1

is estimated at 2 to 171 ft/day (SNL, 1994). A general discussion of the hydrogeology at Kirtland AFB is presented in Section 2.5.

8.14.4 Nature and Extent of Contamination

The following section describes the extent of contamination based on sampling results. Analytical results for soil samples collected and analyzed from ST-299 are summarized in Table 8-30, where only the reportable concentrations of detected analytes are listed. Full analytical results are presented in Appendix F. Laboratory validation reports are in Appendix K.

Organic Compounds

No VOC analytes were detected in any of the soil samples submitted for analysis at ST-299.

Di-n-butylphthalate was the only SVOC analyte detected in two of the four soil samples. The detections were in the 3- to 5-ft samples from background borehole ST-299C-01 and ST-299C-02 with concentrations of 2.5 and 3.1 mg/kg, respectively. Both concentrations were below the HHRB action level of 7,800 mg/kg.

Petroleum Hydrocarbons

No gasoline or diesel range hydrocarbons were detected in any of the soil samples submitted for analysis at ST-299.

Metals

Arsenic, beryllium, and manganese were the only metals detected at concentrations above the HHRB action levels in the soil samples submitted for analysis from ST-299 (Table 8-30). Arsenic (1.6 to 3.2 mg/kg) was detected in all samples collected. All concentrations were above the HHRB action level of 0.37 mg/kg, but were below the 6.5 mg/kg UTL. Beryllium (0.54 to 1.4 mg/kg) was detected in all samples collected at ST-299 above the HHRB action level of 0.15 mg/kg, and in three of the four samples concentrations exceeded the 0.84 mg/kg UTL. The highest beryllium concentration (1.4 mg/kg) was detected in ST-299C-01, the background borehole. Beryllium and arsenic concentrations exceeding HHRB action levels appear to be naturally occurring throughout Kirtland AFB as discussed in Section 4.2.2.

Manganese was detected in two of the four samples submitted for analysis above the HHRB action level of 390 mg/kg. The detections were in borehole ST-299C-01, the background borehole, and ST-299C-03, both from a 3- to 5-ft depth with concentrations of 555 and 411 mg/kg, respectively. These manganese concentration are believed to be naturally occurring.

Soil pH and Moisture

Soil pH ranged from 8.1 to 8.6 in these samples. Soil moisture values ranged from 4.9 to 14.3 percent (Table 8-30).

Table 8-30. Summary of Reportable Concentrations for Soil Analyses at SWMU 10-21, Building 751, Septic Tank, Leach Field, and Lines (ST-299)[1] (Concentrations mg/kg)

Chemical Class	Analyte	HHRB Action Level[2]	PQL UTL	Borehole Number and Sample Depth Interval (ft)			
				ST299C-01 3–5	*ST299C-02* 3–5	*ST299C-03* 3–5	*ST299C-04* 3–5
SVOC	Di-n-butylphthalate	7,800	0.70	2.5	3.1	ND	ND
METALS	Aluminum	78,000	14,700	20,200	11,000	18,200	15,000
	Arsenic	0.37	6.5	1.6	2.0	2.7	3.2
	Barium	5,500	735	201	121	146	85.6
	Beryllium	0.15	0.84	1.4	0.54	0.93	0.89
	Cadmium	39.0	N/A	0.95	ND	0.93	0.78
	Calcium	N/A	121,000	17,300	19,200	35,100	32,200
	Chromium, total	390	21.6	16.1	10.2	13.9	13.6
	Cobalt	4,700	15.4	11.1	9.2	11.9	9.6
	Copper	2,900	223	88.2	30.3	77.4	51.8
	Iron	N/A	23,800	21,800	18,000	23,900	21,600
	Lead	400	17.5	11.2	5.6	8.4	5.7
	Magnesium	N/A	10,400	7,130	3,830	6,560	4,990
	Manganese	390	549	555	256	411	326
	Mercury	23.0	N/A	0.12	ND	ND	ND
	Nickel	1,600	188	12.4	9.2	10.2	9.9
	Potassium	N/A	3,590	4,740	2,340	4,230	3,790
	Sodium	N/A	787	590	126	203	168
	Thallium	N/A	N/A	0.29	0.11	0.19	0.14
	Vanadium	550	55.3	39.9	39.9	49.0	42.9
	Zinc	23,000	114	81.6	41.3	77.1	62.3
OTHER	pH			8.6	8.2	8.1	8.1
	Moisture (%)			4.9	7.7	14.3	9.8

FOOTNOTES

1	Complete laboratory analytical results and method detection limits are presented in Appendix K.
2	Action level of RCRA Proposed Rule Subpart S (55 *FR* 30814, 7/27/90).
*	TPH action level is 100 mg/kg adopted from NMED UST regulations (NMED, 1990). SW-8015 analyzes volatile and semivolatile petroleum hydrocarbon fractions separately. The total concentration of the two fractions analyzed under SW-8015 will be used to assess compliance with stipulated action levels for the purpose of this RFI.
#	Denotes TCLP analysis, results in mg/l.
--	No Data.
FR	Field Replicate.
HHRB	Human health risk based.
J	Estimated value.
N/A	Not Applicable.
NA	Not Analyzed.
ND	Not detected above the method detection limit.
pCi/g	picocuries per gram.
PQL	Practical quantitation limits (defines VOC, SVOC, and TPH).
R	Reject NDs due to interference.
RAD	Radionuclides.
RE	Resample.
SVOC	Semivolatile organic compounds.
TPH	Total petroleum hydrocarbons.
U	Accept data (positive results may be influenced by lab contamination).
UJ	Estimated nondetect.
UTL	Upper tolerance limits (defines metals).
VOC	Volatile organic compounds.

8.14.5 Conclusions and Recommendations

Conclusions

- No VOCs were detected and one SVOC was detected in the soil samples submitted for analysis from this site. All concentrations were below HHRB action levels.
- No gasoline or diesel range hydrocarbons were detected.
- Arsenic, beryllium, and manganese were the only metals detected at concentrations exceeding HHRB action levels. The arsenic and beryllium concentrations appear to be naturally occurring throughout Kirtland AFB and the manganese concentrations, detected in the background borehole and one other, appear to be naturally occurring at this site.
- The analytical results at ST-299 are not indicative of a contaminant release from this site.

Recommendations

- Based on the findings of the RFI, no further action is necessary; therefore, ST-299 does not require further investigation. A No Further Action proposal should be prepared.

8.15 SWMU 10-21, Building 20199, Septic Tank, Leach Field, and Lines (ST-300)

8.15.1 Site Background and Environmental Setting

Septic tank ST-300 is located near Building 20199, the Gibson Boulevard Guard House, in the northwest portion of Kirtland AFB (Figure 8-16). ST-300 was investigated on March 28, 1995.

Based on engineering drawings and observed site conditions, inflow and outflow line lengths are approximately 55 ft and 100 ft, respectively. This tank discharges to a leach field to the west with a drainage area of approximately 105 ft x 40 ft. Potentially, the septic tank could have received contaminants from Building 20199 and, due to the leach field's design, waste from ST-300 can be expected to have entered the surrounding soil.

ST-300 is located in the urban/industrial zone, which is discussed in Section 2.0. The nearest production wells to this site are KAFB-3, 3,000 ft northeast, and KAFB-1, 4,200 ft southeast (Figure 2-11).

8.15.2 Study Area Investigation

The area of investigation was limited to the leach field at ST-300. Possible source materials in the septic tank were not investigated.

8.15.2.1 Previous Investigations

No previous investigations have been performed at this site.

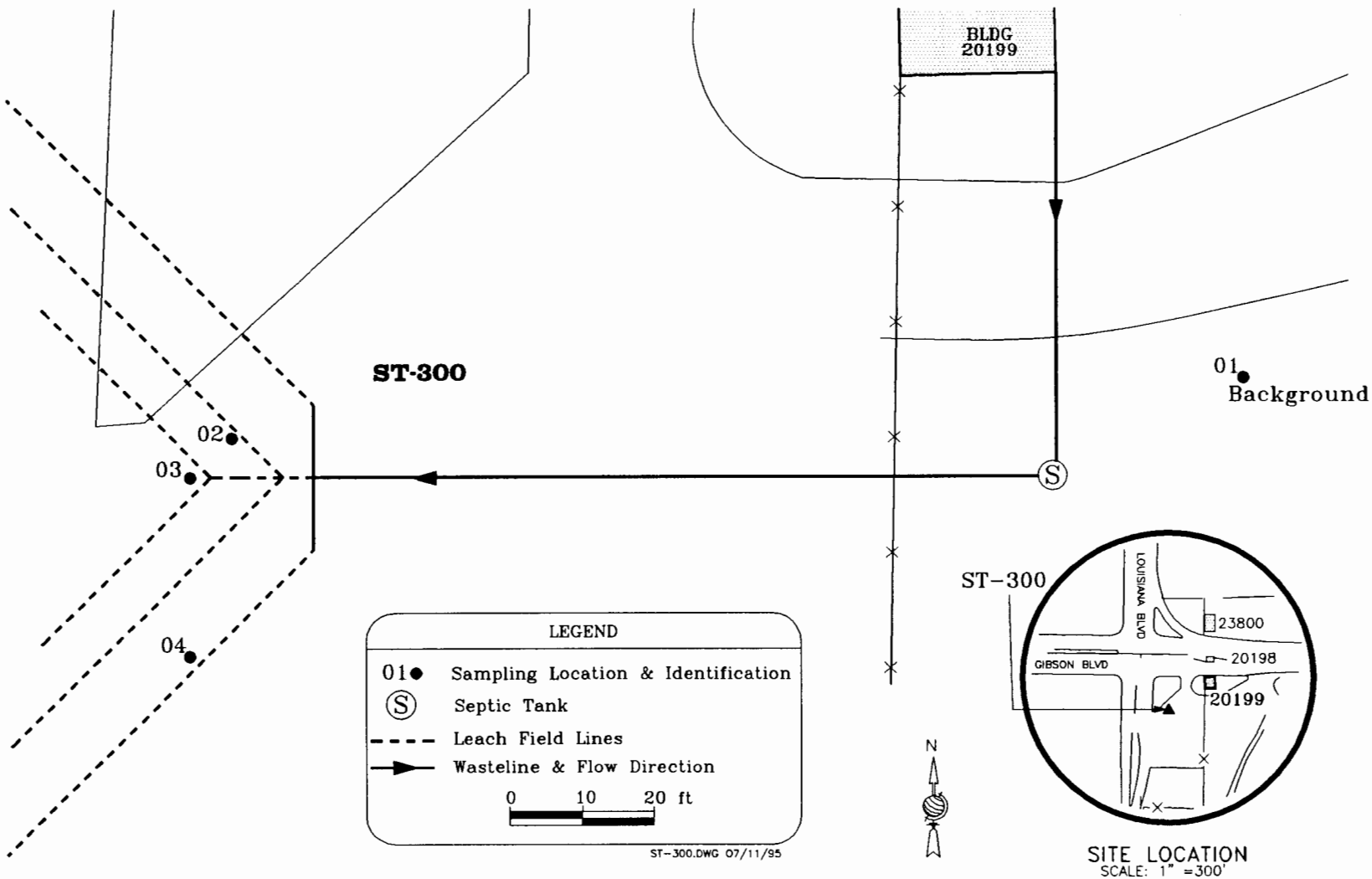


Figure 8-16. Soil Sampling Locations at SWMU 10-21, Building 20199, Septic Tank, Leach Field, and Lines (ST-300)

8.15.2.2 Data Gaps

No information related to the past use of ST-300 was available for review. No data were available to determine the presence or absence of contaminants in the subsurface soil in the leach field.

8.15.2.3 RFI Field Investigation

The objective of this investigation was to determine if contamination is present in the subsurface soil in the leach field area. On March 28, 1995, four boreholes were drilled and sampled using a Geoprobe. Borehole ST-300C-01 was drilled east of the leach field area to collect background concentration data for this site. This borehole was assumed to be in an area away from any known or suspected contamination. All other boreholes were drilled in the leach field area. Based on engineering drawings and observed field conditions, the leach field lines were determined to be 3 ft below grade. The sample interval at each borehole extended from the depth of the leach field line to 5 ft below the leach field line. From this interval, two samples were collected: one at a depth equal to the base of the leach field line, the other from 3 ft below the base of the leach field line.

Sampling operations and sample handling procedures are described in Section 3.0. Borehole locations and depths of samples that were sent to the laboratory are listed in Table 8-31. Borehole logs are in Appendix C.

Table 8-31. Boreholes and Samples Analyzed from SWMU 10-21, Building 20199, Septic Tank, Leach Field, and Lines (ST-300)

Borehole	Borehole Location	Sample Depth (ft)
01	Background Borehole	3–5
02	In the leach field area	3–5
03	In the leach field area	3–5
04	In the leach field area	3–5

8.15.2.4 Laboratory Analysis

Four soil samples were analyzed for VOCs, SVOCs, TPH as DRO and GRO, metals, mercury (the expected contaminants associated with normal operations at this building), soil pH, and soil moisture.

The four brass tubes in each 2-ft sample interval were field-screened for possible contamination using a beta-gamma meter and a FID (as per health and safety requirements). No elevated readings were measured with these instruments.

8.15.3 Site Characteristics

8.15.3.1 Geology

The ST-300 area is underlain by unconsolidated alluvial sediment that is predominantly very fine-grained to fine-grained sand. Four 8-ft boreholes were drilled at ST-300. No boreholes penetrated into the Santa Fe Group sediments that presumably underlie this area. A discussion of the general geology at Kirtland AFB is presented in Section 2.4.

As a result of leach field installation, it is probable that backfill material is present in the leach field area. Borehole logs for this area are presented in Appendix C.

8.15.3.2 Hydrogeology

Groundwater beneath this area is found within the Upper Santa Fe sediments and is generally thought to be unconfined in the upper portion of the aquifer. This area is within the HR1 saturated zone setting as defined by SNL studies (Figure 2-9) (SNL, 1994). Hydrogeologic characterization in this portion of Kirtland AFB is complicated by the presence of numerous production wells (Figure 2-11). It is probable that uniform groundwater conditions do not exist in this region. Local cones of depression associated with groundwater withdrawal have altered the groundwater flow direction in the vicinity of the well fields (Figure 2-7).

The gradient is probably northeast at this site. Two production wells are located in this area of Kirtland AFB: KAFB-3 is upgradient 3,000 ft northeast and KAFB-1 is cross-gradient 4,200 ft north (Figures 2-7 and 2-11). Depth to groundwater is estimated to be about 350 ft below grade (Figure 2-10); however, shallower perched water zones may occur. Hydraulic conductivity within HR1 is estimated at 2 to 171 ft/day (SNL, 1994). A general discussion of the hydrogeology at Kirtland AFB is presented in Section 2.5.

8.15.4 Nature and Extent of Contamination

The following section describes the extent of contamination based on sampling results. Analytical results for soil samples collected and analyzed from ST-300 are summarized in Table 8-32, where only the reportable concentrations of detected analytes are listed. Full analytical results are presented in Appendix F. Laboratory validation reports are in Appendix K.

Organic Compounds

No VOC analytes were detected in any of the soil samples submitted for analysis at ST-300.

The SVOC analyte bis(2-ethylhexyl)phthalate (0.46 mg/kg) was detected in the 3- to 5-ft interval of soil sample ST-300C-04, below the HHRB action level of 46 mg/kg.

Petroleum Hydrocarbons

No gasoline or diesel range hydrocarbons were detected in any of the boreholes at ST-300.

Table 8-32. Summary of Reportable Concentrations for Soil Analyses at SWMU 10-21, Building 20199, Septic Tank, Leach Field, and Lines (ST-300)[1] (Concentrations mg/kg)

Chemical Class	Analyte	HHRB Action Level[2]	PQL UTL	Borehole Number and Sample Depth Interval (ft)			
				ST300C-01	*ST300C-02*	*ST300C-03*	*ST300C-04*
				3–5	3–5	3–5	3–5
SVOC	Bis(2-ethylhexyl)phthalate	50.0	0.70	ND	ND	ND	0.46
METALS	Aluminum	78,000	14,700	11,000	8,920	12,000	7,180
	Arsenic	0.37	6.5	3.0	1.9	3.2	2.2
	Barium	5,500	735	200	140	217	244
	Beryllium	0.15	0.84	0.53	0.41	0.55	0.41
	Cadmium	39.0	N/A	1.6	0.83	0.99	0.83
	Calcium	N/A	121,000	41,600	15,300	42,500	14,000
	Chromium, total	390	21.6	9.6	8.7	10.2	10.0
	Cobalt	4,700	15.4	8.6	5.8	9.7	5.3
	Copper	2,900	223	47.1	61.8	24.4	52.9
	Iron	N/A	23,800	16,600	12,300	19,300	10,900
	Lead	400	17.5	6.8	15.8	8.3	12.7
	Magnesium	N/A	10,400	6,490	3,530	7,250	3,320
	Manganese	390	549	305	229	394	249
	Nickel	1,600	188	25.8	44.1	15.3	9.7
	Potassium	N/A	3,590	2,070	1,940	2,420	1,570
	Sodium	N/A	787	137	119	158	106
	Thallium	N/A	N/A	0.14	ND	0.14	0.10
	Vanadium	550	55.3	40.3	23.7	42.3	22.8
	Zinc	23,000	114	50.1	57.6	51.0	52.7
OTHER	pH			8.3	8.0	8.1	8.0
	Moisture (%)			5.5	3.1	9.2	3.2

FOOTNOTES

1	Complete laboratory analytical results and method detection limits are presented in Appendix K.
2	Action level of RCRA Proposed Rule Subpart S (55 *FR* 30814, 7/27/90).
*	TPH action level is 100 mg/kg adopted from NMED UST regulations (NMED, 1990). SW-8015 analyzes volatile and semivolatile petroleum hydrocarbon fractions separately. The total concentration of the two fractions analyzed under SW-8015 will be used to assess compliance with stipulated action levels for the purpose of this RFI.
#	Denotes TCLP analysis, results in mg/l.
--	No Data.
FR	Field Replicate.
HHRB	Human health risk based.
J	Estimated value.
N/A	Not Applicable.
NA	Not Analyzed.
ND	Not detected above the method detection limit.
pCi/g	picocuries per gram.
PQL	Practical quantitation limits (defines VOC, SVOC, and TPH).
R	Reject NDs due to interference.
RAD	Radionuclides.
RE	Resample.
SVOC	Semivolatile organic compounds.
TPH	Total petroleum hydrocarbons.
U	Accept data (positive results may be influenced by lab contamination).
UJ	Estimated nondetect.
UTL	Upper tolerance limits (defines metals).
VOC	Volatile organic compounds.

Metals

Arsenic, beryllium, and manganese were the only metals detected at concentrations above the HHRB action levels in the soil samples from ST-300 (Table 8-32). Arsenic (1.9 to 3.2 mg/kg) was detected in all samples submitted for analysis. All concentrations were above the HHRB action level of 0.37 mg/kg, but below the 6.5 mg/kg UTL. Beryllium (0.41 to 0.55 mg/kg) was detected in all samples submitted for analysis at ST-300 above the HHRB action level of 0.15 mg/kg, but below the 0.84 mg/kg UTL. Beryllium and arsenic concentrations exceeding HHRB action levels appear to be naturally occurring throughout Kirtland AFB as discussed in Section 4.2.2.

Manganese (394 mg/kg) was detected in borehole ST-300C-03 above the HHRB action level of 390 mg/kg but below the 549 mg/kg UTL. These manganese concentrations are believed to be naturally occurring at this site.

Soil pH and Moisture

Soil pH ranged from 8.0 to 8.3 in these samples. Soil moisture values ranged from 3.1 to 9.2 percent (Table 8-32).

8.15.5 Conclusions and Recommendations

Conclusions

- No VOCs were detected and one SVOC was detected in the soil samples collected from this site. All concentrations were below HHRB action levels.
- No gasoline or diesel range hydrocarbons were detected.
- Arsenic, beryllium, and manganese were the only metals detected at concentrations exceeding HHRB action levels. The arsenic and beryllium concentrations appear to be naturally occurring throughout Kirtland AFB; the manganese concentration detected is not indicative of a contaminant release.
- The analytical results at ST-300 are not indicative of a contaminant release from this site.

Recommendations

- Based on the findings of the RFI, no further action is necessary; therefore, ST-300 does not require further investigation. A No Further Action proposal should be prepared.

8.16 SWMU 10-21, Building 20560, Septic Tank, Leach Field, and Lines (ST-301)

8.16.1 Site Background and Environmental Setting

Septic tank ST-301 is located 95 ft northwest of Building 20560, the Horizontal Polarized Dipole Facility, in the central portion of Kirtland AFB (Figure 8-17). ST-301 was investigated on February 27, 1995.

Based on engineering drawings and observed site conditions, inflow and outflow line lengths are approximately 700 ft and 80 ft, respectively. This tank discharges to a leach field to the northwest with a drainage area approximately 60 ft x 50 ft. Potentially, the septic tank could have received contaminants from Building 20560 and temporary trailers. Due to the leach field's design, waste from ST-301 can be expected to have entered the surrounding soil.

ST-301 is located in the urban/industrial zone, which is discussed in Section 2.0. The nearest production wells to this site are KAFB-4, 825 ft southwest, and KAFB-7, 4,400 ft northwest (Figure 2-11).

8.16.2 Study Area Investigation

The area of investigation was limited to the leach field at ST-301. Possible source materials in the septic tank were not investigated.

8.16.2.1 Previous Investigations

No previous investigations have been performed at this site.

8.16.2.2 Data Gaps

No information related to the past use of ST-301 was available for review. No data were available to determine the presence or absence of contaminants in the subsurface soils at the leach field.

8.16.2.3 RFI Field Investigation

The objective of this investigation was to determine if contamination is present in the subsurface soil in the leach field area. On February 27, 1995, four boreholes were drilled and sampled using a Geoprobe. Borehole ST-301C-01 was drilled north of the leach field area to collect background concentration data for this site. This borehole was assumed to be in an area away from any known or suspected contamination. All other boreholes were drilled in the leach field area. Based on engineering drawings and observed field conditions, the leach field lines were determined to be 3 ft below grade. The sample interval at each borehole extended from the depth of the leach field line to 5 ft below the leach field line. From this interval, two samples were collected: one at a depth equal to the base of the leach field line, the other from 3 ft below the base of the leach field line.

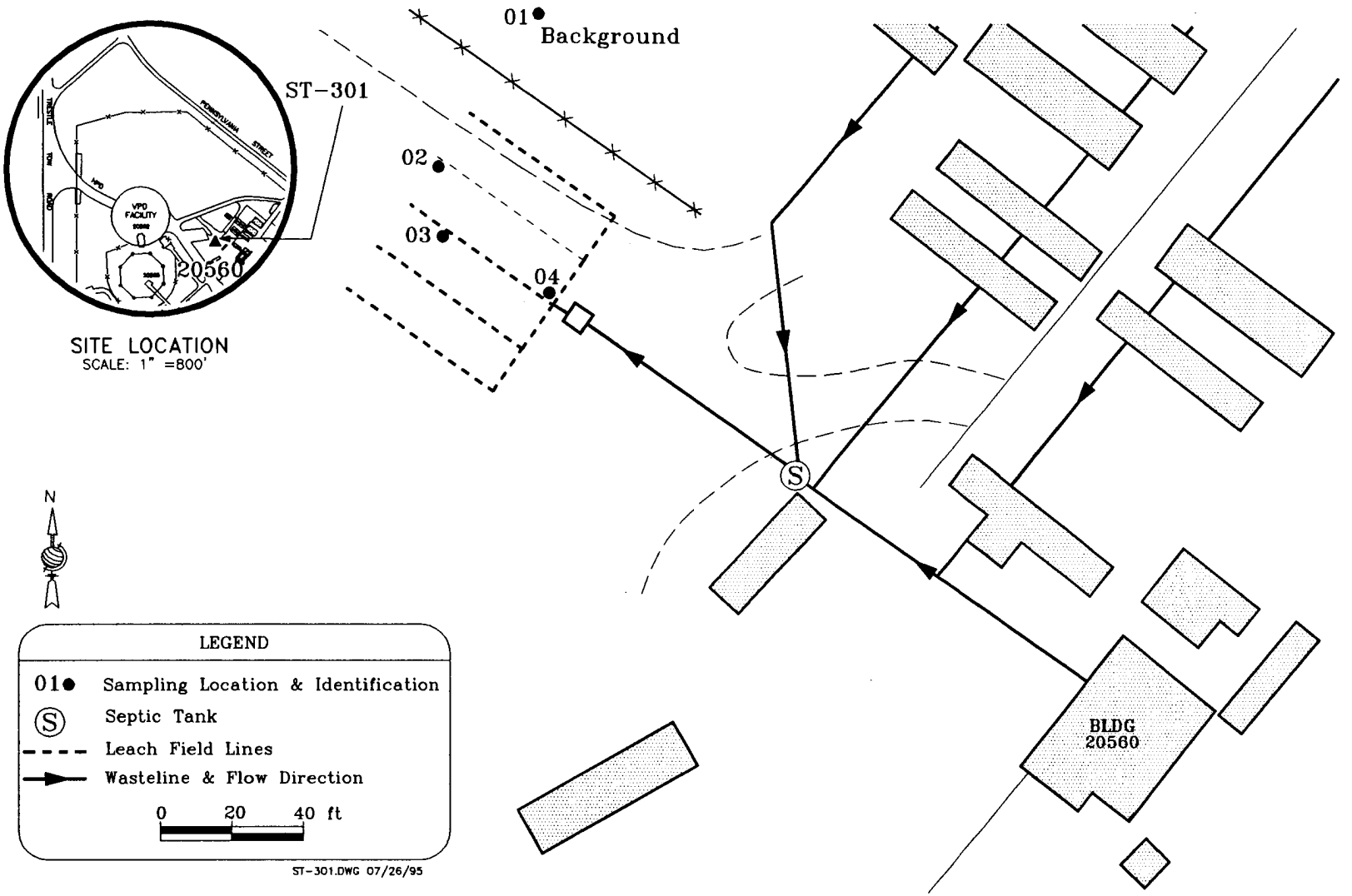


Figure 8-17. Soil Sampling Locations at SWMU 10-21, Building 20560, Septic Tank, Leach Field, and Lines (ST-301)

Sampling operations and sample handling procedures are described in Section 3.0. Borehole locations and depths of the samples that were sent to the laboratory are listed in Table 8-33. Borehole logs are in Appendix C.

Table 8-33. Boreholes and Samples Analyzed from SWMU 10-21, Building 20560, Septic Tank, Leach Field, and Lines (ST-301)

Borehole	Borehole Location	Sample Depth (ft)
01	Background Borehole	3–5
02	In the leach field area	3–5
03	In the leach field area	3–5
04	In the leach field area	3–8[a]

a. Both 2-ft sections of the 5-ft interval were used due to the collection of a replicate sample.

8.16.2.4 Laboratory Analysis

Five soil samples, four normal and one replicate, were analyzed for VOCs, SVOCs, TPH as GRO and DRO, metals, mercury (the expected contaminants associated with normal operations at this building), soil pH, and soil moisture. The four brass tubes in each 2-ft sample interval were field-screened for possible contamination using a beta-gamma meter and a FID (as per health and safety requirements). No elevated readings were detected with these instruments.

8.16.3 Site Characteristics

8.16.3.1 Geology

The ST-301 area is underlain by unconsolidated alluvial sediment that is predominantly very fine-grained to fine-grained sand with some fine gravel. Four 8-ft boreholes were drilled at ST-301. No boreholes penetrated into the Santa Fe Group sediments that presumably underlie this area. A discussion of the general geology at Kirtland AFB is presented in Section 2.4.

As a result of leach field installation, it is probable that backfill material is present in the leach field area. Borehole logs for this area are presented in Appendix C.

8.16.3.2 Hydrogeology

Groundwater beneath this area is found within the Upper Santa Fe sediments and is generally thought to be unconfined in the upper portion of the aquifer. This area is within the HR1 saturated zone setting as defined by SNL studies (Figure 2-9) (SNL, 1994). Hydrogeologic characterization in this portion of

Kirtland AFB is complicated by the presence of numerous production wells (Figure 2-11). It is probable that uniform groundwater conditions do not exist in this region. Local cones of depression associated with groundwater withdrawal have altered the groundwater flow direction in the vicinity of the well fields (Figure 2-7).

The gradient is probably north at this site. Two production wells are located in this area of Kirtland AFB: KAFB-4 is downgradient 825 ft southwest and KAFB-7 is cross-gradient 4,400 ft north (Figures 2-7 and 2-11). Depth to groundwater is estimated to be about 350 ft below grade (Figure 2-10); however, shallower perched water zones may occur. Hydraulic conductivity within HR1 is estimated at 2 to 171 ft/day (SNL, 1994). A general discussion of the hydrogeology at Kirtland AFB is presented in Section 2.5.

8.16.4 Nature and Extent of Contamination

The following section describes the extent of contamination based on sampling results. Analytical results for soil samples collected and analyzed from ST-301 are summarized in Table 8-34; only the reportable concentrations of detected analytes are listed. Full analytical results are presented in Appendix F. Laboratory validation reports are in Appendix K.

Organic Compounds

No VOC or SVOC analytes were detected in any of the soil samples submitted for analysis at ST-301.

Petroleum Hydrocarbons

No gasoline range hydrocarbons were detected in any of the soil samples submitted for analysis at ST-301. ST-301C-03 and the field replicate ST-301C-04 were the only soil samples with any diesel range hydrocarbons detected (7.6 and 6.3 mg/kg, respectively). These concentrations were below the NMED action level of 100 mg/kg.

Metals

Arsenic and beryllium were the only metals detected at concentrations above the HHRB action levels in soil samples submitted for analysis from ST-301 (Table 8-34). Arsenic (1.9 to 3.7 mg/kg) was detected in all samples collected. All concentrations were above the HHRB action level of 0.37 mg/kg, but below the UTL of 6.5 mg/kg. Beryllium (0.31 mg/kg) was detected in the field replicate soil sample collected at ST-301C-04, above the HHRB action level of 0.15 mg/kg, but below the 0.84 mg/kg UTL. Beryllium and arsenic concentrations exceeding HHRB action levels appear to be naturally occurring throughout Kirtland AFB as discussed in Section 4.2.2.

Soil pH and Moisture

Soil pH ranged from 8.1 to 9.4 in these samples. Soil moisture values ranged from 3.1 to 10.4 percent (Table 8-34).

Table 8-34. Summary of Reportable Concentrations for Soil Analyses at SWMU 10-21, Building 20560, Septic Tank, Leach Field, and Lines(ST-301)[1] (Concentrations mg/kg)

Chemical Class	Analyte	HHRB Action Level[2]	PQL UTL	Borehole Number and Sample Depth Interval (ft)				
				ST301C-01	*ST301C-02*	*ST301C-03*	*ST301C-04*	
				3–5	3–5	3–5	3–8 FR	3–8
TPH	Diesel fraction	100	10.0	ND	ND	7.6	6.3	ND
METALS	Aluminum	78,000	14,700	4,260	5,210	4,910	7,670	7,110
	Arsenic	0.37	6.5	2.3	2.9	1.9	3.0	3.7
	Barium	5,500	735	45.8	159	78.7	180	318
	Beryllium	0.15	0.84	ND	ND	ND	0.31	ND
	Cadmium	39.0	N/A	ND	ND	ND	0.62	ND
	Calcium	N/A	121,000	24,900	71,900	34,900	55,000	138,000
	Chromium, total	390	21.6	5.0	4.2	3.9	6.7	6.8
	Cobalt	4,700	15.4	3.9	2.9	4.3	8.3	5.3
	Copper	2,900	223	33.2	46.9	11.7	76.8	47.4
	Iron	N/A	23,800	5,010	5,890	5,810	11,900	8,200
	Lead	400	17.5	3.4	3.2	3.2	5.6	4.1
	Magnesium	N/A	10,400	2,440	2,320	2,100	5,870	7,180
	Manganese	390	549	53.5	58.6	66.4	182	116
	Nickel	1,600	188	2.9	2.9	3.4	7.0	5.4
	Potassium	N/A	3,590	571	685	733	949	841
	Sodium	N/A	787	455	118	58.1	792	1,040
	Vanadium	550	55.3	18.3	17.5	15.4	38.1	29.5
	Zinc	23,000	114	25.2	28.9	14.9	48.4	36.1
OTHERS	pH			9.4	8.4	8.1	8.4	8.5
	Moisture (%)			6.5	10.4	3.6	3.1	7.1

FOOTNOTES

1	Complete laboratory analytical results and method detection limits are presented in Appendix K.
2	Action level of RCRA Proposed Rule Subpart S (55 *FR* 30814, 7/27/90).
*	TPH action level is 100 mg/kg adopted from NMED UST regulations (NMED, 1990). SW-8015 analyzes volatile and semivolatile petroleum hydrocarbon fractions separately. The total concentration of the two fractions analyzed under SW-8015 will be used to assess compliance with stipulated action levels for the purpose of this RFI.
#	Denotes TCLP analysis, results in mg/l.
--	No Data.
FR	Field Replicate.
HHRB	Human health risk based.
J	Estimated value.
N/A	Not Applicable.
NA	Not Analyzed.
ND	Not detected above the method detection limit.
pCi/g	picocuries per gram.
PQL	Practical quantitation limits (defines VOC, SVOC, and TPH).
R	Reject NDs due to interference.
RAD	Radionuclides.
RE	Resample.
SVOC	Semivolatile organic compounds.
TPH	Total petroleum hydrocarbons.
U	Accept data (positive results may be influenced by lab contamination).
UJ	Estimated nondetect.
UTL	Upper tolerance limits (defines metals).
VOC	Volatile organic compounds.

8.16.5 Conclusions and Recommendations

Conclusions

- No VOCs or SVOCs were detected in the soil samples submitted for analysis from this site.
- Diesel range hydrocarbons were detected in two of the samples at this site. The concentrations did not exceed the NMED action level of 100 mg/kg. Diesel range hydrocarbon concentrations in the two samples from ST-301 are similar to the detected concentrations in background samples analyzed during the Appendix III RFI, and are likely not evidence of a release.
- Arsenic and beryllium were the only metals detected at concentrations exceeding HHRB action levels; these concentrations appear to be naturally occurring throughout Kirtland AFB.
- The analytical results at ST-301 are not indicative of a release from the unit.

Recommendations

- Based on the findings of the RFI, no further action is necessary; therefore, ST-301 does not require further investigation. A No Further Action proposal should be prepared.

8.17 SWMU 10-21, Building 20599, Septic Tank, Leach Field, and Lines (ST-302)

8.17.1 Site Background and Environmental Setting

Septic tank ST-302 is located 95 ft south-southwest of Building 20599, a radio transmitter facility, in the central portion of Kirtland AFB (Figure 8-18). ST-302 was investigated on February 14, 1995.

Based on engineering drawings and observed site conditions, inflow and outflow line lengths are approximately 135 ft and 10 ft, respectively. This tank discharges to a leach field to the southwest having a drainage area approximately 135 ft x 10 ft. Potentially, the septic tank could have received contaminants from Building 20599. Due to the leach field's design, waste from ST-302 can be expected to have entered the surrounding soil.

ST-301 is located in the urban/industrial zone, which is discussed in Section 2.0. There are three production wells nearest to this site: KAFB-1 is 4,500 ft north-northwest, Sandia-6 is 4,500 ft northeast, and KAFB-4 is 2,100 ft southwest (Figure 2-11).

8.17.2 Study Area Investigation

The area of investigation was limited to the leach field at ST-302. Possible source materials in the septic tanks were not investigated.

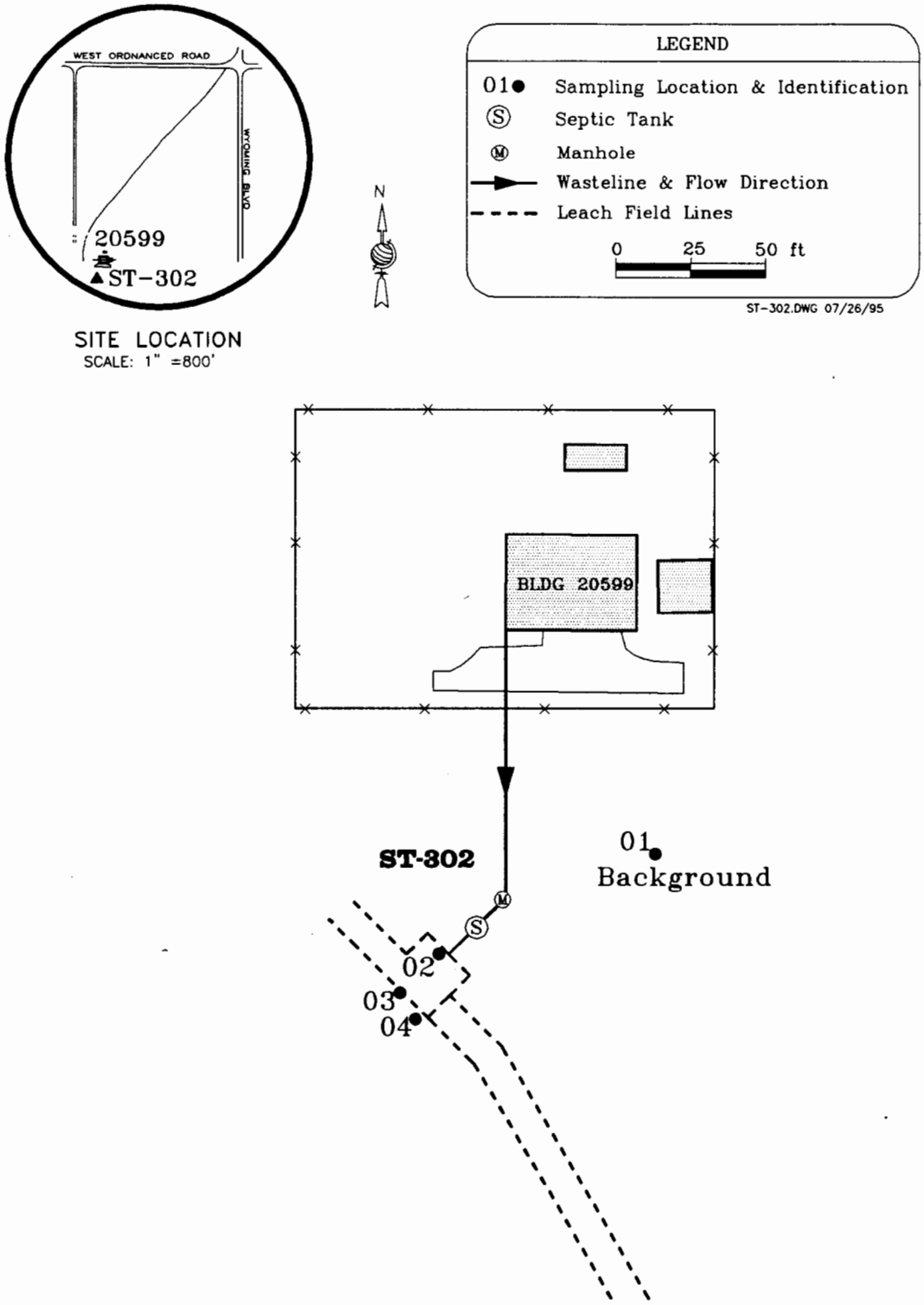


Figure 8-18. Soil Sampling Locations at SWMU 10-21, Building 20599, Septic Tank, Leach Field, and Lines (ST-302)

8.17.2.1 Previous Investigations

No previous investigations have been performed at this site.

8.17.2.2 Data Gaps

No information related to the past use of ST-302 was available for review. No data were available to determine the presence or absence of contaminants in the subsurface soil at the leach field.

8.17.2.3 RFI Field Investigation

The objective of this investigation was to determine if contamination is present in the subsurface soil in the leach field area. On February 14, 1995, four boreholes were drilled and sampled using a Geoprobe. Borehole ST-302C-01 was drilled northeast of the leach field area to collect background concentration data for this site. This borehole was assumed to be in an area away from any known or suspected contamination. All other boreholes were drilled in the leach field area. Based on engineering drawings and observed field conditions, the leach field lines were determined to be 3 ft below grade. The sample interval at each borehole extended from the depth of the leach field line to 5 ft below the leach field line. From this interval, two samples were collected: one at a depth equal to the base of the leach field line, the other from 3 ft below the base of the leach field line.

Sampling operations and sample handling procedures are described in Section 3.0. Borehole locations and depths of the samples that were sent to the laboratory are listed in Table 8-35. Borehole logs are in Appendix C.

Table 8-35. Boreholes and Samples Analyzed from SWMU 10-21, Building 20599, Septic Tank, Leach Field, and Lines (ST-302)

Borehole	Borehole Location	Sample Depth (ft)
01	Background borehole	3-5
02	In the leach field area	3-5
03	In the leach field area	3-5
04	In the leach field area	3-5

8.17.2.4 Laboratory Analysis

Four soil samples were analyzed for VOCs, SVOCs, TPH as GRO and DRO, metals, mercury (the expected contaminants associated with normal operations at this building), soil pH, and soil moisture. The four brass tubes in each 2-ft sample interval were field-screened for possible contamination using a beta-gamma meter and a FID (as per health and safety requirements). No elevated readings were detected with these instruments.

8.17.3 Site Characteristics

8.17.3.1 Geology

The ST-302 area is underlain by unconsolidated alluvial sediment that is predominantly fine-grained to very coarse, well-graded sand with some fine gravel. Four 8-ft boreholes were drilled at ST-302. No boreholes penetrated into the Santa Fe Group sediments that presumably underlie this area. A discussion of the general geology at Kirtland AFB is presented in Section 2.4.

As a result of leach field installation, it is probable that backfill material is present in the leach field area. Borehole logs for this area are presented in Appendix C.

8.17.3.2 Hydrogeology

Groundwater beneath this area is found within the Upper Santa Fe sediments and is generally thought to be unconfined in the upper portion of the aquifer. This area is within the HR1 saturated zone setting as defined by SNL studies (Figure 2-9) (SNL, 1994). Hydrogeologic characterization in this portion of Kirtland AFB is complicated by the presence of numerous production wells (Figure 2-11). It is probable that uniform groundwater conditions do not exist in this region. Local cones of depression associated with groundwater withdrawal have altered the groundwater flow direction in the vicinity of the well fields (Figure 2-7).

The gradient is probably north at this site. Three production wells are located in this area of Kirtland AFB: KAFB-1 is downgradient 4,500 ft north-northwest, KAFB-4 is cross-gradient 2,100 ft southwest, and Sandia-6 is cross-gradient 4,500 ft northeast (Figures 2-7 and 2-11). Depth to groundwater is estimated to be about 350 ft below grade (Figure 2-10); however, shallower perched water zones may occur. Hydraulic conductivity within HR1 is estimated at 2 to 171 ft/day (SNL, 1994). A general discussion of the hydrogeology at Kirtland AFB is presented in Section 2.5.

8.17.4 Nature and Extent of Contamination

The following section describes the extent of contamination based on sampling results. Analytical results for soil samples collected and submitted for analysis from ST-302 are summarized in Table 8-36, where only the reportable concentrations of detected analytes are listed. Full analytical results are presented in Appendix F. Laboratory validation reports are in Appendix K.

Organic Compounds

No VOC or SVOC analytes were detected in any of the soil samples submitted for analysis at ST-302.

Petroleum Hydrocarbons

No gasoline range hydrocarbons were detected in any of the samples submitted for analysis at ST-302. Diesel range hydrocarbons (6.1 mg/kg) were detected in borehole ST-302C-04, but below the NMED action level of 100 mg/kg.

Table 8-36. Summary of Reportable Concentrations for Soil Analyses at SWMU 10-21, Building 20599, Septic Tank, Leach Field, and Lines (ST-302)[1] (Concentrations mg/kg)

Chemical Class	Analyte	HHRB Action Level[2]	PQL UTL	Borehole Number and Sample Depth Interval (ft)			
				ST302C-01 3–5	*ST302C-02* 3–5	*ST302C-03* 3–5	*ST302C-04* 3–5
TPH	Diesel fraction	100	10.0	ND	ND	ND	6.1
METALS	Aluminum	78,000	14,700	5,540	3,990	4,580	7,990
	Arsenic	0.37	6.5	2.6	1.5	1.0	2.6
	Barium	5,500	735	150	67.7	58.7	182
	Beryllium	0.15	0.84	0.32	ND	0.31	0.43
	Calcium	N/A	121,000	97,200	32,800	21,200	42,900
	Chromium, total	390	21.6	5.3	4.2	4.4	6.3
	Cobalt	4,700	15.4	3.9	6.3	5.6	4.2
	Copper	2,900	223	148	53.7	31.1	20.3
	Iron	N/A	23,800	6,620	9,340	10,400	11,700
	Lead	400	17.5	2.6	2.8	2.5	4.8
	Magnesium	N/A	10,400	2,930	3,220	3,510	4,200
	Manganese	390	549	79.5	182	222	181
	Mercury	23.0	N/A	ND	ND	0.11	ND
	Nickel	1,600	188	14.8	8.1	5.4	5.4
	Potassium	N/A	3,590	961	1,050	889	1,530
	Sodium	N/A	787	458	94.9	69.1	1,500
	Thallium	N/A	N/A	ND	ND	ND	0.11
	Vanadium	550	55.3	16.4	19.5	19.8	23.9
	Zinc	23,000	114	58.1	34.9	38.3	28.2
OTHER	pH			8.6	8.8	8.8	8.0
	Moisture (%)			5.0	2.9	3.6	7.5

FOOTNOTES

1	Complete laboratory analytical results and method detection limits are presented in Appendix K.
2	Action level of RCRA Proposed Rule Subpart S (55 *FR* 30814, 7/27/90).
*	TPH action level is 100 mg/kg adopted from NMED UST regulations (NMED, 1990). SW-8015 analyzes volatile and semivolatile petroleum hydrocarbon fractions separately. The total concentration of the two fractions analyzed under SW-8015 will be used to assess compliance with stipulated action levels for the purpose of this RFI.
#	Denotes TCLP analysis, results in mg/l.
--	No Data.
FR	Field Replicate.
HHRB	Human health risk based.
J	Estimated value.
N/A	Not Applicable.
NA	Not Analyzed.
ND	Not detected above the method detection limit.
pCi/g	picocuries per gram.
PQL	Practical quantitation limits (defines VOC, SVOC, and TPH).
R	Reject NDs due to interference.
RAD	Radionuclides.
RE	Resample.
SVOC	Semivolatile organic compounds.
TPH	Total petroleum hydrocarbons.
U	Accept data (positive results may be influenced by lab contamination).
UJ	Estimated nondetect.
UTL	Upper tolerance limits (defines metals).
VOC	Volatile organic compounds.

Metals

Arsenic and beryllium were the only metals detected at concentrations above the HHRB action levels in soil samples from ST-302 (Table 8-36). Arsenic (1.0 to 2.6 mg/kg) was detected in all samples collected. All concentrations were above the HHRB action level of 0.37 mg/kg but below the UTL of 6.5 mg/kg. Beryllium (0.31 to 0.43 mg/kg) was detected in three of the four samples collected at ST-302 above the HHRB action level of 0.15 mg/kg but below the UTL of 0.84 mg/kg. Beryllium and arsenic concentrations exceeding HHRB action levels appear to be naturally occurring throughout Kirtland AFB as discussed in Section 4.2.2.

Soil pH and Moisture

Soil pH ranged from 8.0 to 8.8 in these samples. Soil moisture values ranged from 2.9 to 7.5 percent (Table 8-36).

8.17.5 Conclusions and Recommendations

Conclusions

- No VOCs or SVOCs were detected in the soil samples submitted for analysis from this site.
- No gasoline range hydrocarbons were detected. Diesel range hydrocarbons were detected in one of the samples at this site. The concentrations did not exceed the NMED action level of 100 mg/kg. The diesel range hydrocarbon concentration detected in the sample from ST-302 is similar to concentrations detected in background samples analyzed during the Appendix III RFI, and is not indicative of a release.
- Arsenic and beryllium were the only metals detected at concentrations exceeding HHRB action levels; these concentrations appear to be naturally occurring throughout Kirtland AFB.
- The analytical results at ST-302 are not indicative of a release from the unit.

Recommendations

- Based on the findings of the RFI, no further action is necessary; therefore, ST-302 does not require further investigation. A No Further Action proposal should be prepared.

8.18 SWMU 10-21, Building 20749, Septic Tank, Leach Field, and Lines (ST-303)

8.18.1 Site Background and Environmental Setting

Septic tank ST-303 is located 80 ft south of Building 20749, the ARES Support Building, in the central portion of Kirtland AFB (Figure 8-19). ST-303 was investigated on February 13, 1995.

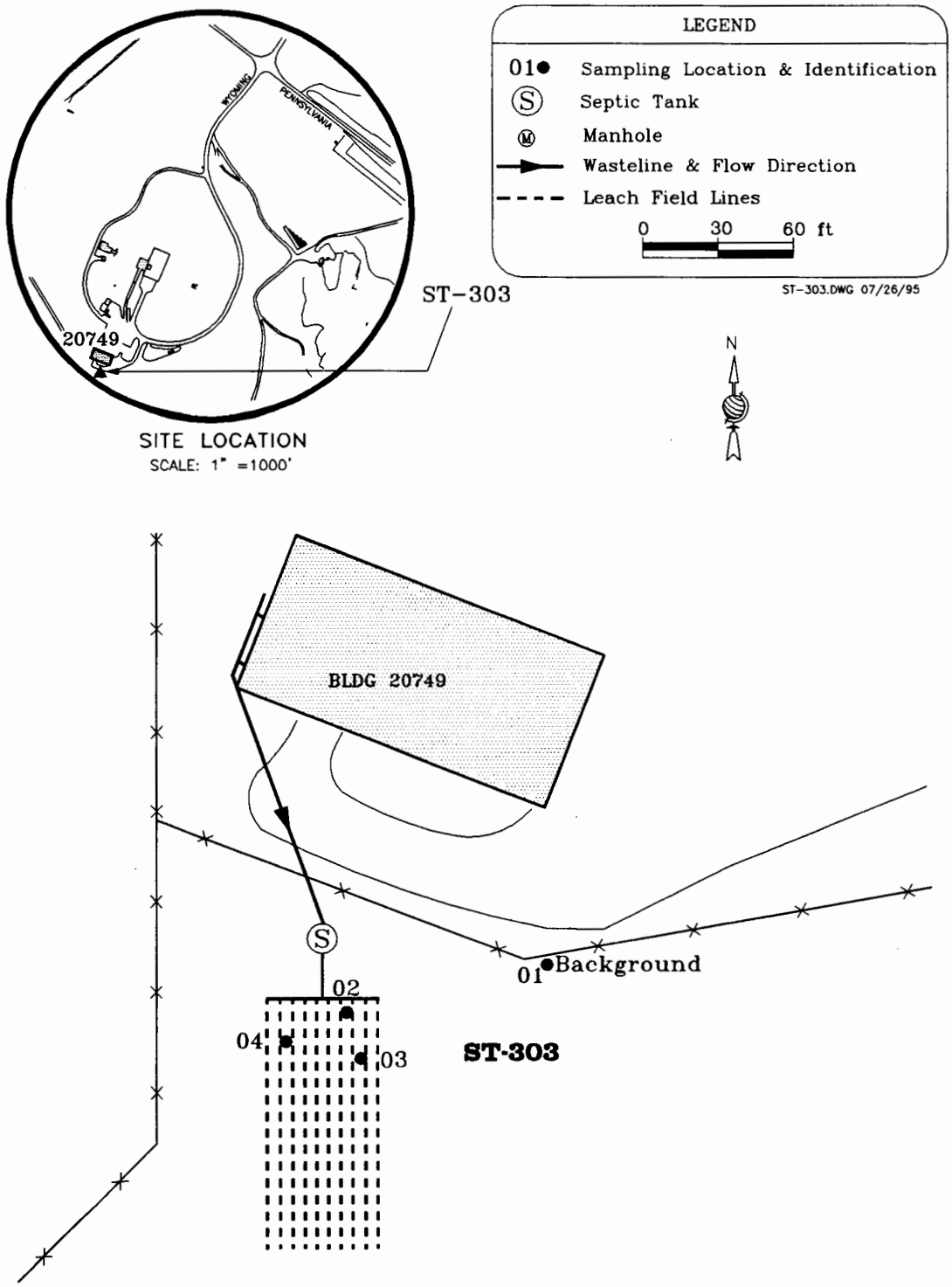


Figure 8-19. Soil Sampling Locations at SWMU 10-21, Building 20749, Septic Tank, Leach Field, and Lines (ST-303)

Based on engineering drawings and observed site conditions, inflow and outflow line lengths are approximately 120 ft and 20 ft, respectively. This tank discharges to a leach field to the south with a drainage area approximately 100 ft x 45 ft. Potentially, the septic tank could have received contaminants from Building 20749. Due to the leach field's design, waste from ST-303 can be expected to have entered the surrounding soil.

ST-303 is located in the urban/industrial zone, which is discussed in Section 2.0. The nearest production well to this site is KAFB-4, 2,600 ft northwest (Figure 2-11).

8.18.2 Study Area Investigation

The area of investigation was limited to the leach field at ST-303. Possible source materials in the septic tank were not investigated.

8.18.2.1 Previous Investigations

No previous investigations have been performed at this site.

8.18.2.2 Data Gaps

No information related to the past use of ST-303 was available for review. No data were available to determine the presence or absence of contaminants in the subsurface soil in the leach field.

8.18.2.3 RFI Field Investigation

The objective of this investigation was to determine if contamination is present in the subsurface soil in the leach field area. On February 13, 1995, four boreholes were drilled and sampled using a Geoprobe. Borehole ST-303C-01 was drilled northeast of the leach field area to collect background concentration data for this site. This borehole was assumed to be in an area away from any known or suspected contamination. All other boreholes were drilled in the leach field area. Based on engineering drawings and observed field conditions the leach field lines were determined to be 4 ft below grade. The sample interval at each borehole extended from the depth of the leach field line to 5 ft below the leach field line. From this interval, two samples were collected: one at a depth equal to the base of the leach field line, the other from 3 ft below the base of the leach field line.

Sampling operations and sample handling procedures are described in Section 3.0. Borehole locations and depths of the samples that were sent to the laboratory are listed in Table 8-37. Borehole logs are in Appendix C.

Table 8-37. Boreholes and Samples Analyzed from SWMU 10-21, Building 20749, Septic Tank, Leach Field, and Lines (ST-303)

Borehole	Borehole Location	Sample Depth (ft)
01	Background borehole	4–6
02	In the leach field area	4–6
03	In the leach field area	4–6
04	In the leach field area	4–9[a]

a. Both 2-ft sections of the 5-ft interval were used due to the collection of a replicate sample.

8.18.2.4 Laboratory Analysis

Five soil samples, including one replicate, were analyzed for VOCs, SVOCs, TPH as GRO and DRO, metals, mercury (the expected contaminants associated with normal operations at this building), soil pH, and soil moisture. The four brass tubes in each 2-ft sample interval were field-screened for possible contamination using a beta-gamma meter and a FID (as per health and safety requirements). No elevated readings were detected with these instruments.

8.18.3 Site Characteristics

8.18.3.1 Geology

The ST-303 area is underlain by unconsolidated alluvial sediment that is predominantly fine-grained to very coarse, well-graded sand with some gravel. Four 9-ft boreholes were drilled at ST-303. No boreholes penetrated into the Santa Fe Group sediments that presumably underlie this area. A discussion of the general geology at Kirtland AFB is presented in Section 2.4.

As a result of leach field installation, it is probable that backfill material is present in the leach field area. Borehole logs for this area are presented in Appendix C.

8.18.3.2 Hydrogeology

Groundwater beneath this area is found within the Upper Santa Fe sediments and is generally thought to be unconfined in the upper portion of the aquifer. This area is within the HR1 saturated zone setting as defined by SNL studies (Figure 2-9) (SNL, 1994). Hydrogeologic characterization in this portion of Kirtland AFB is complicated by the presence of numerous production wells (Figure 2-11). It is probable that uniform groundwater conditions do not exist in this region. Local cones of depression associated with groundwater withdrawal have altered the groundwater flow direction in the vicinity of the well fields (Figure 2-7).

The gradient is probably north at this site. One production well is located in this area of Kirtland AFB: KAFB-4 is downgradient 2,600 ft northwest (Figures 2-7 and 2-11). Depth to groundwater is estimated to be about 350 ft below grade (Figure 2-10); however, shallower perched water zones may occur. Hydraulic conductivity within HR1 is estimated at 2 to 171 ft/day (SNL, 1994). A general discussion of the hydrogeology at Kirtland AFB is presented in Section 2.5.

8.18.4 Nature and Extent of Contamination

The following section describes the extent of contamination based on sampling results. Analytical results for soil samples collected and submitted for analysis from ST-303 are summarized in Table 8-38, where only the reportable concentrations of detected analytes are listed. Full analytical results are presented in Appendix F. Laboratory validation reports are in Appendix K.

Organic Compounds

No VOC or SVOC analytes were detected in any of the soil samples submitted for analysis at ST-303.

Petroleum Hydrocarbons

No gasoline range hydrocarbons were detected in any of the soil samples submitted for analysis at ST-303. Diesel range hydrocarbons (4.4 to 5.2 mg/kg) were detected in all boreholes samples submitted for analysis except, ST-303C-04, the field replicate sample. All concentrations were below the NMED action level of 100 mg/kg.

Metals

Arsenic and beryllium were the only metals detected at concentrations above the HHRB action levels in soil samples submitted for analysis from ST-303 (Table 8-38). Arsenic (1.6 to 2.4 mg/kg) was detected in all samples submitted for analysis. All concentrations were above the HHRB action level of 0.37 mg/kg, but below the UTL of 6.5 mg/kg. Beryllium (0.31 mg/kg) was detected in all samples submitted for analysis at ST-303 above the HHRB action level of 0.15 mg/kg. but below the UTL of 0.84 mg/kg. Beryllium and arsenic concentrations exceeding HHRB action levels appear to be naturally occurring throughout Kirtland AFB as discussed in Section 4.2.2.

Soil pH and Moisture

Soil pH ranged from 7.9 to 8.3 in these samples. Soil moisture values ranged from 1.7 to 3.4 percent (Table 8-38).

Table 8-38. Summary of Reportable Concentrations for Soil Analyses at SWMU 10-21, Building 20749, Septic Tank, Leach Field, and Lines (ST-303)[1] (Concentrations mg/kg)

Chemical Class	Analyte	HHRB Action Level[2]	PQL UTL	Borehole Number and Sample Depth Interval (ft)				
				ST303C-01	*ST303C-02*	*ST303C-03*	*ST303C-04*	
				4–6	4–6	4–6	4–9 FR	4–9
TPH	Diesel fraction	100	10.0	4.9	5.2	4.9	ND	4.4
METALS	Aluminum	78,000	14,700	6,300	5,900	4,660	5,130	6,210
	Arsenic	0.37	6.5	2.4	2.4	2.0	1.6	2.1
	Barium	5,500	735	83.0	86.7	68.3	78.6	80.3
	Beryllium	0.15	0.84	0.31	0.31	0.31	0.31	0.31
	Cadmium	39.0	N/A	ND	0.62	ND	ND	ND
	Calcium	N/A	121,000	22,200	20,500	21,100	21,900	23,100
	Chromium, total	390	21.6	6.5	7.4	6.2	6.4	7.5
	Cobalt	4,700	15.4	6.3	5.9	6.1	6.0	5.9
	Copper	2,900	223	31.1	17.6	34.1	57.5	53.0
	Iron	N/A	23,800	16,900	12,200	11,500	9,810	13,500
	Lead	400	17.5	5.0	5.4	4.2	4.1	5.5
	Magnesium	N/A	10,400	3,100	3,040	2,440	2,750	2,890
	Manganese	390	549	199	195	171	175	190
	Nickel	1,600	188	4.3	4.5	5.3	5.1	4.1
	Potassium	N/A	3,590	1,320	1,420	964	1,020	1,210
	Sodium	N/A	787	177	51.9	67.6	97.6	132
	Thallium	N/A	N/A	ND	ND	ND	0.11	ND
	Vanadium	550	55.3	34.1	22.4	21.3	20.6	27.7
	Zinc	23,000	0.00	34.2	28.3	27.3	38.9	37.2
OTHER	pH			8.1	8.3	8.1	7.9	8.1
	Moisture (%)			1.7	3.1	2.8	3.4	2.3

FOOTNOTES

1	Complete laboratory analytical results and method detection limits are presented in Appendix K.
2	Action level of RCRA Proposed Rule Subpart S (55 *FR* 30814, 7/27/90).
*	TPH action level is 100 mg/kg adopted from NMED UST regulations (NMED, 1990). SW-8015 analyzes volatile and semivolatile petroleum hydrocarbon fractions separately. The total concentration of the two fractions analyzed under SW-8015 will be used to assess compliance with stipulated action levels for the purpose of this RFI.
#	Denotes TCLP analysis, results in mg/l.
--	No Data.
FR	Field Replicate.
HHRB	Human health risk based.
J	Estimated value.
N/A	Not Applicable.
NA	Not Analyzed.
ND	Not detected above the method detection limit.
pCi/g	picocuries per gram.
PQL	Practical quantitation limits (defines VOC, SVOC, and TPH).
R	Reject NDs due to interference.
RAD	Radionuclides.
RE	Resample.
SVOC	Semivolatile organic compounds.
TPH	Total petroleum hydrocarbons.
U	Accept data (positive results may be influenced by lab contamination).
UJ	Estimated nondetect.
UTL	Upper tolerance limits (defines metals).
VOC	Volatile organic compounds.

8.18.5 Conclusions and Recommendations

Conclusions

- No VOCs or SVOCs were detected in the soil samples submitted for analysis from this site.
- No gasoline range hydrocarbons were detected. Diesel range hydrocarbons were detected in four of the five samples at this site. The concentrations did not exceed the NMED action level of 100 mg/kg. Diesel range hydrocarbon concentrations detected in the samples from ST-303 are similar to the concentrations detected in background samples during the Appendix III RFI, and are not indicative of a release.
- Arsenic and beryllium were the only metals detected at concentrations exceeding HHRB action levels; these concentrations appear to be naturally occurring throughout Kirtland AFB.
- The analytical results at ST-303 are not indicative of a release from the unit.

Recommendations

- Based on the findings of the RFI, no further action is necessary; therefore, ST-303 does not require further investigation. A No Further Action proposal should be prepared.

8.19 SWMU 10-21, Building 20797, Septic Tank, Leach Field, and Lines (ST-304)

8.19.1 Site Background and Environmental Setting

Septic tank ST-304 is located 400 ft south of Building 20797, part of the Trestle Facility, in the central portion of Kirtland AFB (Figure 8-20). ST-304 was investigated on March 7, 1995.

Based on engineering drawings and observed site conditions, inflow and outflow line lengths are approximately 250 ft and 150 ft, respectively. This tank discharges to a leach field to the south with a drainage area approximately 80 ft x 50 ft. Potentially, the septic tank could have received contaminants from Building 20797. Due to the leach field's design, waste from ST-304 can be expected to have entered the surrounding soil.

ST-304 is located in the urban/industrial zone, which is discussed in Section 2.0. The nearest production well to this site is KAFB-4, 2,500 ft north-northwest (Figure 2-11).

8.19.2 Study Area Investigation

The area of investigation was limited to the leach field at ST-304. Possible source materials in the septic tank were not investigated.

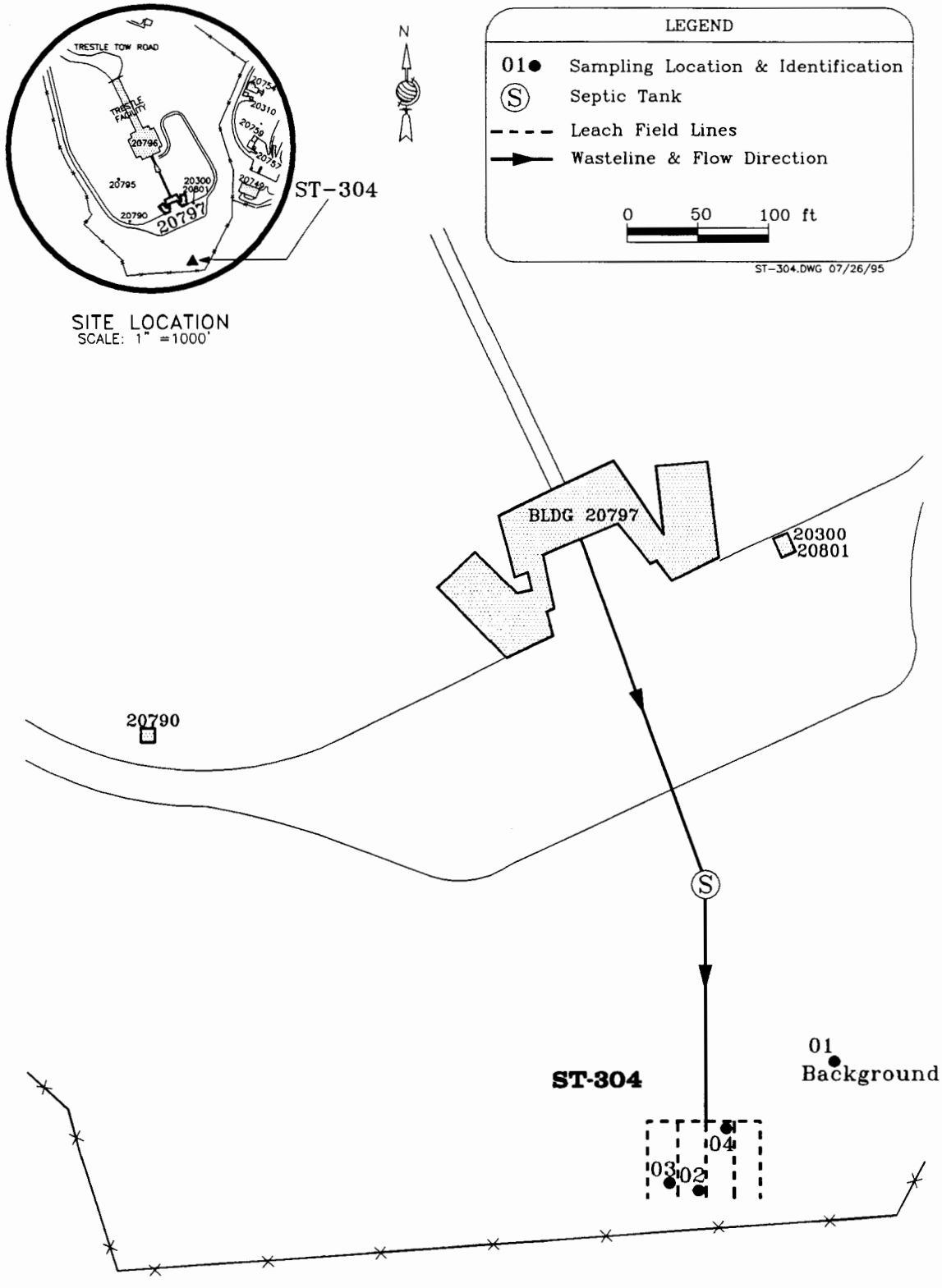


Figure 8-20. Soil Sampling Locations at SWMU 10-21, Building 20797, Septic Tank, Leach Field, and Lines (ST-304)

8.19.2.1 Previous Investigations

No previous investigations have been performed at this site.

8.19.2.2 Data Gaps

No information related to the past use of ST-304 was available for review. No data were available to determine the presence or absence of contaminants in the subsurface soils at the leach fields.

8.19.2.3 RFI Field Investigation

The objective of this investigation was to determine if contamination is present in the subsurface soil in the leach field area. On March 7, 1995, four boreholes were drilled and sampled using a Geoprobe. Borehole ST-304C-01 was drilled northeast of the leach field area to collect background concentration data for this site. This borehole was assumed to be in an area away from any known or suspected contamination. All other boreholes were drilled in the leach field area. Based on engineering drawings and observed field conditions, the leach field lines were determined to be 4 ft below grade. The sample interval at each borehole extended from the depth of the leach field line to 5 ft below the leach field line. From this interval, two samples were collected: one at a depth equal to the base of the leach field line, the other from 3 ft below the base of the leach field line.

Sampling operations and sample handling procedures are described in Section 3.0. Borehole locations and depths of the samples that were sent to the laboratory are listed in Table 8-39. Borehole logs are in Appendix C.

Table 8-39. Boreholes and Samples Analyzed from SWMU 10-21, Building 20797, Septic Tank, Leach Field, and Lines (ST-304)

Borehole	Borehole Location	Sample Depth (ft)
01	Background borehole	4–6
02	In the leach field area	4–6
03	In the leach field area	4–9[a]
04	In the leach field area	4–9[b]

a. Both 2-ft sections of the 5-ft interval were used due to the collection of an MS/MSD sample.
b. Both 2-ft sections of the 5-ft interval were used due to the collection of a replicate sample.

8.19.2.4 Laboratory Analysis

Five soil samples, including one replicate, were analyzed for VOCs, SVOCs, TPH as GRO and DRO, metals, mercury (the expected contaminants associated with normal operations at this building), soil pH, and soil moisture. The four brass tubes in each 2-ft sample interval were field-screened for possible

contamination using a beta-gamma meter and a FID (as per heath and safety requirements). No elevated readings were detected with these instruments.

8.19.3 Site Characteristics

8.19.3.1 Geology

The ST-304 area is underlain by unconsolidated alluvial sediment that is predominantly very fine-grained to fine-grained sand with some gravel. Four 9-ft boreholes were drilled at ST-304. No boreholes penetrated into the Santa Fe Group sediments that presumably underlie this area. A discussion of the general geology at Kirtland AFB is presented in Section 2.4.

As a result of leach field installation, it is probable that backfill material is present in the leach field area. Borehole logs for this area are presented in Appendix C.

8.19.3.2 Hydrogeology

Groundwater beneath this area is found within the Upper Santa Fe sediments and is generally thought to be unconfined in the upper portion of the aquifer. This area is within the HR1 saturated zone setting as defined by SNL studies (Figure 2-9) (SNL, 1994). Hydrogeologic characterization in this portion of Kirtland AFB is complicated by the presence of numerous production wells (Figure 2-11). It is probable that uniform groundwater conditions do not exist in this region. Local cones of depression associated with groundwater withdrawal have altered the groundwater flow direction in the vicinity of the well fields (Figure 2-7).

The gradient is probably north at this site. One production well is located in this area of Kirtland AFB: KAFB-4 is downgradient 2,500 ft north-northwest (Figures 2-7 and 2-11). Depth to groundwater is estimated to be about 350 ft below grade (Figure 2-7); however, shallower perched water zones may occur. Hydraulic conductivity within HR1 is estimated at 2 to 171 ft/day (SNL, 1994). A general discussion of the hydrogeology at Kirtland AFB is presented in Section 2.5.

8.19.4 Nature and Extent of Contamination

The following section describes the extent of contamination based on sampling results. Analytical results for soil samples collected and submitted for analysis from ST-304 are summarized in Table 8-40; only the reportable concentrations of detected analytes are listed. Full analytical results are presented in Appendix F. Laboratory validation reports are in Appendix K.

Organic Compounds

No VOC analytes were detected in any of the boreholes at ST-304.

The SVOC di-n-butylphthalate (1.3 to 2.4 mg/kg) was detected in all soil samples submitted for analysis, at concentrations below the HHRB action level of 7,800 mg/kg.

Table 8-40. Summary of Reportable Concentrations for Soil Analyses at SWMU 10-21, Building 20797, Septic Tank, Leach Field, and Lines (ST-304)[1] (Concentrations mg/kg)

Chemical Class	Analyte	HHRB Action Level[2]	PQL UTL	Borehole Number and Sample Depth Interval (ft)				
				ST304C-01	*ST304C-02*	*ST304C-03*	*ST304C-04*	
				4–6	4–6	4–9	4–9 FR	4–9
SVOC	Di-n-butylphthalate	7,800	0.70	1.9	2.4	1.8	1.3	1.8
METALS	Aluminum	78,000	14,700	9,720	17,700	15,400	10,700	14,600
	Arsenic	0.37	6.5	2.9	3.7	3.0	2.9	3.5
	Barium	5,500	735	140	263	182	191	230
	Beryllium	0.15	0.84	0.52	0.90	0.73	0.63	0.87
	Cadmium	39.0	N/A	0.94	1.7	0.94	0.63	1.7
	Calcium	N/A	121,000	34,900	54,200	44,700	42,100	50,000
	Chromium, total	390	21.6	6.6	13.0	8.8	9.4	12.0
	Cobalt	4,700	15.4	7.6	10.7	9.3	7.4	8.9
	Copper	2,900	223	24.3	29.7	36.4	32.0	43.0
	Iron	N/A	23,800	13,100	21,200	16,900	13,800	18,200
	Lead	400	17.5	6.4	12.6	7.9	5.3	10.0
	Magnesium	N/A	10,400	4,740	6,900	6,340	5,070	6,460
	Manganese	390	549	296	560	389	307	482
	Nickel	1,600	188	8.4	18.0	12.1	9.5	12.1
	Potassium	N/A	3,590	2,400	3,590	4,060	2,830	3,330
	Sodium	N/A	787	101	193	101	85.1	126
	Thallium	N/A	N/A	ND	0.21	0.15	ND	0.17
	Vanadium	550	55.3	24.7	35.3	33.0	26.4	30.6
	Zinc	23,000	114	39.6	63.0	54.3	43.0	56.5
OTHER	pH			7.9	7.9	7.8	8.0	7.9
	Moisture (%)			4.0	10.8	4.5	4.8	7.9

FOOTNOTES

1	Complete laboratory analytical results and method detection limits are presented in Appendix K.
2	Action level of RCRA Proposed Rule Subpart S (55 *FR* 30814, 7/27/90).
*	TPH action level is 100 mg/kg adopted from NMED UST regulations (NMED, 1990). SW-8015 analyzes volatile and semivolatile petroleum hydrocarbon fractions separately. The total concentration of the two fractions analyzed under SW-8015 will be used to assess compliance with stipulated action levels for the purpose of this RFI.
#	Denotes TCLP analysis, results in mg/l.
--	No Data.
FR	Field Replicate.
HHRB	Human health risk based.
J	Estimated value.
N/A	Not Applicable.
NA	Not Analyzed.
ND	Not detected above the method detection limit.
pCi/g	picocuries per gram.
PQL	Practical quantitation limits (defines VOC, SVOC, and TPH).
R	Reject NDs due to interference.
RAD	Radionuclides.
RE	Resample.
SVOC	Semivolatile organic compounds.
TPH	Total petroleum hydrocarbons.
U	Accept data (positive results may be influenced by lab contamination).
UJ	Estimated nondetect.
UTL	Upper tolerance limits (defines metals).
VOC	Volatile organic compounds.

Petroleum Hydrocarbons

No gasoline or diesel range hydrocarbons were detected in any of the soil samples submitted for analysis at ST-304.

Metals

Arsenic, beryllium, and manganese were the only metals detected at concentrations above the HHRB action levels in the soil samples submitted for analysis from ST-304 (Table 8-40). Arsenic (2.9 to 3.7 mg/kg) was detected in all samples analyzed. All concentrations were above the HHRB action level of 0.37 mg/kg, but below the UTL of 6.5 mg/kg. Beryllium (0.52 to 0.90 mg/kg) was detected in all samples collected at ST-304 above the HHRB action level of 0.15 mg/kg. Two of the five detections (0.90 and 0.87 mg/kg) exceeded the UTL of 0.84 mg/kg; the other three detections were below the UTL. Beryllium and arsenic concentrations exceeding HHRB action levels appear to be naturally occurring throughout Kirtland AFB as discussed in Section 4.2.2.

Manganese (482 and 560 mg/kg) was detected in two of the five samples above the HHRB action level of 390 mg/kg. All manganese detections are below the UTL of 549 mg/kg, except for one (560 mg/kg). These concentrations are believed to be naturally occurring and are probably related to the underlying geology of this site as represented by the concentrations ranging from 296 to 560 mg/kg.

Soil pH and Moisture

Soil pH ranged from 7.8 to 8.0 in these samples. Soil moisture values ranged from 4.0 to 10.8 percent (Table 8-40).

8.19.5 Conclusions and Recommendations

Conclusions

- No VOCs were detected in the soil samples collected from this site.
- One SVOC was detected in the soil samples submitted for analysis at ST-304, but below the HHRB action level.
- No diesel or gasoline range hydrocarbons were detected.
- Arsenic, beryllium, and manganese were the only metals detected at concentrations exceeding HHRB action levels. The beryllium and arsenic concentrations appear to be naturally occurring throughout Kirtland AFB; the manganese concentration appears to be naturally occurring at this site.
- The analytical results at ST-304 are not indicative of a release from the unit.

Recommendations

- Based on the findings of the RFI, no further action is necessary; therefore, ST-304 does not require further investigation. A No Further Action proposal should be prepared.

8.20 SWMU 10-21, Building 28054, Septic Tank, Leach Field, and Lines (ST-305)

8.20.1 Site Background and Environmental Setting

Septic tank ST-305 is located east of Building 28054, the clubhouse at the golf course, in the central portion of Kirtland AFB (Figure 8-21). ST-305 was investigated on March 28, 1995.

Based on engineering drawings and observed site conditions, inflow and outflow line lengths are approximately 9 ft and 160 ft, respectively. This tank discharges to a leach field to the east with a drainage area approximately 60 ft x 44 ft. The leach field also receives waste from ST-306. Potentially, the septic tank could have received contaminants from Building 28054. Due to the leach field's design, waste from ST-305 can be expected to have entered the surrounding soil.

ST-305 is located just east of the urban/industrial zone, which is discussed in Section 2.0. The nearest production well to this site is KAFB-4, approximately 2 mi northwest (Figure 2-11).

8.20.2 Study Area Investigation

The area of investigation was limited to the leach field at ST-305. Possible source materials in the septic tanks were not investigated.

8.20.2.1 Previous Investigations

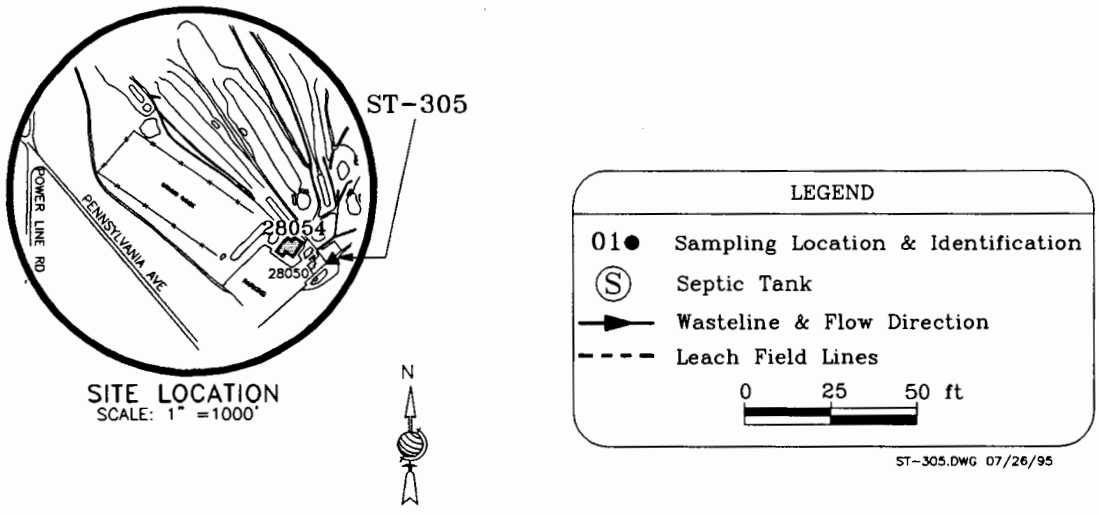
No previous investigations have been performed at this site.

8.20.2.2 Data Gaps

No information related to the past use of ST-305 was available for review. No data were available to determine the presence or absence of contaminants in the subsurface soils at the leach fields.

8.20.2.3 RFI Field Investigation

The objective of this investigation was to determine if contamination is present in the subsurface soil in the leach field area. On March 28, 1995, four boreholes were drilled and sampled using a Geoprobe. Borehole ST-305C-01 was drilled north of the leach field area to collect background concentration data for this site. This borehole was assumed to be in an area away from any known or suspected contamination. All other boreholes were drilled in the leach field area. Based on engineering drawings and observed field conditions, the leach field lines were determined to be 3 ft below grade. The sample interval at each borehole extended from the depth of the leach field line to 5 ft below the leach field line. From this interval, two samples were collected: one at a depth equal to the base of the leach field line, the other from 3 ft below the base of the leach field line.



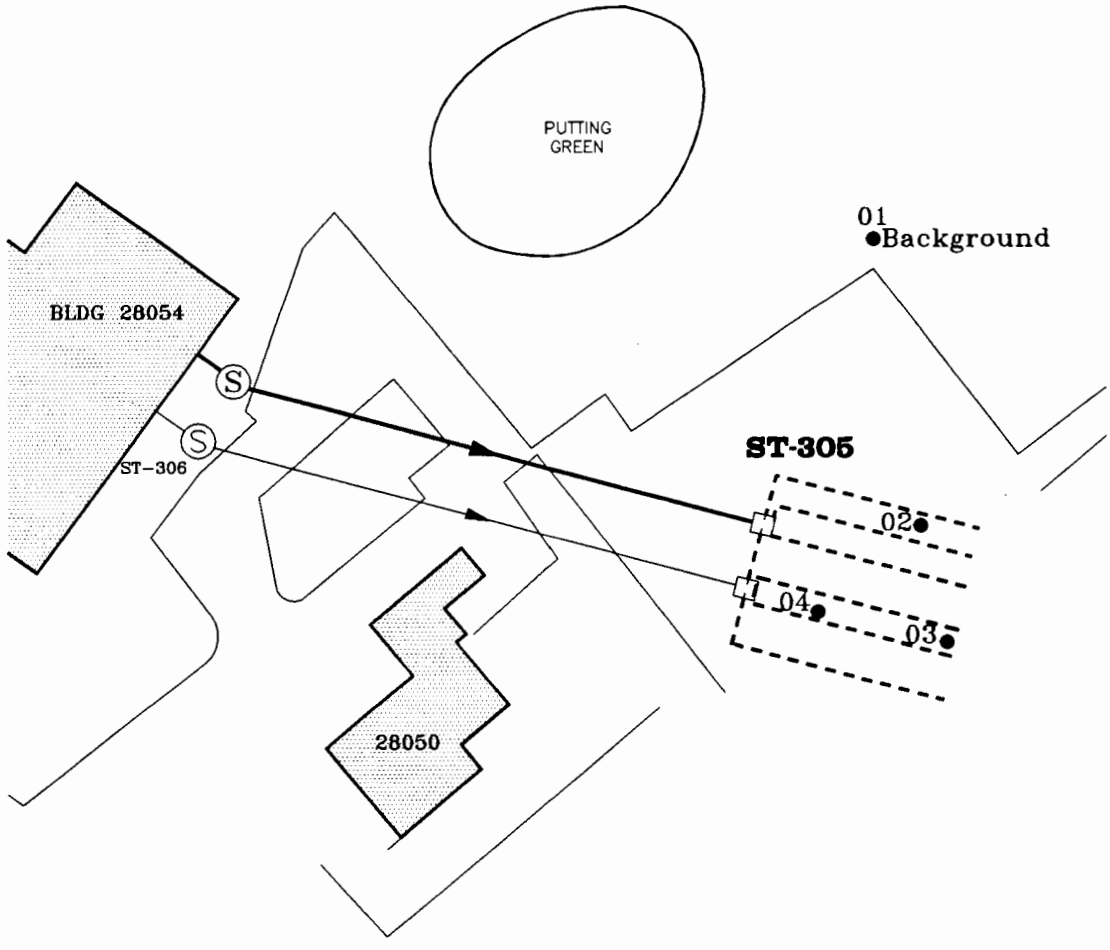


Figure 8-21. Soil Sampling Locations at SWMU 10-21, Bulding 28054, Septic Tank, Leach Field, and Lines (ST-305)

Sampling operations and sample handling procedures are described in Section 3.0. Borehole locations and depths of the samples that were sent to the laboratory are listed in Table 8-41. Borehole logs are in Appendix C.

Table 8-41. Boreholes and Samples Analyzed from SWMU 10-21, Building 28054, Septic Tank, Leach Field, and Lines (ST-305)

Borehole	Borehole Location	Sample Depth (ft)
01	Background Borehole	3–5
02	In the leach field area	3–5
03	In the leach field area	3–8[a]
04	In the leach field area	3–5

a. Both 2-ft sections of the 5-ft interval were used due to the collection of a replicate sample.

8.20.2.4 Laboratory Analysis

Five soil samples, including one replicate, were analyzed for VOCs, SVOCs, TPH as GRO and DRO, metals, mercury (the expected contaminants associated with normal operations at this building), soil pH, and soil moisture. The four brass tubes in each 2-ft sample interval were field-screened for possible contamination using a beta-gamma meter and a FID (as per health and safety requirements). No elevated readings were detected with these instruments.

8.20.3 Site Characteristics

8.20.3.1 Geology

The ST-305 area is underlain by unconsolidated alluvial sediment that is predominantly very fine-grained to fine-grained sand. Four 8-ft boreholes were drilled at ST-305. No boreholes penetrated into the Santa Fe Group sediments that presumably underlie this area. A discussion of the general geology at Kirtland AFB is presented in Section 2.4.

As a result of leach field installation, it is probable that backfill material is present in the leach field area. Borehole logs for this area are presented in Appendix C.

8.20.3.2 Hydrogeology

Groundwater beneath this area is found within the Upper Santa Fe sediments and is generally thought to be unconfined in the upper portion of the aquifer. This area is within the HR1 saturated zone setting as defined by SNL studies (Figure 2-9) (SNL, 1994). Hydrogeologic characterization in this portion of

Kirtland AFB is complicated by the presence of numerous production wells (Figure 2-11). It is probable that uniform groundwater conditions do not exist in this region. Local cones of depression associated with groundwater withdrawal have altered the groundwater flow direction in the vicinity of the well fields (Figure 2-7).

The gradient is probably north at this site. One production well is located in this area of Kirtland AFB: KAFB-4 is cross-gradient 2 mi northwest (Figures 2-7 and 2-11). Depth to groundwater is estimated to be about 350 ft below grade (Figure 2-10); however, shallower perched water zones may occur. Hydraulic conductivity within HR1 is estimated at 2 to 171 ft/day (SNL, 1994). A general discussion of the hydrogeology at Kirtland AFB is presented in Section 2.5.

8.20.4 Nature and Extent of Contamination

The following section describes the extent of contamination based on sampling results. Analytical results for soil samples submitted for analysis at ST-305 are summarized in Table 8-42, where only the reportable concentrations of detected analytes are listed. Full analytical results are presented in Appendix F. Laboratory validation reports are in Appendix K.

Organic Compounds

No VOC or SVOC analytes were detected in any of the soil samples submitted for analysis at ST-305.

Petroleum Hydrocarbons

No gasoline or diesel range hydrocarbons were detected in any of the soil samples submitted for analysis at ST-305.

Metals

Arsenic, beryllium, and manganese were the only metals detected at concentrations above the HHRB action levels in the soil samples submitted for analysis from ST-305 (Table 8-42). Arsenic (1.8 to 5.0 mg/kg) was detected in all samples collected. All concentrations were above the HHRB action level of 0.37 mg/kg but below the UTL of 6.5 mg/kg. Beryllium (0.41 to 0.84 mg/kg) was detected in all samples collected at ST-305 above the HHRB action level of 0.15 mg/kg, but below the UTL of 0.84 mg/kg (one detection was equal to the UTL). Beryllium and arsenic concentrations exceeding HHRB action levels appear to be naturally occurring throughout Kirtland AFB as discussed in Section 4.2.2.

Manganese (451 mg/kg) was detected in ST-305C-01, the background borehole, above the HHRB action level of 390 mg/kg, but below the UTL of 549 mg/kg. This manganese concentration is believed to be naturally occurring and is probably related to the underlying geology of this site as represented by the manganese concentrations ranging from 245 to 451 mg/kg.

Table 8-42. Summary of Reportable Concentrations for Soil Analyses at SWMU 10-21, Building 28054, Septic Tank, Leach Field, and Lines (ST-305)[1] (Concentrations mg/kg)

Chemical Class	Analyte	HHRB Action Level[2]	PQL UTL	Borehole Number and Sample Depth Interval (ft)				
				ST305C-01	*ST305C-02*	*ST305C-03*		*ST305C-04*
				3–5	3–5	3–8 FR	3–8	3–5
METALS	Aluminum	78,000	14,700	9,260	6,560	8,600	4,690	16,700
	Arsenic	0.37	6.5	4.2	1.8	2.4	5.0	4.4
	Barium	5,500	735	107	84.4	106	60.2	162
	Beryllium	0.15	0.84	0.55	0.43	0.62	0.41	0.84
	Cadmium	39.0	N/A	0.66	0.64	0.72	0.81	1.8
	Calcium	N/A	121,000	32,700	12,700	22,500	22,800	65,600
	Chromium, total	390	21.6	10.9	8.7	10.4	7.7	13.5
	Cobalt	4,700	15.4	6.7	5.3	6.7	4.3	7.4
	Copper	2,900	223	14.7	39.9	30.6	33.9	26.7
	Iron	N/A	23,800	12,100	9,440	11,900	10,100	16,300
	Lead	400	17.5	6.3	4.6	5.7	3.9	8.8
	Magnesium	N/A	10,400	4,040	2,660	3,590	2,500	5,620
	Manganese	390	549	451	324	299	245	266
	Nickel	1,600	188	9.7	6.6	10.2	6.5	13.4
	Potassium	N/A	3,590	1,880	1,780	2,250	1,070	3,120
	Sodium	N/A	787	716	77.8	114	77.8	280
	Thallium	N/A	N/A	0.14	ND	0.14	0.17	0.18
	Vanadium	550	55.3	22.5	17.1	20.6	19.6	34.0
	Zinc	23,000	114	33.8	40.0	37.0	27.5	43.7
OTHER	pH			7.7	7.7	7.8	8.0	7.9
	Moisture (%)			8.4	6.3	3.2	1.3	16.4

FOOTNOTES

1	Complete laboratory analytical results and method detection limits are presented in Appendix K.
2	Action level of RCRA Proposed Rule Subpart S (55 *FR* 30814, 7/27/90).
*	TPH action level is 100 mg/kg adopted from NMED UST regulations (NMED, 1990). SW-8015 analyzes volatile and semivolatile petroleum hydrocarbon fractions separately. The total concentration of the two fractions analyzed under SW-8015 will be used to assess compliance with stipulated action levels for the purpose of this RFI.
#	Denotes TCLP analysis, results in mg/l.
--	No Data.
FR	Field Replicate.
HHRB	Human health risk based.
J	Estimated value.
N/A	Not Applicable.
NA	Not Analyzed.
ND	Not detected above the method detection limit.
pCi/g	picocuries per gram.
PQL	Practical quantitation limits (defines VOC, SVOC, and TPH).
R	Reject NDs due to interference.
RAD	Radionuclides.
RE	Resample.
SVOC	Semivolatile organic compounds.
TPH	Total petroleum hydrocarbons.
U	Accept data (positive results may be influenced by lab contamination).
UJ	Estimated nondetect.
UTL	Upper tolerance limits (defines metals).
VOC	Volatile organic compounds.

Soil pH and Moisture

Soil pH ranged from 7.7 to 8.0 in these samples. Soil moisture values ranged from 1.3 to 16.4 percent (Table 8-42).

8.20.5 Conclusions and Recommendations

Conclusions

- No VOCs or SVOCs were detected in the soil samples submitted for analysis from this site.
- No diesel or gasoline range hydrocarbons were detected.
- Arsenic, beryllium, and manganese were the only metals detected at concentrations exceeding HHRB action levels. The beryllium and arsenic concentrations appear to be naturally occurring throughout Kirtland AFB; the manganese concentration appears to be naturally occurring at this site.
- The analytical results at ST-305 are not indicative of a contaminant release from this site.

Recommendations

- Based on the findings of the RFI, no further action is necessary; therefore, ST-305 does not require further investigation. A No Further Action proposal should be prepared.

8.21 SWMU 10-21, Building 28054, Septic Tank, Leach Field, and Lines (ST-306)

8.21.1 Site Background and Environmental Setting

Septic tank ST-306 is located east-southeast of Building 28054, the clubhouse at the golf course, in the central portion of Kirtland AFB (Figure 8-22). ST-306 discharges to the same leach field as ST-305, which was investigated on March 28, 1995.

Based on engineering drawings and observed site conditions, inflow and outflow line lengths are approximately 9 ft and 160 ft, respectively. This tank discharges to a leach field to the east with a drainage area approximately 60 ft x 44 ft. Potentially, the septic tank could have received contaminants from Building 28054. Due to the leach field's design, waste from ST-306 can be expected to have entered the surrounding soil.

ST-306 is located just east of the urban/industrial zone, which is discussed in Section 2.0. The nearest production well to this site is KAFB-4, located approximately 2 mi northwest (Figure 2-11).

8.21.2 Study Area Investigation

The area of investigation was limited to the leach field at ST-306, which is the leach field associated with ST-305. The leach field investigation is presented under Section 8.20 of this RFI. Possible source materials in the septic tank were not investigated.

8.21.2.1 Previous Investigations

No previous investigations have been performed at this site.

8.21.2.2 Data Gaps

No information related to the past use of ST-306 was available for review. No data were available to determine the presence or absence of contaminants in the subsurface soils at the leach field.

8.21.2.3 RFI Field Investigation

The objective of this investigation was to determine if contamination is present in the subsurface soil in the leach field area. Septic tank ST-306 discharges to the same leach field area as ST-305. The sample locations from ST-305 are used to describe both sites. See Section 8.20.2.3.

8.21.2.4 Laboratory Analysis

See Section 8.20.2.4.

8.21.3 Site Characteristics

8.21.3.1 Geology

See Section 8.20.3.1

8.21.3.2 Hydrogeology

See Section 8.20.3.2.

8.21.4 Nature and Extent of Contamination

See Section 8.20.4.

8.21.5 Conclusions and Recommendations

See Section 8.20.5.

8.22 SWMU 10-21, Building 30101, Septic Tank, Leach Field, and Lines (ST-307)

8.22.1 Site Background and Environmental Setting

Septic tank ST-307 is located 5 ft south of Building 30101, which formerly was the entrance to the MWSA and was also an equipment research testing facility in the central portion of Kirtland AFB (Figure 8-22). ST-307 was investigated on February 20, 1995.

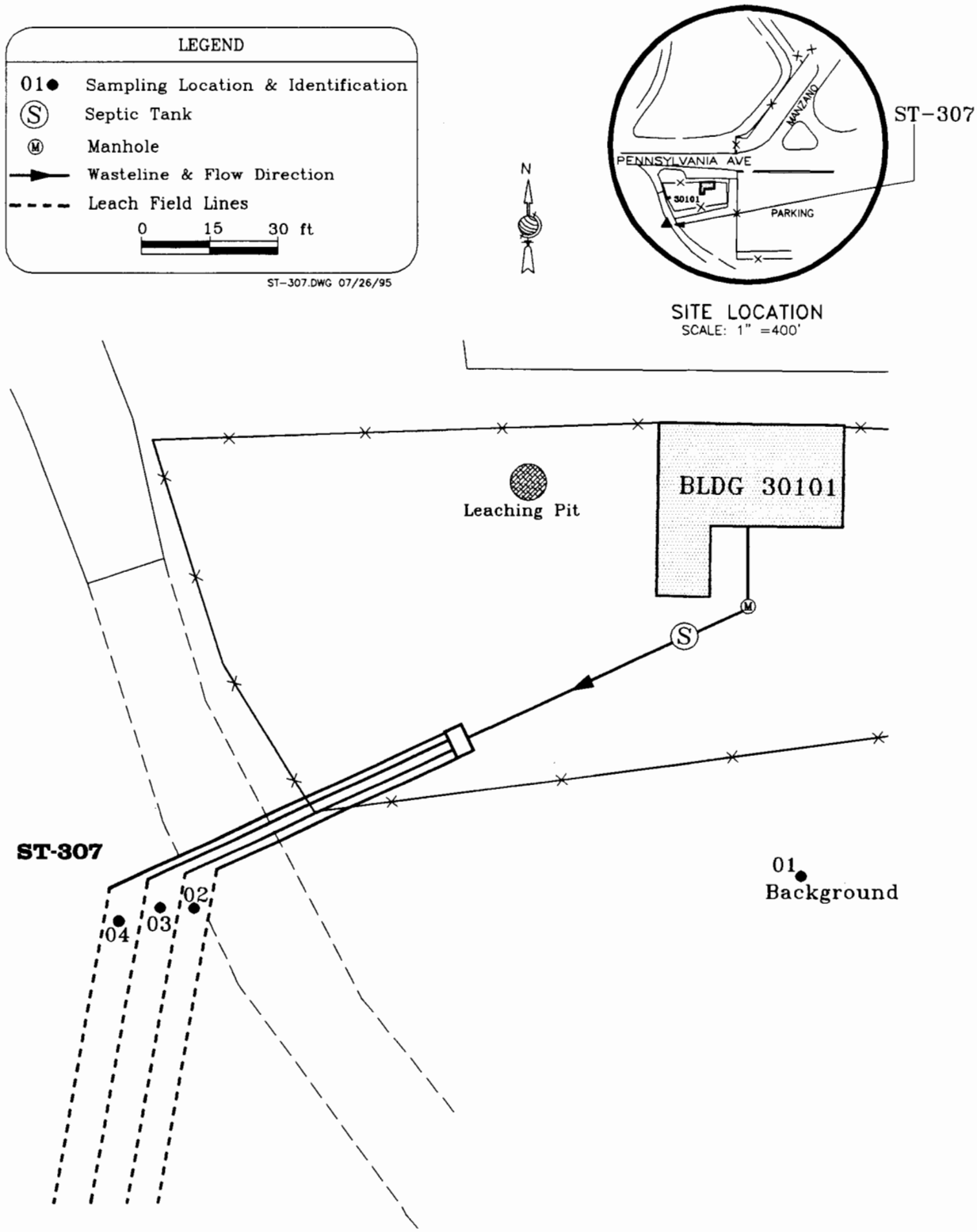


Figure 8-22. Soil Sampling Locations at SWMU 10-21, Building 30101, Septic Tank, Leach Field, and Lines (ST-307)

Based on engineering drawings and observed site conditions, inflow and outflow line lengths are estimated to be approximately 30 ft and 125 ft, respectively. This tank discharges to a leach field to the southwest with a drainage area approximately 70 ft x 25 ft. Potentially, the septic tank could have received contaminants from Building 30101. Due to the leach field's design, waste from ST-307 can be expected to have entered the surrounding soil.

Building 30101 is located near the entrance to the MWSA. This site is isolated from the urban/industrial environmental zone and is located at the foot of the Manzano Mountains on the east boundary of the Albuquerque-Belen Basin. No production wells exist near this site (Figure 2-11).

8.22.2 Study Area Investigation

The area of investigation was limited to the leach field at ST-307. Possible source materials in the septic tank were not investigated.

8.22.2.1 Previous Investigations

No previous investigations have been performed at this site.

8.22.2.2 Data Gaps

No information related to the past use of ST-307 was available for review. No data were available to determine the presence or absence of contaminants in the subsurface soils at the leach fields.

8.22.2.3 RFI Field Investigation

The objective of this investigation was to determine if contamination is present in the subsurface soil in the leach field area. On February 20, 1995, four boreholes were drilled and sampled using a Geoprobe. Borehole ST-307C-01 was drilled east of the leach field area to collect background concentration data for this site. This borehole was assumed to be in an area away from any known or suspected contamination. All other boreholes were drilled in the leach field area. Based on engineering drawings and observed field conditions, the leach field lines were determined to be 3 ft below grade. The sample interval at each borehole extended from the depth of the leach field line to 5 ft below the leach field line. From this interval, two samples were collected: one at a depth equal to the base of the leach field line, the other from 3 ft below the base of the leach field line.

Sampling operations and sample handling procedures are described in Section 3.0. Borehole locations and depths of the samples that were sent to the laboratory are listed in Table 8-43. Borehole logs are in Appendix C.

Table 8-43. Boreholes and Samples Analyzed from SWMU 10-21, Building 30101, Septic Tank, Leach Field, and Lines (ST-307)

Borehole	Borehole Location	Sample Depth (ft)
01	Background borehole	3–8[a]
02	In the leach field area	3–8[b]
03	In the leach field area	6–8[c]
04	In the leach field area	3–5

a. Both 2-ft sections of the 5-ft interval were used due to the collection of a MS/MSD sample.
b. Both 2-ft sections of the 5-ft interval were used due to the collection of a replicate sample.
c. The lower 2-ft section of the 5-ft interval was used due to the low recovery in the upper 2-ft section.

8.22.2.4 Laboratory Analysis

Five soil samples, including one replicate, were analyzed for VOCs, SVOCs, TPH as GRO and DRO, metals, mercury (the expected contaminants associated with normal operations at this building), soil pH, and soil moisture. The four brass tubes in each 2-ft sample interval were field-screened for possible contamination using a beta-gamma meter and a FID (as per health and safety requirements). No elevated readings were detected with these instruments.

8.22.3 Site Characteristics

8.22.3.1 Geology

The ST-307 area is underlain by unconsolidated alluvial sediment that is predominantly fine-grained sand to very coarse, well-graded sand with some gravel. Four 8-ft boreholes were drilled at ST-307. No boreholes penetrated into the Santa Fe Group sediments that presumably underlie this area. A discussion of the general geology at Kirtland AFB is presented in Section 2.4. As a result of leach field installation, it is probable that backfill material is present in the leach field area. Borehole logs for this area are presented in Appendix C.

8.22.3.2 Hydrogeology

This site is in the HR2 saturated zone setting as defined by SNL studies (Figure 2-9) (SNL, 1994). HR2 straddles the Tijeras/Hubbell Springs/Sandia Fault complex. The saturated zone hydrogeology is characterized by the juxtaposition of higher permeability Santa Fe Group sediments against low permeability Paleozoic and Precambrian bedrock (Thorn *et al.*, 1993). Santa Fe Group sediments are faulted down to the west along the faults. Very little is known about groundwater flow in this region

except that a steep gradient exists across the fault zone. East of the fault zone, the static water elevation is estimated at 5,710 ft amsl (Figure 2-7).

Groundwater beneath ST-307 is estimated to be approximately 320 ft below the surface (Figure 2-10). This area may serve as a recharge area for the Albuquerque basin aquifer with groundwater movement west across the fault (SNL, 1994). A more detailed discussion of the hydrogeology at Kirtland AFB is presented in Section 2.5.

8.22.4 Nature and Extent of Contamination

The following section describes the extent of contamination based on sampling results. Analytical results for soil samples collected and submitted for analysis from ST-307 are summarized in Table 8-44, where only the reportable concentrations of detected analytes are listed. Full analytical results are presented in Appendix F. Laboratory validation reports are in Appendix K.

Organic Compounds

No VOC or analytes were detected in any of the soil samples submitted for analysis at ST-307.

The SVOC bis(2-ethylhexyl)phthalate (0.35 mg/kg) was detected in ST-307C-01, the background soil sample, at a concentration below the HHRB action level of 46 mg/kg.

Petroleum Hydrocarbons

No gasoline or diesel range hydrocarbons were detected in any of the soil samples submitted for analysis at ST-307.

Metals

Arsenic, beryllium, and manganese were the only metals detected at concentrations above the HHRB action levels in the soil samples submitted for analysis from ST-307 (Table 8-44). Arsenic (0.95 to 3.4 mg/kg) was detected in four of the five samples collected. All concentrations were above the HHRB action level of 0.37 mg/kg, but below the UTL of 6.5 mg/kg. Beryllium (0.31 to 0.44 mg/kg) was detected in all samples submitted for analysis at ST-307 above the HHRB action level of 0.15 mg/kg, but below the UTL of 0.84 mg/kg. Beryllium and arsenic concentrations exceeding HHRB action levels appear to be naturally occurring throughout Kirtland AFB as discussed in Section 4.2.2.

Manganese was detected in ST-307C-03 (406 mg/kg) above the HHRB action level of 390 mg/kg, but below the UTL of 549 mg/kg. Manganese was also detected in the other four soil samples analyzed at concentrations below the HHRB (249 to 388 mg/kg). This concentration is believed to be naturally occurring and is probably related to the underlying geology of this site as represented by the concentrations ranging from 249 to 406 mg/kg.

Table 8-44. Summary of Reportable Concentrations for Soil Analyses at SWMU 10-21, Building 30101, Septic Tank, Leach Field, and Lines (ST-307)[1] (Concentrations mg/kg)

Chemical Class	Analyte	HHRB Action Level[2]	PQL UTL	Borehole Number and Sample Depth Interval (ft)				
				ST307C-01	*ST307C-02*		*ST307C-03*	*ST307C-04*
				3–8	3–8 FR	3–8	6–8	3–5
SVOC	Bis(2-ethylhexyl)phthalate	46.0	0.70	0.35	ND	ND	ND	ND
METALS	Aluminum	78,000	14,700	11,600	11,100	11,600	11,800	12,900
	Arsenic	0.37	6.5	2.5	1.3	ND	0.95	3.4
	Barium	5,500	735	148	175	135	107	229
	Beryllium	0.15	0.84	0.42	0.31	0.32	0.41	0.44
	Cadmium	39.0	N/A	ND	1.7	0.74	1.1	ND
	Calcium	N/A	121,000	19,900	18,300	15,100	11,500	90,700
	Chromium, total	390	21.6	35.4	30.8	37.1	49.2	48.5
	Cobalt	4,700	15.4	17.2	20.6	18.7	20.0	13.7
	Copper	2,900	223	53.6	58.1	128	52.2	83.4
	Iron	N/A	23,800	22,100	23,600	22,200	25,900	19,700
	Lead	400	17.5	6.0	5.5	4.0	5.4	6.5
	Magnesium	N/A	10,400	11,800	10,700	10,200	11,000	9,360
	Manganese	390	549	350	386	369	406	249
	Molybdenum	390	N/A	ND	ND	ND	ND	6.1
	Nickel	1,600	188	41.2	25.1	28.8	49.3	25.4
	Potassium	N/A	3,590	3,090	3,670	4,350	3,300	3,010
	Sodium	N/A	787	350	186	234	333	346
	Thallium	N/A	N/A	0.10	0.28	0.18	0.11	0.11
	Vanadium	550	55.3	55.4	51.5	51.9	58.0	47.5
	Zinc	23,000	114	52.5	60.8	71.2	52.2	55.8
OTHER	pH			9.1	8.7	8.8	9.3	8.6
	Moisture (%)			4.7	3.3	4.9	1.9	8.3

FOOTNOTES

1	Complete laboratory analytical results and method detection limits are presented in Appendix K.
2	Action level of RCRA Proposed Rule Subpart S (55 *FR* 30814, 7/27/90).
*	TPH action level is 100 mg/kg adopted from NMED UST regulations (NMED, 1990). SW-8015 analyzes volatile and semivolatile petroleum hydrocarbon fractions separately. The total concentration of the two fractions analyzed under SW-8015 will be used to assess compliance with stipulated action levels for the purpose of this RFI.
#	Denotes TCLP analysis, results in mg/l.
--	No Data.
FR	Field Replicate.
HHRB	Human health risk based.
J	Estimated value.
N/A	Not Applicable.
NA	Not Analyzed.
ND	Not detected above the method detection limit.
pCi/g	picocuries per gram.
PQL	Practical quantitation limits (defines VOC, SVOC, and TPH).
R	Reject NDs due to interference.
RAD	Radionuclides.
RE	Resample.
SVOC	Semivolatile organic compounds.
TPH	Total petroleum hydrocarbons.
U	Accept data (positive results may be influenced by lab contamination).
UJ	Estimated nondetect.
UTL	Upper tolerance limits (defines metals).
VOC	Volatile organic compounds.

Soil pH and Moisture

Soil pH ranged from 8.6 to 9.3 in these samples. Soil moisture values ranged from 1.9 to 8.3 percent (Table 8-44).

8.22.5 Conclusions and Recommendations

Conclusions

- No VOCs were detected in the soil samples submitted for analysis from this site.
- One SVOC was detected in the soil sample submitted for analysis at the background borehole (ST-307C-01), but the concentration was below the HHRB action level.
- No diesel or gasoline range hydrocarbons were detected.
- Arsenic, beryllium, and manganese were the only metals detected at concentrations exceeding HHRB action levels. The beryllium and arsenic concentrations appear to be naturally occurring throughout Kirtland AFB; the manganese concentration appears to be naturally occurring at this site.
- The analytical results at ST-307 are not indicative of a contaminant release from this site.

Recommendations

- Based on the findings of the RFI, no further action is necessary; therefore, ST-307 does not require further investigation. A No Further Action proposal should be prepared.

8.23 SWMU 10-21, Building 37511, Septic Tank, Leach Field, and Lines (ST-308)

8.23.1 Site Background and Environmental Setting

Septic tank ST-308 is located 420 ft southwest of Building 37511, the Rescue Fire Team Facility, in the central portion of Kirtland AFB (Figure 8-23). ST-308 was investigated on March 6, 1995.

Based on engineering drawings and observed site conditions, inflow and outflow line lengths are approximately 420 ft and 65 ft, respectively. This tank discharges to a leach field to the south-southwest with a drainage area approximately 110 ft x 30 ft. Potentially, the septic tank could have received contaminants from Building 37511. Due to the leach field's design, waste from ST-307 can be expected to have entered the surrounding soil.

Building 37511 is located near the entrance on the inside of the fenced compound to the MWSA. This site is isolated from the urban/industrial environmental zone and is located at the foot of the Manzano Mountains on the east boundary of the Albuquerque-Belen Basin. No production wells exist near this site (Figure 2-11).

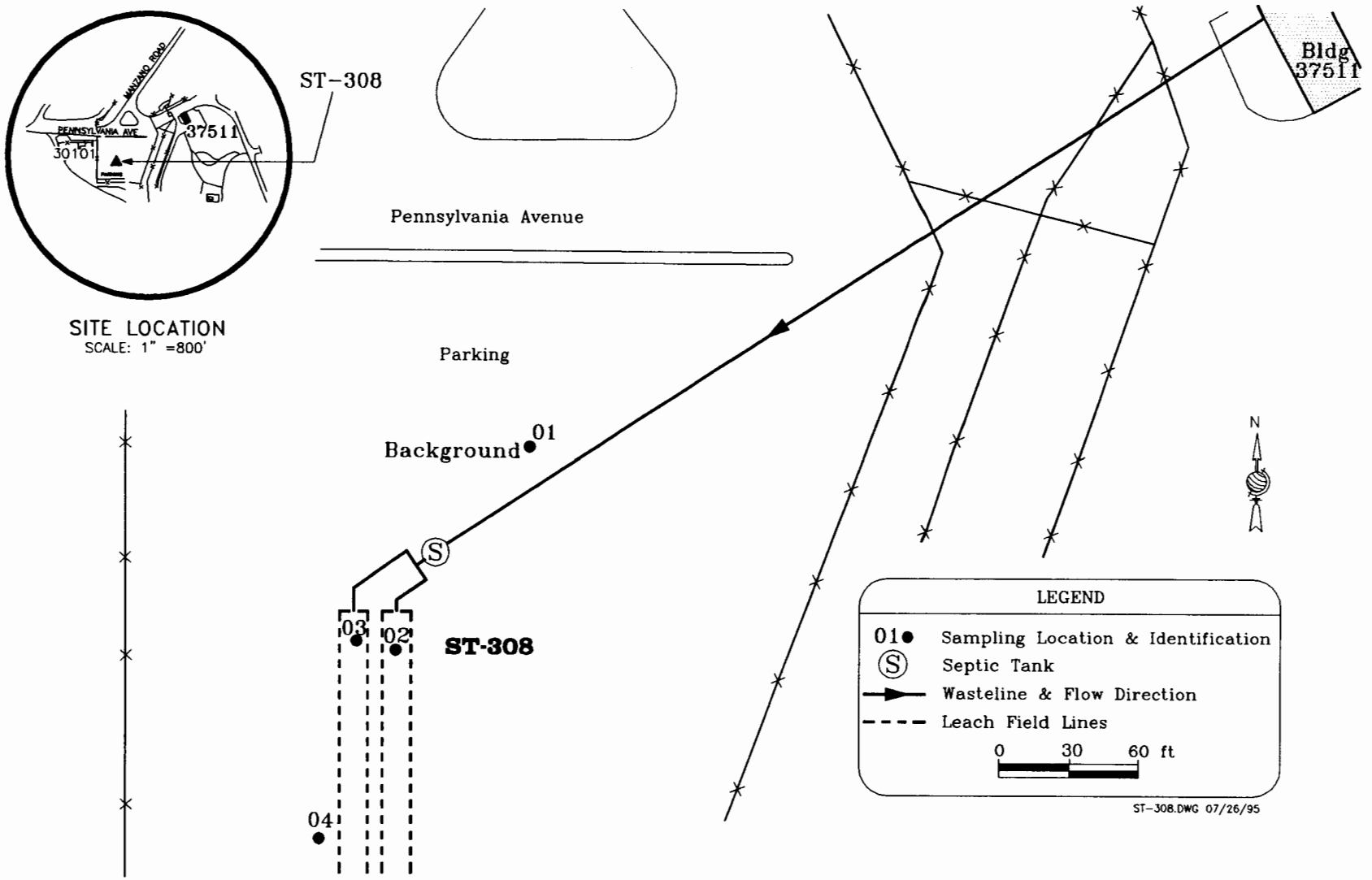


Figure 8-23. Soil Sampling Locations at SWMU 10-21, Building 37511, Septic Tank, Leach Field, and Lines (ST-308)

8.23.2 Study Area Investigation

The area of investigation was limited to the leach field at ST-308. Possible source materials in the septic tank were not investigated.

8.23.2.1 Previous Investigations

No previous investigations have been performed at this site.

8.23.2.2 Data Gaps

No information related to the past use of ST-308 was available for review. No data were available to determine the presence or absence of contaminants in the subsurface soils at the leach fields.

8.23.2.3 RFI Field Investigation

The objective of this investigation was to determine if contamination is present in the subsurface soil in the leach field area. On March 8, 1995, four boreholes were drilled and sampled using a Geoprobe. Borehole ST-308C-01 was drilled northeast of the leach field area to collect background concentration data for this site. This borehole was assumed to be in an area away from any known or suspected contamination. All other boreholes were drilled in the leach field area. Based on engineering drawings and observed field conditions, the leach field lines were determined to be 3 ft below grade. The sample interval at each borehole extended from the depth of the leach field line to 5 ft below the leach field line. From this interval, two samples were collected: one at a depth equal to the base of the leach field line, the other from 3 ft below the base of the leach field line.

Sampling operations and sample handling procedures are described in Section 3.0 . Borehole locations and depths of the samples that were sent to the laboratory are listed in Table 8-45. Borehole logs are in Appendix C.

Table 8-45. Boreholes and Samples Analyzed from SWMU 10-21, Building 37511, Septic Tank, Leach Field, and Lines (ST-308)

Borehole	Borehole Location	Sample Depth (ft)
ST-308C-01	Background borehole	3–5
ST-308C-02	In the leach field area	3–5
ST-308C-03	In the leach field area	3–5
ST-308C-04	In the leach field area	3–5

8.23.2.4 Laboratory Analysis

Four soil samples were analyzed for VOCs, SVOCs, TPH as GRO and DRO, metals, mercury (the expected contaminants associated with normal operations at this building), soil pH, and soil moisture. The four brass tubes in each 2-ft sample interval were field-screened for possible contamination using a

beta-gamma meter and a FID (as per health and safety requirements). No elevated readings were detected with these instruments.

8.23.3 Site Characteristics

8.23.3.1 Geology

The ST-308 area is underlain by unconsolidated alluvial sediment that is predominantly very fine-grained to very coarse-grained, well-graded sand. Four 8-ft boreholes were drilled at ST-308. No boreholes penetrated into the Santa Fe Group sediments that presumably underlie this area. A discussion of the general geology at Kirtland AFB is presented in Section 2.4.

As a result of leach field installation, it is probable that backfill material (pea gravel immediately adjacent to the leach field lines) is present in the leach field area. Borehole logs for this area are presented in Appendix C.

8.23.3.2 Hydrogeology

This site is in the HR2 saturated zone setting as defined by SNL studies (Figure 2-9) (SNL, 1994). HR2 straddles the Tijeras/Hubbell Springs/Sandia Fault complex. The saturated zone hydrogeology is characterized by the juxtaposition of higher permeability Santa Fe Group sediments against low permeability Paleozoic and Precambrian bedrock (Thorn *et al.*, 1993). Santa Fe Group sediments are faulted down to the west along the faults. Very little is known about groundwater flow in this region except that a steep gradient exists across the fault zone. East of the fault zone, the static water elevation is estimated at 5,710 ft amsl (Figure 2-7).

Groundwater beneath ST-308 is estimated to be approximately 320 ft below the surface (Figure 2-10). This area may serve as a recharge area for the Albuquerque Basin aquifer with groundwater movement west across the fault (SNL, 1994). A more detailed discussion of the hydrogeology at Kirtland AFB is presented in Section 2.5.

8.23.4 Nature and Extent of Contamination

The following section describes the extent of contamination based on sampling results. Analytical results for soil samples collected and submitted for analysis from ST-308 are summarized in Table 8-46, where only the reportable concentrations of detected analytes are listed. Full analytical results are presented in Appendix F. Laboratory validation reports are in Appendix K.

Organic Compounds

No VOC analytes were detected in any of the soil samples submitted for analysis at ST-308.

The SVOC analytes di-n-butylphthalate and benzyl butyl phthalate were detected in one or more of the soil samples collected at ST-308. Di-n-butylphthalate (1.9 to 2.5 mg/kg) was detected in all samples collected. Benzyl butyl phthalate (0.43 mg/kg) was detected in only one soil sample (ST-308C-01), from the background borehole. All concentrations were below HHRB action levels (Table 8-46).

Table 8-46. Summary of Reportable Concentrations for Soil Analyses at SWMU 10-21, Building 37511, Septic Tank, Leach Field and Lines (ST-308)[1] (Concentrations mg/kg)

Chemical Class	Analyte	HHRB Action Level[2]	PQL UTL	Borehole Number and Sample Depth Interval (ft)			
				ST308C-01 3–5	*ST308C-02* 3–5	*ST308C-03* 3–5	*ST308C-04* 3–5
SVOC	Benzyl butyl phthalate	16,000	1.3	0.43	ND	ND	ND
	Di-n-butylphthalate	7,800	0.70	1.9	2.1	2.3	2.5
TPH	Diesel fraction	100	10.0	ND	ND	4.7	ND
METALS	Aluminum	78,000	14,700	10,400	10,900	8,740	10,400
	Arsenic	0.37	6.5	2.7	1.4	1.1	1.4
	Barium	5,500	735	152	120	187	119
	Beryllium	0.15	0.84	0.31	0.32	0.31	0.31
	Cadmium	39.0	N/A	0.61	1.3	0.73	1.7
	Calcium	N/A	121,000	31,300	44,100	16,900	11,400
	Chromium, total	390	21.6	28.3	27.2	23.7	27.9
	Cobalt	4,700	15.4	16.4	16.1	14.0	19.8
	Copper	2,900	223	40.8	108	111	163
	Iron	N/A	23,800	17,700	18,600	15,600	23,200
	Lead	400	17.5	4.9	4.7	5.5	4.4
	Magnesium	N/A	10,400	9,830	9,750	7,910	11,100
	Manganese	390	549	315	337	299	396
	Nickel	1,600	188	30.2	34.7	36.2	40.6
	Potassium	N/A	3,590	2,880	2,680	1,970	2,860
	Sodium	N/A	787	118	121	84.8	109
	Thallium	N/A	N/A	0.10	0.11	0.13	0.10
	Vanadium	550	55.3	46.6	43.8	35.3	53.0
	Zinc	23,000	114	39.7	59.1	70.2	80.7
OTHER	pH			8.6	8.6	7.8	8.7
	Moisture (%)			1.9	6.7	4.1	3.2

FOOTNOTES

1	Complete laboratory analytical results and method detection limits are presented in Appendix K.
2	Action level of RCRA Proposed Rule Subpart S (55 FR 30814, 7/27/90).
*	TPH action level is 100 mg/kg adopted from NMED UST regulations (NMED, 1990). SW-8015 analyzes volatile and semivolatile petroleum hydrocarbon fractions separately. The total concentration of the two fractions analyzed under SW-8015 will be used to assess compliance with stipulated action levels for the purpose of this RFI.
#	Denotes TCLP analysis, results in mg/l.
--	No Data.
FR	Field Replicate.
HHRB	Human health risk based.
J	Estimated value.
N/A	Not Applicable.
NA	Not Analyzed.
ND	Not detected above the method detection limit.
pCi/g	picocuries per gram.
PQL	Practical quantitation limits (defines VOC, SVOC, and TPH).
R	Reject NDs due to interference.
RAD	Radionuclides.
RE	Resample.
SVOC	Semivolatile organic compounds.
TPH	Total petroleum hydrocarbons.
U	Accept data (positive results may be influenced by lab contamination).
UJ	Estimated nondetect.
UTL	Upper tolerance limits (defines metals).
VOC	Volatile organic compounds.

Petroleum Hydrocarbons

No gasoline range hydrocarbons were detected in any of the boreholes at ST-308. Diesel range hydrocarbons (4.7 mg/kg) were detected in one soil sample (ST-308C-03). This concentration was below the NMED action level of 100 mg/kg.

Metals

Arsenic, beryllium, and manganese were the only metals detected at concentrations above the HHRB action levels in the soil samples from ST-308 (Table 8-46). Arsenic (1.1 to 2.7 mg/kg) was detected in all samples analyzed. All concentrations were above the HHRB action level of 0.37 mg/kg, but below the UTL of 6.5 mg/kg. Beryllium (0.31 to 0.32 mg/kg) was detected in all samples analyzed at ST-308 above the HHRB action level of 0.15 mg/kg, but below the UTL of 0.84 mg/kg. Beryllium and arsenic concentrations exceeding HHRB action levels appear to be naturally occurring throughout Kirtland AFB as discussed in Section 4.2.2.

Manganese was detected in ST-308C-04 (396 mg/kg) above the HHRB action level of 390 mg/kg, but below the UTL of 549 mg/kg. This concentration is believed to be naturally occurring and is probably related to the underlying geology of this site as represented by the concentrations ranging from 299 to 396 mg/kg.

Soil pH and Moisture

Soil pH ranged from 7.8 to 8.7 in these samples. Soil moisture values ranged from 1.9 to 6.7 percent (Table 8-46).

8.23.5 Conclusions and Recommendations

Conclusions

- No VOCs were detected in the soil samples collected from this site.
- Two SVOCs were detected in the soil samples collected at ST-308, but below the HHRB action levels.
- No gasoline range hydrocarbons were detected. Diesel range hydrocarbons were detected in one sample at this site. The concentration did not exceed the NMED action level of 100 mg/kg. The diesel range hydrocarbon concentration detected was similar to the concentrations detected in background samples analyzed during the Appendix III RFI; and is not attributable to a release.

- Arsenic, beryllium, and manganese were the only metals detected at concentrations exceeding HHRB action levels. The beryllium and arsenic concentrations appear to be naturally occurring throughout Kirtland AFB; the manganese concentrations appear to be naturally occurring at this site.

- The analytical results at ST-308 are not indicative of a release from the unit.

Recommendations

- Based on the findings of the RFI, no further action is necessary; therefore, ST-308 does not require further investigation. A No Further Action proposal should be prepared.

8.24 SWMU 10-21, Building 37504, Septic Tank, Leach Field, and Lines (ST-309)

8.24.1 Site Background and Environmental Setting

Septic tank ST-309 is located 45 ft west-northwest of Building 37504, an equipment research facility inside the MWSA, in the central portion of Kirtland AFB (Figure 8-24). This site is isolated from the urban/industrial environmental zone and is located at the foot of the Manzano Mountains on the east boundary of the Albuquerque-Belen Basin. No production wells are near this site (Figure 2-11). ST-309 was investigated on March 15, 1995.

Based on engineering drawings and observed site conditions, inflow and outflow line lengths are approximately 75 ft and 10 ft, respectively. This tank discharges to a leach field to the northwest with a drainage area approximately 80 ft x 40 ft. Potentially, the septic tank could have received contaminants from Building 37504. Due to the leach field's design, waste from ST-309 can be expected to have entered the surrounding soil.

8.24.2 Study Area Investigation

The area of investigation was limited to the leach field at ST-309. Possible source materials in the septic tank were not investigated.

8.24.2.1 Previous Investigations

No previous investigations have been performed at this site.

8.24.2.2 Data Gaps

No information related to the past use of ST-309 was available for review. No data were available to determine the presence or absence of contaminants in the subsurface soils at the leach fields.

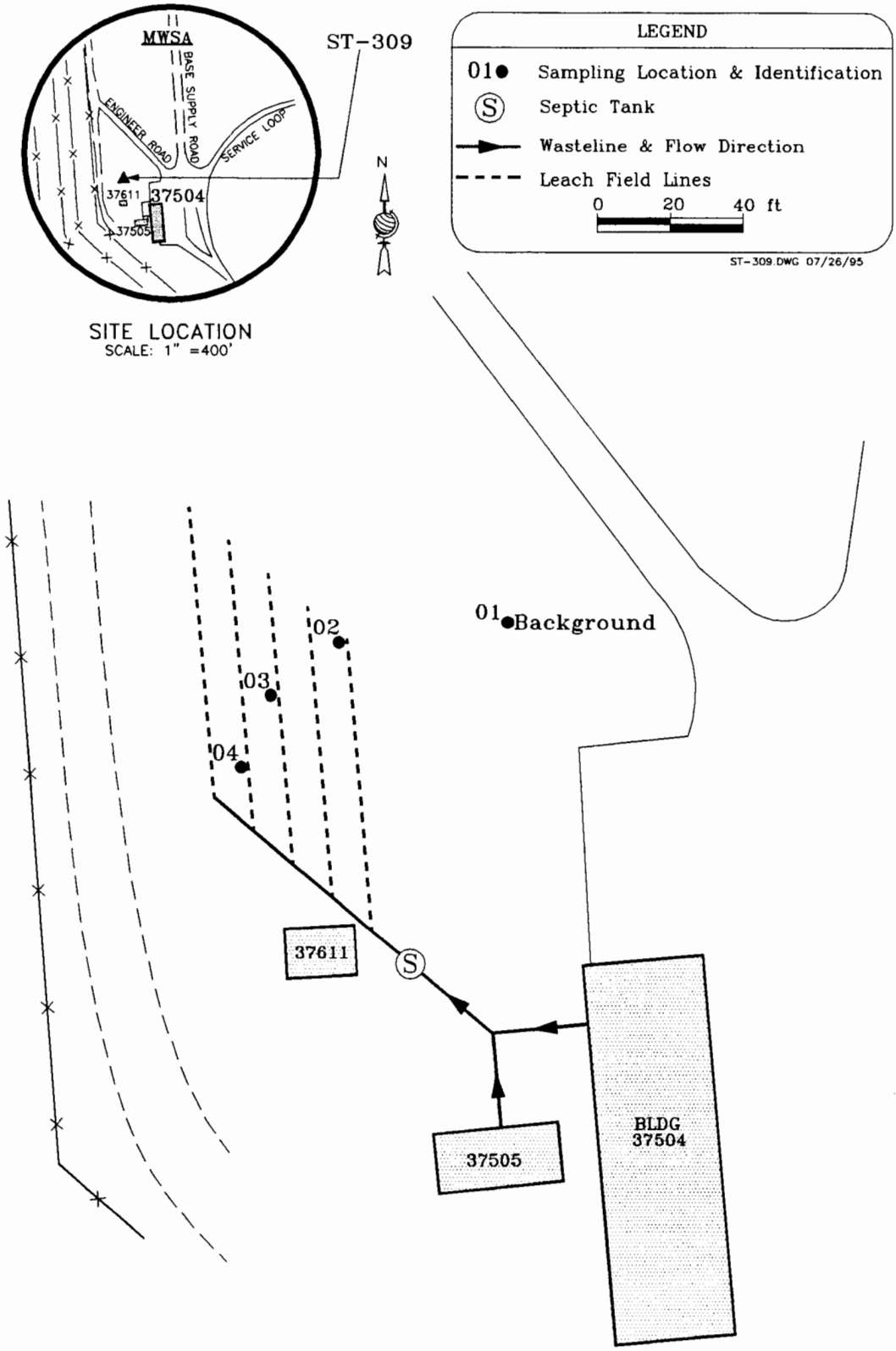


Figure 8-24. Soil Sampling Locations at SWMU 10-21, Building 37504, Septic Tank, Leach Field, and Lines (ST-309)

8.24.2.3 RFI Field Investigation

The objective of this investigation was to determine if contamination is present in the subsurface soil in the leach field area. On March 15, 1995, four boreholes were drilled and sampled using a Geoprobe. Borehole ST-309C-01 was drilled northeast of the leach field area to collect background concentration data for this site. This borehole was assumed to be in an area away from any known or suspected contamination. All other boreholes were drilled in the leach field area. Based on engineering drawings and observed field conditions, the leach field lines were determined to be 4 ft below grade. The sample interval at each borehole extended from the depth of the leach field line to 5 ft below the leach field line. From this interval, two samples were collected: one at a depth equal to the base of the leach field line, the other from 3 ft below the base of the leach field line. Due to poor sample recovery, the 8- to 10-ft interval was sampled at ST-309C-02.

Sampling operations and sample handling procedures are described in Section 3.0. Borehole locations and depths of the samples that were sent to the laboratory are listed in Table 8-47. Borehole logs are in Appendix C.

Table 8-47. Boreholes and Samples Analyzed from SWMU 10-21, Building 37504, Septic Tank, Leach Field, and Lines (ST-309)

Borehole	Borehole Location	Sample Depth	FID (ppm_v)
ST-309C-01	Background borehole	4–6	0
ST-309C-02	In the leach field area	8–10[a]	2
ST-309C-03	In the leach field area	4–6	0
ST-309C-04	In the leach field area	7–9[b]	0

FID readings are values above background values recorded in ppm_v as methane)

a. Due to poor sample recovery, the interval shown was analyzed.

8.24.2.4 Laboratory Analysis

Four soil samples were analyzed for VOCs, SVOCs, TPH as GRO and DRO, metals, mercury (the expected contaminants associated with normal operations at this building), soil pH, and soil moisture. The four brass tubes in each 2-ft sample interval were field-screened for possible contamination using a beta-gamma meter and a FID (as per health and safety requirements). Elevated FID readings were measured in samples collected for laboratory analysis at ST-309C-02. The brass tube with the highest FID reading measured in the sample interval was submitted for VOC analysis. The highest reading measured for the sample interval is listed in Table 8-47.

8.24.3 Site Characteristics

8.24.3.1 Geology

The ST-309 area is underlain by unconsolidated alluvial sediment and weathered granite. The sediment is sandy gravel to well-graded sand. One 6-ft, one 10-ft, and two 9-ft deep boreholes were drilled at

ST-309. No boreholes penetrated into the Santa Fe Group sediments that presumably underlie this area. A discussion of the general geology at Kirtland AFB is presented in Section 2.4.

As a result of leach field installation, it is probable that backfill material is present in the leach field area. Borehole logs for this area are presented in Appendix C.

8.24.3.2 Hydrogeology

This site is in the HR2 saturated zone setting as defined by SNL studies (Figure 2-9) (SNL, 1994). HR2 straddles the Tijeras/Hubbell Springs/Sandia Fault complex. The saturated zone hydrogeology is characterized by the juxtaposition of higher permeability Santa Fe Group sediments against low permeability Paleozoic and Precambrian bedrock (Thorn *et al.,* 1993). Santa Fe Group sediments are faulted down to the west across the faults. Very little is known about groundwater flow in this region except that a steep gradient exists across the fault zone. East of the fault zone, the static water elevation is estimated at 5,710 ft amsl (Figure 2-7).

Groundwater beneath ST-309 is estimated to be approximately 320 ft below the surface (Figure 2-10). This area may serve as a recharge area for the Albuquerque Basin aquifer with groundwater movement west across the fault (SNL, 1994). A more detailed discussion of the hydrogeology at Kirtland AFB is presented in Section 2.5.

8.24.4 Nature and Extent of Contamination

The following section describes the extent of contamination based on sampling results. Analytical results for soil samples collected and submitted for analysis from ST-309 are summarized in Table 8-48, where only the reportable concentrations of detected analytes are listed. Full analytical results are presented in Appendix F. Laboratory validation reports are in Appendix K.

Organic Compounds

No VOC analytes were detected in any of the soil samples submitted for analysis at ST-309.

Di-n-butylphthalate was the only SVOC analyte detected in the soil samples submitted for analysis, ranging from 1.2 to 1.8 mg/kg. All concentrations were below the HHRB action level of 7,800 mg/kg.

Petroleum Hydrocarbons

No gasoline or diesel range hydrocarbons were detected in any of the analyzed soil samples.

Metals

Arsenic and beryllium were the only metals detected at concentrations above the HHRB action levels in soil samples analyzed from ST-309 (Table 8-48). Arsenic (3.2 to 7.9 mg/kg) was detected in all samples analyzed. All concentrations were above the HHRB action level of 0.37 mg/kg, but only one was above the UTL of

Table 8-48. Summary of Reportable Concentrations for Soil Analyses at SWMU 10-21, Building 37504, Septic Tank, Leach Field, and Lines (ST-309)[1] (Concentrations mg/kg)

Chemical Class	Analyte	HHRB Action Level[2]	PQL UTL	Borehole Number and Sample Depth Interval (ft)			
				ST309C-01 4–6	*ST309C-02* 8–10	*ST309C-03* 4–6	*ST309C-04* 7–9
SVOC	Di-n-butylphthalate	8,000	0.70	1.8	1.8	1.4	1.2
METALS	Aluminum	78,000	14,700	4,940	5,260	4,570	5,480
	Arsenic	0.37	6.5	3.2	6.3	4.7	7.9
	Barium	5,500	735	71.6	109	119	301
	Beryllium	0.15	0.84	0.31	0.40	ND	ND
	Cadmium	39.0	N/A	0.72	0.91	0.51	0.51
	Calcium	N/A	121,000	55,500	36,700	51,900	77,500
	Chromium, total	390	21.6	10.0	10.2	7.2	14.5
	Cobalt	4,700	15.4	5.7	7.2	4.6	4.5
	Copper	2,900	223	144	928	308	408
	Iron	N/A	23,800	8,970	12,700	9,510	8,300
	Lead	400	17.5	4.9	5.1	5.9	4.5
	Magnesium	N/A	10,400	4,720	5,420	5,640	7,930
	Manganese	390	549	180	322	172	101
	Molybdenum	390	N/A	ND	ND	ND	7.3
	Nickel	1,600	188	74.2	6.5	10.2	12.6
	Potassium	N/A	3,590	1,230	1,550	1,280	1,800
	Silver	390	N/A	ND	ND	ND	38.9
	Sodium	N/A	787	112	147	154	943
	Vanadium	550	55.3	43.4	60.0	41.3	42.2
	Zinc	23,000	114	64.0	306	117	143
OTHER	pH			7.9	9.4	8.1	8.5
	Moisture (%)			3.4	0.80	2.0	1.8

FOOTNOTES

1	Complete laboratory analytical results and method detection limits are presented in Appendix K.
2	Action level of RCRA Proposed Rule Subpart S (55 *FR* 30814, 7/27/90).
*	TPH action level is 100 mg/kg adopted from NMED UST regulations (NMED, 1990). SW-8015 analyzes volatile and semivolatile petroleum hydrocarbon fractions separately. The total concentration of the two fractions analyzed under SW-8015 will be used to assess compliance with stipulated action levels for the purpose of this RFI.
#	Denotes TCLP analysis, results in mg/l.
--	No Data.
FR	Field Replicate.
HHRB	Human health risk based.
J	Estimated value.
N/A	Not Applicable.
NA	Not Analyzed.
ND	Not detected above the method detection limit.
pCi/g	picocuries per gram.
PQL	Practical quantitation limits (defines VOC, SVOC, and TPH).
R	Reject NDs due to interference.
RAD	Radionuclides.
RE	Resample.
SVOC	Semivolatile organic compounds.
TPH	Total petroleum hydrocarbons.
U	Accept data (positive results may be influenced by lab contamination).
UJ	Estimated nondetect.
UTL	Upper tolerance limits (defines metals).
VOC	Volatile organic compounds.

6.5 mg/kg (ST-309C-04, 7.9 mg/kg). Beryllium (0.31 and 0.40 mg/kg) was detected in ST-309C-01, the background soil sample, and ST-309C-02, above the HHRB action level of 0.15 mg/kg, but below the UTL of 0.84 mg/kg. Beryllium and arsenic concentrations exceeding HHRB action levels appear to be naturally occurring throughout Kirtland AFB as discussed in Section 4.2.2.

Soil pH and Moisture

Soil pH ranged from 7.9 to 9.4 in these samples. Soil moisture values ranged from 0.8 to 3.4 percent (Table 8-48).

8.24.5 Conclusions and Recommendations

Conclusions

- No VOCs were detected and one SVOC was detected in the soil samples collected from this site. All SVOC concentrations were below HHRB action levels.
- No gasoline or diesel range hydrocarbons were detected.
- Arsenic and beryllium were the only metals detected at concentrations exceeding HHRB action levels; these concentrations appear to be naturally occurring throughout Kirtland AFB.
- The analytical results at ST-309 are not indicative of a contaminant release from this site.

Recommendations

- Based on the findings of the RFI, no further action is necessary; therefore, ST-309 does not require further investigation. A No Further Action proposal should be prepared.

8.25 SWMU 10-21, Buildings 37507/37508/37513, Septic Tank, Leach Field, and Lines (ST-310)

8.25.1 Site Background and Environmental Setting

Septic tank ST-310 is located west of Buildings 37507, 37508, and 37513, at the MWSA located in the central portion of Kirtland AFB (Figure 8-25). ST-310 was investigated on March 13, 1995.

Based on engineering drawings and observed site conditions, inflow and outflow line lengths are approximately 510 ft and 15 ft, respectively. This tank discharges to a leach field to the west with a drainage area approximately 200 ft x 10 ft. Potentially, the septic tank could have received contaminants from Buildings 37507, 37508, and 37513. Due to the leach field's design, waste from ST-310 can be expected to have entered the surrounding soil.

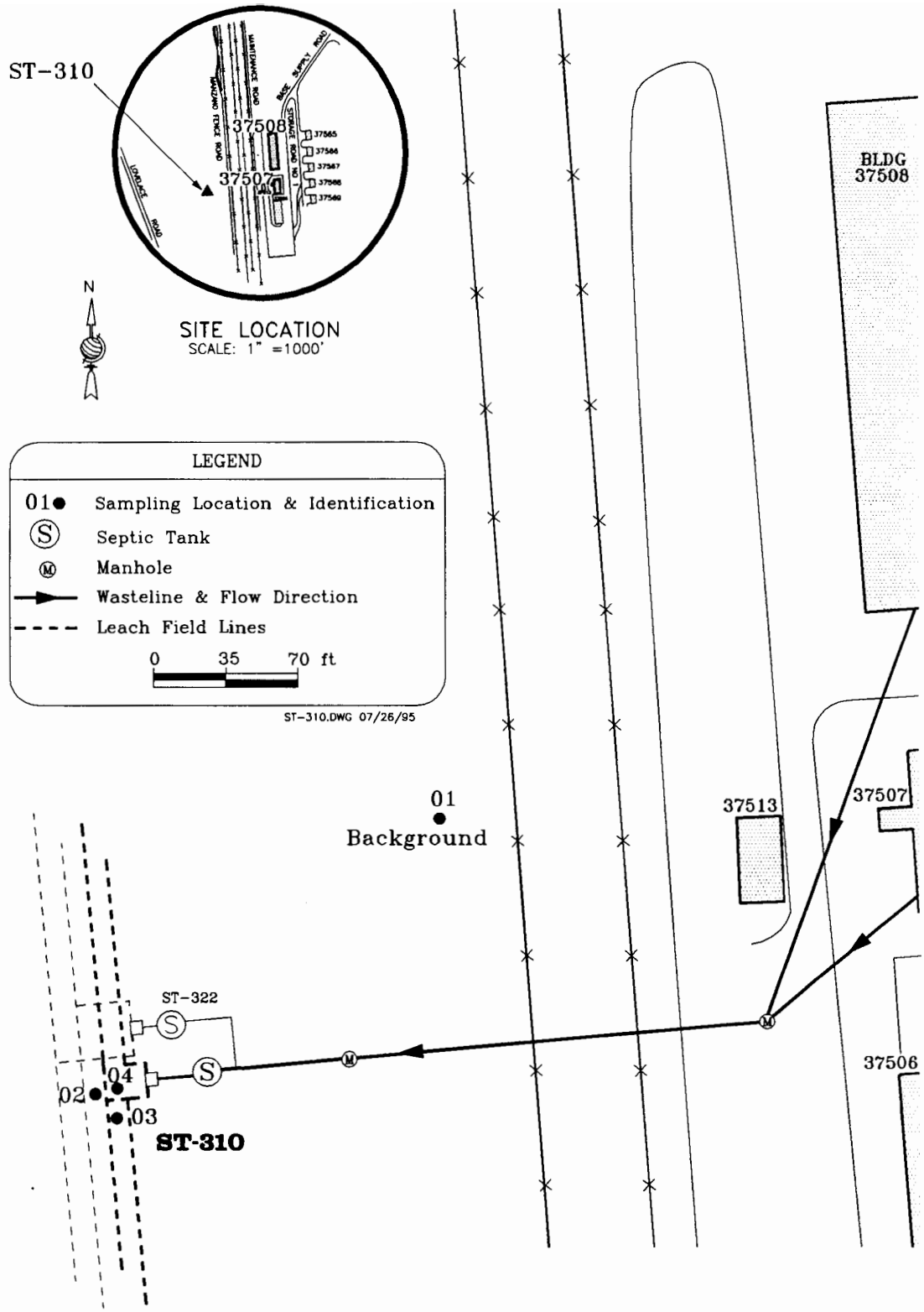


Figure 8-25. SWMU 10-21, Buildings 37507/37508/37513, Septic Tank, Leach Field, and Lines (ST-310)

Buildings 37507, 37508, and 37513 are located in the MWSA. This site is isolated from the urban/industrial environmental zone and is located at the foot of the Manzano Mountains on the east boundary of the Albuquerque-Belen Basin. No production wells exist near this site (Figure 2-11).

8.25.2 Study Area Investigation

The area of investigation was limited to the leach field at ST-310. Possible source materials in the septic tank were not investigated.

8.25.2.1 Previous Investigations

No previous investigations have been performed at this site.

8.25.2.2 Data Gaps

No information related to the past use of ST-310 was available for review. No data were available to determine the presence or absence of contaminants in the subsurface soils at the leach fields.

8.25.2.3 RFI Field Investigation

The objective of this investigation was to determine if contamination is present in the subsurface soil in the leach field area. On March 13, 1995, four boreholes were drilled and sampled using a Geoprobe. Borehole ST-310C-01 was drilled north-northeast of the leach field area to collect background concentration data for this site. This borehole was assumed to be in an area away from any known or suspected contamination. All other boreholes were drilled in the leach field area. Based on engineering drawings and observed field conditions, the leach field lines were determined to be 4 ft below grade. The sample interval at each borehole extended from the depth of the leach field line to 5 ft below the leach field line. From this interval, two samples were collected: one at a depth equal to the base of the leach field line, the other from 3 ft below the base of the leach field line.

Sampling operations and sample handling procedures are described in Section 3.0. Borehole locations and depths of the samples that were sent to the laboratory are listed in Table 8-49. Borehole logs are in Appendix C.

Table 8-49. Boreholes and Samples Analyzed from SWMU 10-21, Buildings 37507/37508/37513, Septic Tank, Leach Field, and Lines (ST-310)

Borehole	Borehole Location	Sample Depth (ft)
ST-310C-01	Background borehole	4–6
ST-310C-02	In the leach field area	4–6
ST-310C-03	In the leach field area	4–6
ST-310C-04	In the leach field area	4–6

8.25.2.4 Laboratory Analysis

Four soil samples were analyzed for VOCs, SVOCs, TPH as GRO and DRO, metals, mercury (the expected contaminants associated with normal operations at this building), soil pH, and soil moisture. The four brass tubes in each 2-ft sample interval were field-screened for possible contamination using a beta-gamma meter and a FID (as per health and safety requirements). No elevated readings were detected with these instruments.

8.25.3 Site Characteristics

8.25.3.1 Geology

The ST-310 area is underlain by unconsolidated alluvial sediment that is predominantly very fine-grained to very coarse-grained, well-graded sand with some fine gravel. Four 9-ft boreholes were drilled at ST-310. No boreholes penetrated into the Santa Fe Group sediments that presumably underlie this area. A discussion of the general geology at Kirtland AFB is presented in Section 2.4.

As a result of leach field installation, it is probable that backfill material is present in the leach field area. Borehole logs for this area are presented in Appendix C.

8.25.3.2 Hydrogeology

This site is in the HR2 saturated zone setting as defined by SNL studies (Figure 2-9) (SNL, 1994). HR2 straddles the Tijeras/Hubbell Springs/Sandia Fault complex. The saturated zone hydrogeology is characterized by the juxtaposition of higher permeability Santa Fe Group sediments against low permeability Paleozoic and Precambrian bedrock (Thorn *et al.,* 1993). Santa Fe Group sediments are faulted down to the west along the faults. Very little is known about groundwater flow in this region except that a steep gradient exists across the fault zone. East of the fault zone, the static water elevation is estimated at 5,710 ft amsl (Figure 2-7).

Groundwater beneath ST-310 is estimated to be approximately 320 ft below the surface (Figure 2-10). This area may serve as a recharge area for the Albuquerque basin aquifer with groundwater movement west across the fault (SNL, 1994). A more detailed discussion of the hydrogeology at Kirtland AFB is presented in Section 2.5.

8.25.4 Nature and Extent of Contamination

The following section describes the extent of contamination based on sampling results. Analytical results for soil samples submitted for analysis at ST-310 are summarized in Table 8-50, where only the reportable concentrations of detected analytes are listed. Full analytical results are presented in Appendix F. Laboratory validation reports are in Appendix K.

Table 8-50. Summary of Reportable Concentrations for Soil Analyses at SWMU 10-21, Buildings 37507/37508/37513, Septic Tank, Leach Field, and Lines (ST-310)[1] (Concentrations mg/kg)

Chemical Class	Analyte	HHRB Action Level[2]	PQL UTL	Borehole Number and Sample Depth Interval (ft)			
				ST310C-01 4–6	*ST310C-02* 4–6	*ST310C-03* 4–6	*ST310C-04* 4–6
SVOC	Di-n-butylphthalate	7,800	0.70	2.6	2.7	2.6	2.9
METALS	Aluminum	78,000	14,700	10,800	8,460	13,100	7,990
	Arsenic	0.37	6.5	4.0	1.5	1.5	1.1
	Barium	5,500	735	151	82.8	84.5	69.1
	Beryllium	0.15	0.84	0.56	0.32	0.54	0.44
	Cadmium	39.0	N/A	ND	ND	0.87	ND
	Calcium	N/A	121,000	75,400	2,910	3,240	2,890
	Chromium, total	390	21.6	13.9	11.7	15.9	10.9
	Cobalt	4,700	15.4	8.1	8.3	10.0	9.5
	Copper	2,900	223	63.5	43.6	35.0	23.7
	Iron	N/A	23,800	13,200	12,900	15,800	13,400
	Lead	400	17.5	5.7	5.9	7.5	6.1
	Magnesium	N/A	10,400	6,720	3,760	4,740	4,190
	Manganese	390	549	245	226	225	198
	Nickel	1,600	188	13.0	19.2	12.4	31.3
	Potassium	N/A	3,590	1,540	1,430	2,440	1,250
	Sodium	N/A	787	195	84.4	171	68.2
	Thallium	N/A	N/A	ND	ND	0.13	ND
	Vanadium	550	55.3	30.1	25.9	31.7	26.0
	Zinc	23,000	114	45.3	63.4	43.6	61.7
OTHER	pH			7.8	8.0	6.9	7.3
	Moisture (%)			10.3	6.9	7.8	8.3

FOOTNOTES

1	Complete laboratory analytical results and method detection limits are presented in Appendix K.
2	Action level of RCRA Proposed Rule Subpart S (55 *FR* 30814, 7/27/90).
*	TPH action level is 100 mg/kg adopted from NMED UST regulations (NMED, 1990). SW-8015 analyzes volatile and semivolatile petroleum hydrocarbon fractions separately. The total concentration of the two fractions analyzed under SW-8015 will be used to assess compliance with stipulated action levels for the purpose of this RFI.
#	Denotes TCLP analysis, results in mg/l.
--	No Data.
FR	Field Replicate.
HHRB	Human health risk based.
J	Estimated value.
N/A	Not Applicable.
NA	Not Analyzed.
ND	Not detected above the method detection limit.
pCi/g	picocuries per gram.
PQL	Practical quantitation limits (defines VOC, SVOC, and TPH).
R	Reject NDs due to interference.
RAD	Radionuclides.
RE	Resample.
SVOC	Semivolatile organic compounds.
TPH	Total petroleum hydrocarbons.
U	Accept data (positive results may be influenced by lab contamination).
UJ	Estimated nondetect.
UTL	Upper tolerance limits (defines metals).
VOC	Volatile organic compounds.

Organic Compounds

No VOC analytes were detected in any of the soil samples submitted for analysis at ST-310.

Di-n-butylphthalate was the only SVOC analyte detected; it was present in all soil samples submitted for analysis from 2.6 to 2.9 mg/kg. All concentrations were below the HHRB action level of 7,800 mg/kg.

Petroleum Hydrocarbons

No gasoline or diesel range hydrocarbons were detected in any of the soil samples submitted for analysis at ST-310.

Metals

Arsenic and beryllium were the only metals detected at concentrations above the HHRB action levels in soil samples analyzed from ST-310 (Table 8-50). Arsenic (1.1 to 4.0 mg/kg) was detected in all samples collected. All concentrations were above the HHRB action level of 0.37 mg/kg, but below the UTL of 6.5 mg/kg.

Beryllium (0.32 to 0.56 mg/kg) was detected in all samples above the HHRB action level of 0.15 mg/kg, but below the UTL of 0.84 mg/kg. Beryllium and arsenic concentrations exceeding HHRB action levels appear to be naturally occurring throughout Kirtland AFB as discussed in Section 4.2.2.

Soil pH and Moisture

Soil pH ranged from 6.9 to 8.0 in these samples. Soil moisture values ranged from 6.9 to 10.3 percent (Table 8-50).

8.25.5 Conclusions and Recommendations

Conclusions

- No VOCs were detected and one SVOC was detected in the soil samples analyzed from this site. All concentrations were below HHRB action levels.
- No gasoline or diesel range hydrocarbons were detected.
- Arsenic and beryllium were the only metals detected at concentrations exceeding HHRB action levels; these concentrations appear to be naturally occurring throughout Kirtland AFB.
- The analytical results at ST-310 are not indicative of a contaminant release from this site.

Recommendations

- Based on the findings of the RFI, no further action is necessary; therefore, ST-310 does not require further investigation. A No Further Action proposal should be prepared.

8.26 SWMU 10-21, Building 37501 and Plant 1, Septic Tank, Leach Field, and Lines (ST-311)

8.26.1 Site Background and Environmental Setting

Septic tank ST-311 is located west-northwest of Building 37501, a guard house, and Plant 1, in the central portion of Kirtland AFB (Figure 8-26). ST-311 was investigated on March 23, 1995.

Based on engineering drawings and observed site conditions, inflow and outflow line lengths are approximately 380 ft and 5 ft, respectively. This tank discharges to a leach field to the west with a drainage area of approximately 70 ft x 25 ft. Potentially, the septic tank could have received contaminants from Building 37501 and Bunker 37401. Due to the leach field's design, waste from ST-311 can be expected to have entered the surrounding soil.

Building 37501 and Bunker 37401 are located in the MWSA. This site is isolated from the urban/industrial environmental zone and is located at the foot of the Manzano Mountains on the east boundary of the Albuquerque-Belen Basin. No production wells exist near this site (Figure 2-11).

8.26.2 Study Area Investigation

The area of investigation was limited to the leach field at ST-311. Possible source materials in the septic tank were not investigated.

8.26.2.1 Previous Investigations

No previous investigations have been performed at this site.

8.26.2.2 Data Gaps

No information related to the past use of ST-311 was available for review. No data were available to determine the presence or absence of contaminants in the subsurface soil in the leach field.

8.26.2.3 RFI Field Investigation

The main objective of this investigation was to determine if contamination is present in the subsurface soil in the leach field area. On March 23, 1995, four boreholes were drilled and sampled using a Geoprobe. Borehole ST-311C-01 was drilled northeast of the leach field area to collect background concentration data for this site. This borehole was assumed to be in an area away from any known or suspected contamination. All other boreholes were drilled in the leach field area. Based on engineering drawings and observed field conditions, the leach field lines were determined to be 3 ft below grade. The sample interval at each borehole extended from the depth of the leach field line to 5 ft below the leach field line. From this interval, two samples were collected: one at a depth equal to the base of the leach field line, the other from 3 ft below the base of the leach field line.

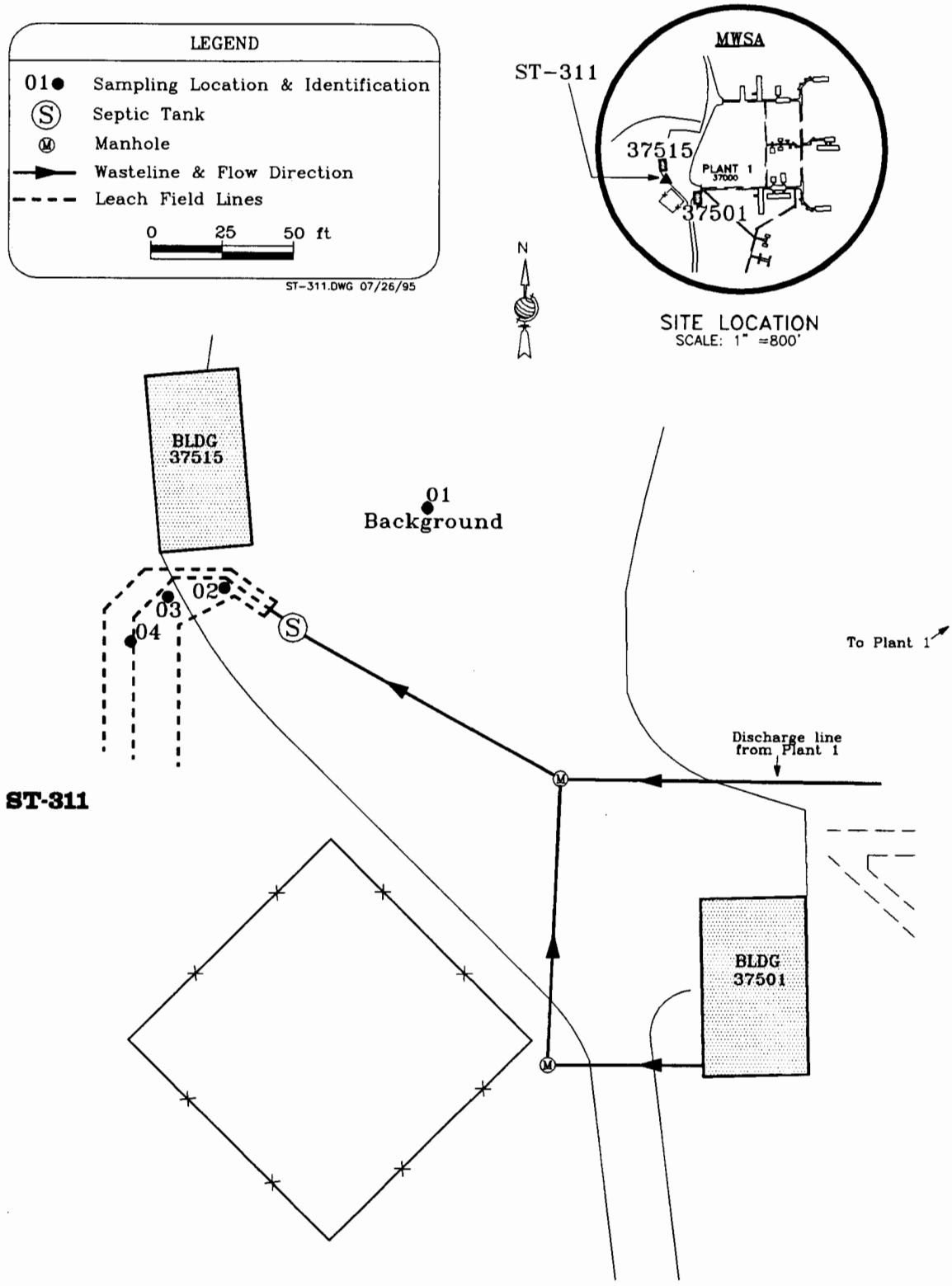


Figure 8-26. Soil Sampling Locations at SWMU 10-21, Building 37501 and Plant 1, Septic Tank, Leach Field, and Lines (ST-311)

Sampling operations and sample handling procedures are described in Section 3.0. Borehole locations and depths of samples that were sent to the laboratory are listed in Table 8-51. Borehole logs are in Appendix C.

Table 8-51. Boreholes and Samples Analyzed from SWMU 10-21, Building 37501 and Plant 1, Septic Tank, Leach Field, and Lines (ST-311)

Borehole	Borehole Location	Sample Depth (ft)
ST-311C-01	Background borehole	3–5
ST-311C-02	In the leach field area	3–5
ST-311C-03	In the leach field area	3–5
ST-311C-04	In the leach field area	3–5

8.26.2.4 Laboratory Analysis

Four soil samples were analyzed for VOCs, SVOCs, TPH as DRO and GRO, metals, mercury (the expected contaminants associated with normal operations at this building), soil pH, and soil moisture. The four brass tubes in each 2-ft sample interval were field-screened for possible contamination using a beta-gamma meter and a FID (as per health and safety requirements). No elevated readings were measured with these instruments.

8.26.3 Site Characteristics

8.26.3.1 Geology

The ST-311 area is underlain by unconsolidated alluvial sediment that is predominantly very fine-grained to very coarse, well-graded sand with some fine gravel. One 10-ft and three 8-ft boreholes were drilled at ST-311. No boreholes penetrated into the Santa Fe Group sediments that presumably underlie this area. A discussion of the general geology at Kirtland AFB is presented in Section 2.4.

As a result of leach field installation, it is probable that backfill material is present in the leach field area. Borehole logs for this area are presented in Appendix C.

8.26.3.2 Hydrogeology

This site is in the HR2 saturated zone setting as defined by SNL studies (Figure 2-9) (SNL, 1994). HR2 straddles the Tijeras/Hubbell Springs/Sandia Fault complex. The saturated zone hydrogeology is characterized by the juxtaposition of higher permeability Santa Fe Group sediments against low permeability Paleozoic and Precambrian bedrock (Thorn *et al.*, 1993). Santa Fe Group sediments are faulted down to the west across the faults. Very little is known about groundwater flow in this region except that a steep gradient exists across the fault zone. East of the fault zone, the static water elevation is estimated at 5,710 ft amsl (Figure 2-7).

Groundwater beneath ST-311 is estimated to be approximately 320 ft below the surface (Figure 2-10). This area may serve as a recharge area for the Albuquerque Basin aquifer with groundwater movement west across the fault (SNL, 1994). A more detailed discussion of the hydrogeology at Kirtland AFB is presented in Section 2.5.

8.26.4 Nature and Extent of Contamination

The following section describes the extent of contamination based on sampling results. Analytical results for soil samples collected and analyzed from ST-311 are summarized in Table 8-52, where only the reportable concentrations of detected analytes are listed. Full analytical results are presented in Appendix F. Laboratory validation reports are in Appendix K.

Organic Compounds

No VOC analytes were detected in any of the soil samples submitted for analysis at ST-311.

Three phthalates, benzyl butyl phthalate, bis(2-ethylhexyl)phthalate, and di-n-butylphthalate, were the only SVOCs detected in one or more of the soil samples collected at ST-311. None of these compounds were detected at concentrations exceeding HHRB action levels (Table 8-52).

Petroleum Hydrocarbons

No gasoline range hydrocarbons detected in any of the soil samples submitted for analysis. Diesel range hydrocarbons were detected in the 3- to 5-ft sample from borehole ST-311C-03 at a concentration of 100 mg/kg. The TPH concentration equaled the NMED action level of 100 mg/kg (Table 8-52).

Metals

Arsenic, beryllium, and manganese were the only metals detected at concentrations above their respective HHRB action levels. Arsenic (0.49 and 1.1 mg/kg) was detected in two of the four samples submitted for analysis. Both concentrations were above the HHRB action level of 0.37 mg/kg, but below the UTL of 6.5 mg/kg. Beryllium (0.41 to 0.62 mg/kg) was detected in all samples collected at ST-311 above the HHRB action level of 0.15 mg/kg, but below the 0.84 mg/kg UTL. Beryllium and arsenic concentrations exceeding HHRB action levels appear to be naturally occurring throughout Kirtland AFB as discussed in Section 4.2.2. Manganese (510 to 814 mg/kg) was detected in all samples above the HHRB action level of 390 mg/kg and above the UTL of 549 mg/kg in two samples. These concentrations are believed to be naturally occurring and are probably related to the underlying geology of this site, which is predominantly weathered granite.

Soil pH and Moisture

Soil pH ranged from 8.0 to 8.5 in these samples. Soil moisture ranged from 3.1 to 4.9 percent (Table 8-52).

Table 8-52. Summary of Reportable Concentrations for Soil Analyses at SWMU 10-21, Buildings 37501 and Plant 1, Septic Tank, Leach Field, and Lines (ST-311) (Concentrations mg/kg)

Chemical Class	Analyte	HHRB Action Level[2]	PQL UTL	Borehole Number and Sample Depth Interval (ft)			
				ST311C-01 3–5	*ST311C-02* 3–5	*ST311C-03* 3–5	*ST311C-04* 3–5
SVOC	Benzyl butyl phthalate	20,000	1.3	0.89	0.78	ND	ND
	Bis(2-ethylhexyl)phthalate	50.0	0.70	ND	ND	ND	1.5
	Di-n-butylphthalate	8,000	0.70	2.6	1.4	ND	ND
TPH	Diesel fraction	100	10.0	ND	ND	100	ND
METALS	Aluminum	N/A	14,700	11,600	12,100	8,270	9,360
	Arsenic	0.40	6.5	1.1	ND	0.49	ND
	Barium	5,600	735	121	139	86.1	78.9
	Beryllium	0.20	0.84	0.53	0.62	0.41	0.42
	Cadmium	40.0	N/A	1.3	ND	0.93	ND
	Calcium	N/A	121,000	14,600	10,300	10,200	8,700
	Chromium, total	400	21.6	6.5	7.0	4.8	6.2
	Cobalt	N/A	15.4	15.1	16.9	11.9	14.0
	Copper	N/A	223	63.2	28.6	30.1	39.3
	Iron	N/A	23,800	24,900	28,800	18,200	20,300
	Lead	400	17.5	14.6	13.4	9.8	10.2
	Magnesium	N/A	10,400	8,760	9,320	6,390	6,940
	Manganese	400	549	675	814	510	560
	Mercury	20.0	N/A	0.14	ND	ND	ND
	Nickel	1,600	188	14.9	7.0	6.2	55.7
	Potassium	N/A	3,590	4,120	3,990	2,700	3,510
	Sodium	N/A	787	51.6	75.6	33.8	150
	Thallium	7.2	N/A	0.18	0.26	ND	0.18
	Vanadium	720	55.3	40.9	43.6	32.0	35.6
	Zinc	24,000	114	98.9	106	97.4	89.8
OTHER	pH			8.2	8.1	8.0	8.5
	Moisture (%)			4.9	3.1	3.5	4.7

FOOTNOTES

1	Complete laboratory analytical results and method detection limits are presented in Appendix K.
2	Action level of RCRA Proposed Rule Subpart S (55 *FR* 30814, 7/27/90).
*	TPH action level is 100 mg/kg adopted from NMED UST regulations (NMED, 1990). SW-8015 analyzes volatile and semivolatile petroleum hydrocarbon fractions separately. The total concentration of the two fractions analyzed under SW-8015 will be used to assess compliance with stipulated action levels for the purpose of this RFI.
#	Denotes TCLP analysis, results in mg/l.
--	No Data.
FR	Field Replicate.
HHRB	Human health risk based.
J	Estimated value.
N/A	Not Applicable.
NA	Not Analyzed.
ND	Not detected above the method detection limit.
pCi/g	picocuries per gram.
PQL	Practical quantitation limits (defines VOC, SVOC, and TPH).
R	Reject NDs due to interference.
RAD	Radionuclides.
RE	Resample.
SVOC	Semivolatile organic compounds.
TPH	Total petroleum hydrocarbons.
U	Accept data (positive results may be influenced by lab contamination).
UJ	Estimated nondetect.
UTL	Upper tolerance limits (defines metals).
VOC	Volatile organic compounds.

8.26.5 Conclusions and Recommendations

Conclusions

- No VOCs were detected in the soil samples submitted for analysis from this site.
- Three SVOCs were detected, but at concentrations below HHRB action levels.
- No gasoline range hydrocarbons were detected. Diesel range hydrocarbons were detected in one borehole, ST-311C-03, but no VOCs or SVOCs were present in the borehole to coincide with the TPH presence. The concentration equaled the NMED action level of 100 mg/kg.
- Arsenic, beryllium, and manganese were the only metals detected at concentrations exceeding HHRB action levels; these concentrations appear to be naturally occurring throughout Kirtland AFB.

Recommendations

- Additional soil sampling should be performed at ST-311 in the vicinity of Borehole ST-311C-03 to determine if TPH is present at concentrations above the NMED action level and to define the lateral and vertical extent, if possible, of potential soil contamination.

8.27 SWMU 10-21, Building 37503 and Plant 2, Septic Tank, Leach Field, and Lines (ST-312)

8.27.1 Site Background and Environmental Setting

ST-312 is located 145 ft west-southwest of Building 37503 and Plant 2, in the central portion of Kirtland AFB (Figure 8-27). ST-312 was investigated on March 23 and 24, 1995.

Based on engineering drawings and observed site conditions, inflow and outflow line lengths are approximately 340 ft and 15 ft, respectively. This tank discharges to a leach field to the south with a drainage area of approximately 30 ft x 30 ft. Potentially, the septic tank could have received contaminants from Building 37503 and Bunker 37410. Due to the leach field's design, waste from ST-312 can be expected to have entered the surrounding soil.

Building 37503 and Bunker 37410 are located in the MWSA. This site is isolated from the urban/industrial environmental zone and is located at the foot of the Manzano Mountains on the east boundary of the Albuquerque-Belen Basin. No production wells exist near this site (Figure 2-11).

8.27.2 Study Area Investigation

The area of investigation limited to the leach field at ST-312. Possible source materials in the septic tank were not investigated.

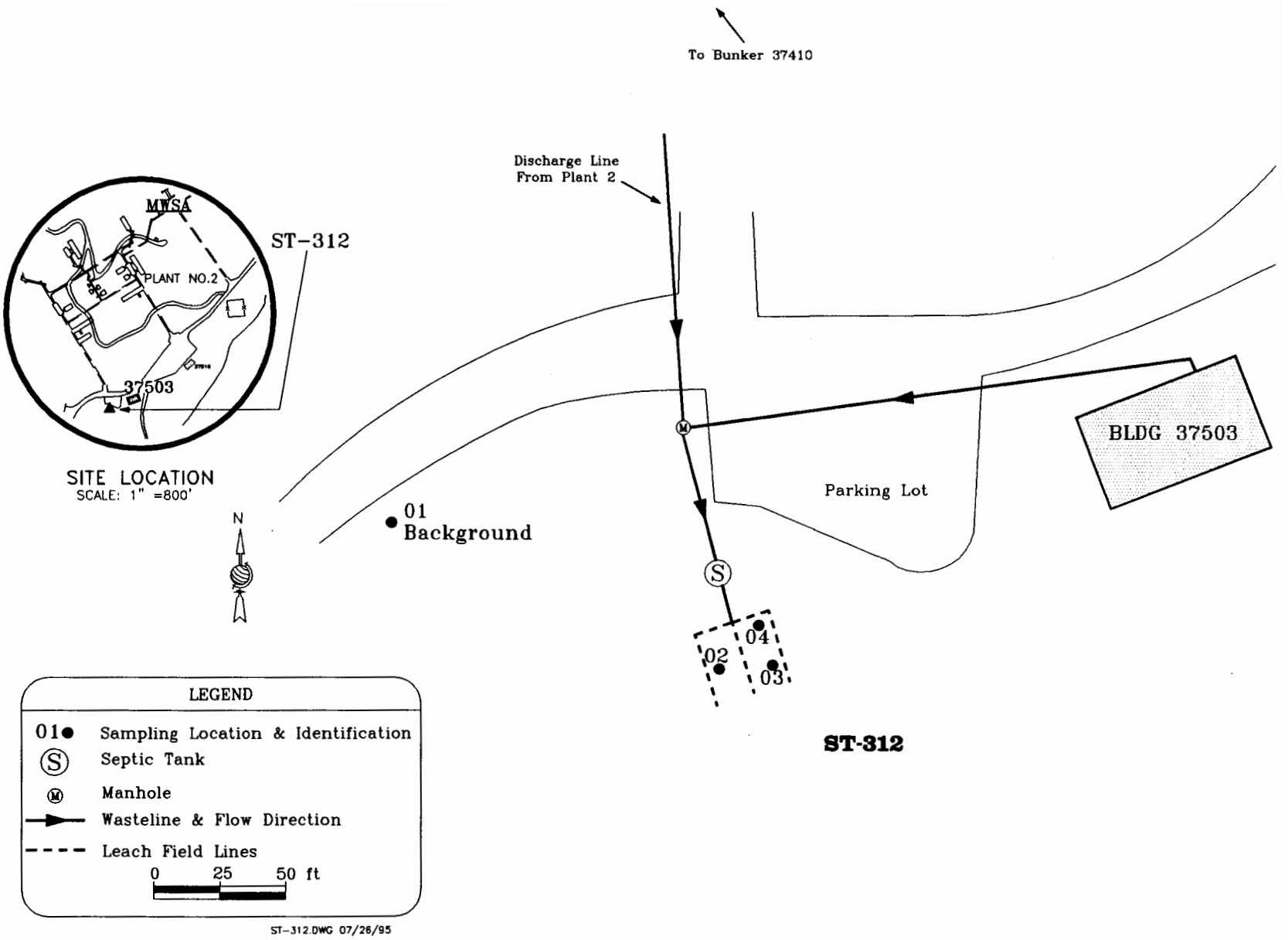


Figure 8-27. Soil Sampling Locations at SWMU 10-21, Building 37503 and Plant 2, Septic Tank, Leach Field, and Lines (ST-312)

8.27.2.1 Previous Investigations

No previous investigations have been performed at this site.

8.27.2.1 Data Gaps

No information related to the past use of ST-312 was available. No data were available to determine the presence or absence of contaminants in the subsurface soil in the leach field.

8.27.2.3 RFI Field Investigation

The objective of this investigation was to determine if contamination is present in the subsurface soil in the leach field area. On March 23 and 24, 1995, four boreholes were drilled and sampled using a Geoprobe. Borehole ST-312C-01 was drilled northwest of the leach field area to collect background concentration data for this site. This borehole was assumed to be in an area away from any known or suspected contamination. All other boreholes were drilled in the leach field area. Based on engineering drawings and observed field conditions, the leach field lines were determined to be 3 ft below grade. The sample interval at each borehole extended from the depth of the leach field line to 12 to 15 ft below the leach field line. The long sample intervals were necessary because of poor recovery in the predominantly cobble and boulder soil at the site.

Sampling operations and sampling handling procedures are described in Section 3.0. Borehole locations and sample depths that were sent to the laboratory are listed in Table 8-53. Borehole logs are in Appendix C.

Table 8-53. Boreholes and Samples Analyzed from SWMU 10-21, Building 37503 and Plant 2, Septic Tank, Leach Field, and Lines (ST-312)

Borehole	Borehole Location	Sample Depth (ft)
ST-312C-01	Background Borehole	2-4
ST-312C-02	In the leach field area	3–17
ST-312C-03	In the leach field area	3–18
ST-312C-04	In the leach field area	3-15

8.27.2.4 Laboratory Analysis

Four soil samples were analyzed for VOCs, SVOCs, TPH as DRO and GRO, metals, mercury (the expected contaminants associated with normal operations at this building), soil pH, and soil moisture. The four brass tubes in each complete sample interval were field-screened for possible contamination using a beta-gamma meter and a FID. No elevated readings were measured with these instruments.

8.27.3 Site Characteristics

8.27.3.1 Geology

The ST-312 area is underlain by unconsolidated alluvial sediment that is predominantly a gravel and sand fill in the leach field area; the background borehole is a very fine-grain to very coarse, well-graded sand with some weathered granite. One 4-ft, two 18-ft, and one 17-ft deep boreholes were drilled at ST-312. No boreholes penetrated into the Santa Fe Group sediments that presumably underlie this area. A discussion of the general geology at Kirtland AFB is presented in Section 2.4.

As a result of leach field installation, it is probable that backfill material is present in the leach field area. Borehole logs for this area are presented in Appendix C.

8.27.3.2 Hydrogeology

This site is in the HR2 saturated zone setting as defined by SNL studies (Figure 2-9) (SNL, 1994). HR2 straddles the Tijeras/Hubbell Springs/Sandia Fault complex. The saturated zone hydrogeology is characterized by the juxtaposition of higher permeability Santa Fe Group sediments against low permeability Paleozoic and Precambrian bedrock (Thorn *et al.*, 1993). Santa Fe Group sediments are faulted down to the west across the faults. Very little is known about groundwater flow in this region except that a steep gradient exists across the fault zone. East of the fault zone, the static water elevation is estimated at 5,710 ft amsl (Figure 2-7).

Groundwater beneath ST-312 is estimated to be approximately 320 ft below the surface (Figure 2-10). This area may serve as a recharge area for the Albuquerque basin aquifer with groundwater movement west across the fault (SNL, 1994). A more detailed discussion of the hydrogeology at Kirtland AFB is presented in Section 2.5.

8.27.4 Nature and Extent of Contamination

The following section describes the extent of contamination based on sampling results. Analytical results for soil samples collected at ST-312 are summarized in Table 8-54, where only the reportable concentrations of detected analytes are listed. Full analytical results are presented in Appendix F. Laboratory validation reports are in Appendix K.

Organic Compounds

No VOC or analytes were detected in any of the soil samples submitted for analysis at ST-312.

Two phthalates—benzyl butyl phthalate and di-n-butylphthalate—were detected in one or more of the soil samples collected at ST-312. Benzyl butyl phthalate (0.35 and 0.52 mg/kg) was detected in borehole ST-312C-03 and ST-312C-04. Di-n-butylphthalate (2.4 to 2.7 mg/kg) was detected in three of the four samples collected. All concentrations were below HHRB action levels (Table 8-54).

Table 8-54. Summary of Reportable Concentrations for Soil Analyses at SWMU 10-21, Building 37503 and Plant 2, Septic Tank, Leach Field, and Lines (ST-312)[1] (Concentrations mg/kg)

Chemical Class	Analyte	HHRB Action Level[2]	PQL UTL	Borehole Number and Sample Depth Interval (ft)			
				ST312C-01 2–4	*ST312C-02* 3–17	*ST312C-03* 3–18	*ST312C-04* 3–15
SVOC	Benzyl Butyl Pthalate	20,000	1.3	ND	ND	0.35	0.52
	di-n-Butylphthalate	8,000	0.70	ND	2.7	2.5	2.4
TPH	Diesel fraction	100	10.0	4.6	ND	ND	ND
METALS	Aluminum	78,000	14,800	11,000	17,900	8,080	12,700
	Antimony	31.0	N/A	ND	ND	0.51	ND
	Arsenic	0.37	6.5	ND	ND	1.4	1.0
	Barium	5,500	736	122	89.8	109	108
	Beryllium	0.15	0.84	ND	0.51	0.31	0.31
	Cadmium	39.0	N/A	ND	1.8	ND	0.83
	Calcium	N/A	122,000	6,700	18,700	21,000	17,100
	Chromium, Total	390	21.8	19.0	97.0	19.8	38.8
	Cobalt	4,700	15.4	19.9	26.8	12.1	21.3
	Copper	2,900	225	142	481	49.2	216
	Iron	N/A	23,900	18,700	31,000	15,700	23,500
	Lead	400	13.6	8.3	12.4	7.8	13.1
	Magnesium	N/A	10,400	9,020	20,400	7,390	12,100
	Manganese	390	551	269	588	321	491
	Mercury	23.0	N/A	ND	0.10	0.13	ND
	Nickel	1,600	189	45.0	123	20.7	202
	Potassium	N/A	3,600	3,440	4,840	2,140	2,100
	Sodium	N/A	792	139	137	62.9	149
	Thallium	N/A	N/A	0.13	ND	ND	0.10
	Vanadium	550	55.5	51.3	67.1	33.8	55.0
	Zinc	23,000	115	62.4	203	45.1	89.2
OTHER	pH			7.8	8.4	8.3	8.1
	Moisture (%)			2.8	2.6	2.7	3.4

FOOTNOTES

1	Complete laboratory analytical results and method detection limits are presented in Appendix K.
2	Action level of RCRA Proposed Rule Subpart S (55 *FR* 30814, 7/27/90).
*	TPH action level is 100 mg/kg adopted from NMED UST regulations (NMED, 1990). SW-8015 analyzes volatile and semivolatile petroleum hydrocarbon fractions separately. The total concentration of the two fractions analyzed under SW-8015 will be used to assess compliance with stipulated action levels for the purpose of this RFI.
#	Denotes TCLP analysis, results in mg/l.
--	No Data.
FR	Field Replicate.
HHRB	Human health risk based.
J	Estimated value.
N/A	Not Applicable.
NA	Not Analyzed.
ND	Not detected above the method detection limit.
pCi/g	picocuries per gram.
PQL	Practical quantitation limits (defines VOC, SVOC, and TPH).
R	Reject NDs due to interference.
RAD	Radionuclides.
RE	Resample.
SVOC	Semivolatile organic compounds.
TPH	Total petroleum hydrocarbons.
U	Accept data (positive results may be influenced by lab contamination).
UJ	Estimated nondetect.
UTL	Upper tolerance limits (defines metals).
VOC	Volatile organic compounds.

Petroleum Hydrocarbons

No gasoline range hydrocarbons were detected in any of the soil samples submitted for analysis at ST-312. Diesel range hydrocarbons (4.6 mg/kg) were detected in borehole ST-312C-01, the background borehole. This concentration was below the NMED action level of 100 mg/kg.

Metals

Arsenic, beryllium, and manganese were the only metals detected at concentrations above the HHRB action levels in the soil samples submitted for analysis from ST-312 (Table 8-54). Arsenic (1.0 and 1.4 mg/kg) was detected in two of the four samples collected; both concentrations were above the HHRB action level of 0.37 mg/kg, but were below the 6.5 mg/kg UTL. Beryllium (0.31 to 0.51 mg/kg) was detected in three of the four samples collected at ST-312 above the HHRB action level of 0.15 mg/kg, but all concentrations were below the 0.84 mg/kg UTL. Manganese (588 and 491 mg/kg) was detected in ST-312C-03 and ST-312C-04, above the HHRB action level of 390 mg/kg. Beryllium, arsenic, and manganese concentrations exceeding HHRB action levels appear to be naturally occurring throughout Kirtland AFB as discussed in Section 4.2.2.

Soil pH and Moisture

Soil pH ranged from 7.8 to 8.4 in these samples. Soil moisture values ranged from 2.6 to 3.4 percent (Table 8-54).

8.27.5 Conclusions and Recommendations

Conclusions

- No VOCs were detected in the soil samples submitted for analysis from this site.
- Two SVOCs were detected in the soil samples submitted for analysis at ST-312, but below the HHRB action levels.
- No gasoline range hydrocarbons were detected in the soil samples submitted for analysis from this site. Diesel range hydrocarbons (4.6 mg/kg) were detected in one sample. This concentration does not exceed the NMED action level of 100 mg/kg. The diesel range hydrocarbon concentration is similar to those detected in background samples analyzed during the Appendix III RFI, and is not attributable to a release.
- Arsenic, beryllium, and manganese were the only metals detected at concentrations exceeding HHRB action levels. These concentrations of arsenic, beryllium, and manganese appear to be naturally occurring throughout Kirtland AFB.
- The analytical results at ST-312 are not indicative of a contaminant release from this site.

Recommendations

- Based on the findings of the RFI, no further action is necessary; therefore, ST-312 does not require further investigation. A No Further Action proposal should be prepared.

8.28 SWMU 10-21, Buildings 37529/37530, Septic Tank, Leach Field, and Lines (ST-313)

8.28.1 Site Background and Environmental Setting

Septic tank ST-313 is located near Buildings 37529 and 37530, a physics science laboratory, in the central portion of Kirtland AFB (Figure 8-28). ST-313 was investigated on March 20, 1995.

Based on engineering drawings and observed site conditions, inflow and outflow line lengths are approximately 510 ft and 12 ft, respectively. This tank discharges to a leach field to the west, with a drainage area of approximately 200 ft x 20 ft. Potentially, the septic tank could have received contaminants from Buildings 37529 and 37530. Due to the leach field's design, waste from ST-313 can be expected to have entered the surrounding soil.

Buildings 37529 and 37530 are located in the MWSA. This site is isolated from the urban/industrial environmental zone and is located at the foot of the Manzano Mountains on the east boundary of the Albuquerque-Belen Basin. No production wells exist near this site (Figure 2-11).

8.28.2 Study Area Investigation

The area of investigation was limited to the leach field at ST-313. Possible source materials in the septic tank were not investigated.

8.28.2.1 Previous Investigations

No previous investigations have been performed at this site.

8.28.2.2 Data Gaps

No information related to the past use of ST-313 was available. No data were available to determine the presence or absence of contaminants in the subsurface soil in the leach field. No engineering drawings were available to locate the septic tank at ST-313.

8.28.2.3 RFI Field Investigation

The objective of this investigation was to determine if contamination is present in the subsurface soil in the leach field area. On March 20, 1995, four boreholes were drilled and sampled using a Geoprobe. Borehole ST-313C-01 was drilled east of the leach field area to collect background concentration data for

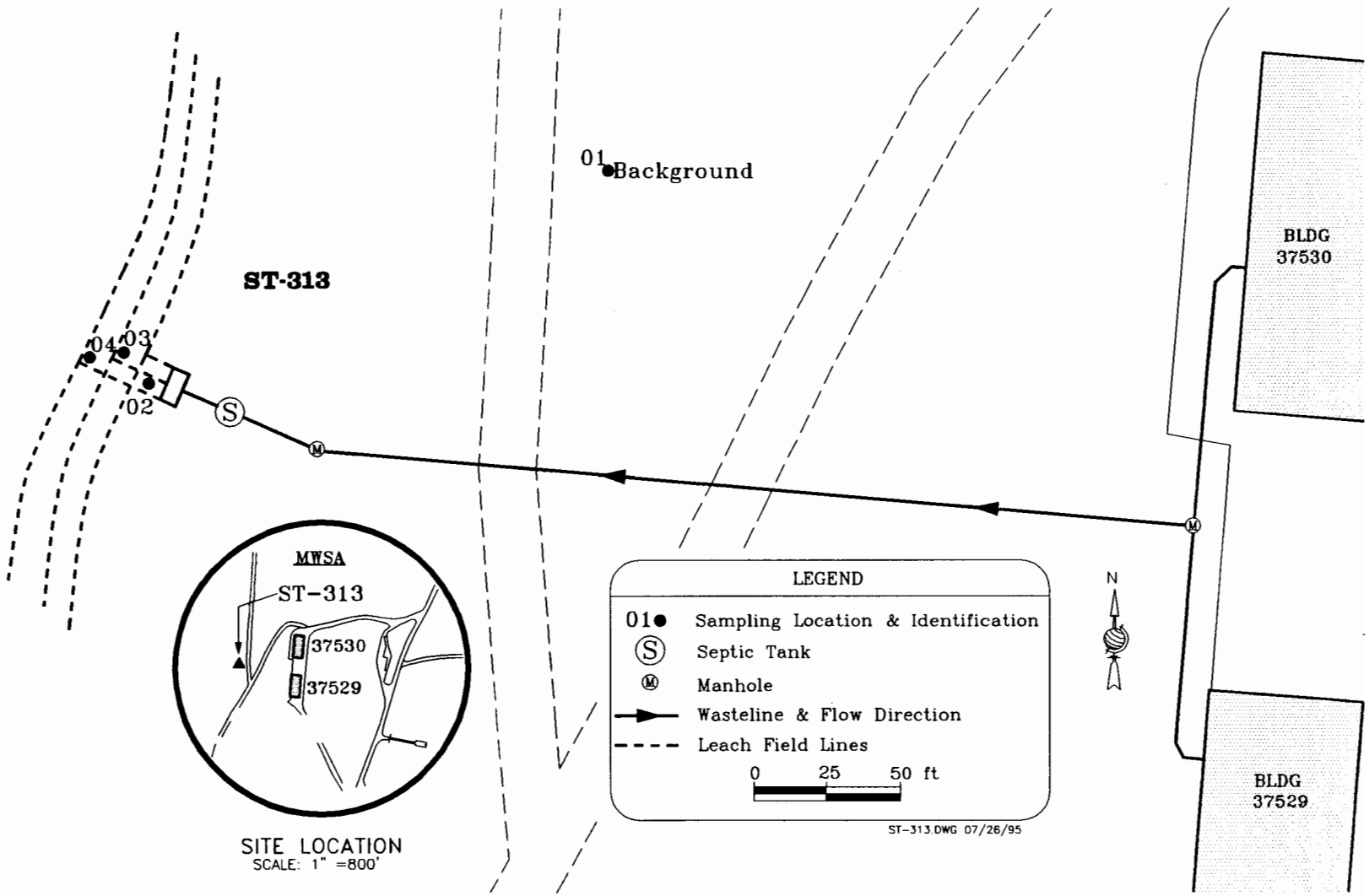


Figure 8-28. Soil Sampling Locations at SWMU 10-21, Buildings 37529/37530, Septic Tank, Leach Field, and Lines (ST-313)

this site. This borehole was assumed to be in an area away from any known or suspected contamination. All other boreholes were drilled in the leach field area. Based on engineering drawings and observed field conditions, the leach field lines were determined to be 3 ft below grade. The sample interval at each borehole extended from the depth of the leach field line to 5 ft below the leach field line. From this interval, two samples were collected: one at a depth equal to the base of the leach field line, the other from 3 ft below the base of the leach field line.

Sampling operations and sample handling procedures are described in Section 3.0. Borehole locations and depths of the samples that were sent to the laboratory are listed in Table 8-55. Borehole logs are in Appendix C.

Table 8-55. Boreholes and Samples Analyzed from SWMU 10-21, Buildings 37529/37530, Septic Tank, Leach Field, and Lines (ST-313)

Borehole	Borehole Location	Sample Depth (ft)
ST-313C-01	Background borehole	3–5
ST-313C-02	In the leach field area	3–5
ST-313C-03	In the leach field area	3–5
ST-313C-04	In the leach field area	3–8[a]

a. Both 2-ft sections of the 5-ft interval were used due to the collection of a MS/MSD sample.

8.28.2.4 Laboratory Analysis

Four soil samples were analyzed for VOCs, SVOCs, TPH as GRO and DRO, metals, mercury (the expected contaminants associated with normal operations at this building), soil pH, and soil moisture. The four brass tubes in each 2-ft sample interval were field-screened for possible contamination using a beta-gamma meter and a FID. No elevated readings were measured with these instruments.

8.28.3 Site Characteristics

8.28.3.1 Geology

The ST-313 area is underlain by unconsolidated alluvial sediment that is predominantly very fine-grained to very coarse, well-graded sand with some fine gravel. Four 8-ft boreholes were drilled at ST-313. No boreholes penetrated into the Santa Fe Group sediment that presumably underlies this area. A discussion of the general geology at Kirtland AFB is presented in Section 2.4.

As a result of leach field installation, it is probable that backfill material is present in the leach field area. Borehole logs for this area are presented in Appendix C.

8.28.3.2 Hydrogeology

This site is in the HR2 saturated zone setting as defined by SNL studies (Figure 2-9) (SNL, 1994). HR2 straddles the Tijeras/Hubbell Springs/Sandia Fault complex. The saturated zone hydrogeology is characterized by the juxtaposition of higher permeability Santa Fe Group sediments against low permeability Paleozoic and Precambrian bedrock (Thorn *et al.*, 1993). Santa Fe Group sediments are faulted down to the west across the faults. Very little is known about groundwater flow in this region except that a steep gradient exists across the fault zone. East of the fault zone, the static water elevation is estimated at 5,710 ft amsl (Figure 2-7).

Groundwater beneath ST-313 is estimated to be approximately 320 ft below the surface (Figure 2-10). This area may serve as a recharge area for the Albuquerque Basin aquifer with groundwater movement west across the fault (SNL, 1994). A more detailed discussion of the hydrogeology at Kirtland AFB is presented in Section 2.5.

8.28.4 Nature and Extent of Contamination

The following section describes the extent of contamination based on sampling results. Analytical results for soil samples collected and submitted for analysis from ST-313 are summarized in Table 8-56, where only the reportable concentrations of detected analytes are listed. Full analytical results are presented in Appendix F. Laboratory validation reports are in Appendix K.

Organic Compounds

No VOC or SVOC analytes were detected in any of the soil samples submitted for analysis at ST-313.

Petroleum Hydrocarbons

No gasoline or diesel range hydrocarbons were detected in any of the soil samples submitted for analysis at ST-313.

Metals

Arsenic, beryllium, and manganese were the only metals detected at concentrations above the HHRB action levels in the soil samples submitted for analysis from ST-313 (Table 8-56). Arsenic (1.5 mg/kg) was detected in ST-313C-02 at a concentration above the HHRB action level of 0.37 mg/kg, but below the 6.5 mg/kg UTL. Beryllium (0.41 to 0.56 mg/kg) was detected in all samples collected at ST-313 above the HHRB action level of 0.15 mg/kg, but below the 0.84 mg/kg UTL. Beryllium and arsenic concentrations exceeding HHRB action levels appear to be naturally occurring throughout Kirtland AFB as discussed in Section 4.2.2.

Table 8-56. Summary of Reportable Concentrations for Soil Analyses at SWMU 10-21, Buildings 37529/37530, Septic Tank, Leach Field, and Lines (ST-313)[1] (Concentrations mg/kg)

Chemical Class	Analyte	HHRB Action Level[2]	UTL	Borehole Number and Sample Depth Interval (ft)			
				ST313C-01	*ST313C-02*	*ST313C-03*	*ST313C-04*
				3–5	3–5	3–5	3–8
METALS	Aluminum	78,000	14,700	8,100	11,800	8,120	8,920
	Arsenic	0.37	6.5	ND	1.5	ND	ND
	Barium	5,500	735	69.5	104	88.4	69.4
	Beryllium	0.15	0.84	0.42	0.56	0.41	0.51
	Cadmium	39.0	N/A	1.1	ND	ND	0.61
	Calcium	N/A	121,000	18,000	44,400	31,600	7,940
	Chromium, total	390	21.6	7.2	10.5	6.7	6.8
	Cobalt	4,700	15.4	11.7	12.9	10.1	15.6
	Copper	2,900	223	26.8	47.6	29.3	56.5
	Iron	N/A	23,800	19,000	23,500	16,600	27,400
	Lead	400	17.5	5.5	8.1	9.0	6.6
	Magnesium	N/A	10,400	6,510	8,560	5,910	6,910
	Manganese	390	549	378	502	344	456
	Nickel	1,600	188	9.2	14.0	7.9	10.7
	Potassium	N/A	3,590	2,020	1,940	1,490	1,860
	Sodium	N/A	787	96.0	89.4	81.3	46.2
	Thallium	N/A	N/A	0.13	ND	0.12	0.10
	Vanadium	550	55.3	34.7	43.7	31.4	49.5
	Zinc	23,000	114	47.0	122	44.5	65.4
OTHER	pH			8.6	8.4	8.4	8.4
	Moisture (%)			5.3	10.2	3.3	1.5

FOOTNOTES

1	Complete laboratory analytical results and method detection limits are presented in Appendix K.
2	Action level of RCRA Proposed Rule Subpart S (55 *FR* 30814, 7/27/90).
*	TPH action level is 100 mg/kg adopted from NMED UST regulations (NMED, 1990). SW-8015 analyzes volatile and semivolatile petroleum hydrocarbon fractions separately. The total concentration of the two fractions analyzed under SW-8015 will be used to assess compliance with stipulated action levels for the purpose of this RFI.
#	Denotes TCLP analysis, results in mg/l.
--	No Data.
FR	Field Replicate.
HHRB	Human health risk based.
J	Estimated value.
N/A	Not Applicable.
NA	Not Analyzed.
ND	Not detected above the method detection limit.
pCi/g	picocuries per gram.
PQL	Practical quantitation limits (defines VOC, SVOC, and TPH).
R	Reject NDs due to interference.
RAD	Radionuclides.
RE	Resample.
SVOC	Semivolatile organic compounds.
TPH	Total petroleum hydrocarbons.
U	Accept data (positive results may be influenced by lab contamination).
UJ	Estimated nondetect.
UTL	Upper tolerance limits (defines metals).
VOC	Volatile organic compounds.

Manganese (502 and 456 mg/kg) was detected in ST-313C-02 and ST-313C-04, above the HHRB action level of 390 mg/kg but below the 549 mg/kg UTL. These concentrations are believed to be naturally occurring and are probably related to the underlying geology of this site, which is predominantly weathered granite.

Soil pH and Moisture

Soil pH ranged from 8.4 to 8.6 in these samples. Soil moisture values ranged from 1.5 to 10.2 percent (Table 8-56).

8.28.5 Conclusions and Recommendations

Conclusions

- No VOCs or SVOCs were detected in the soil samples submitted for analysis from this site.
- No gasoline or diesel range hydrocarbons were detected at ST-313.
- Arsenic, beryllium, and manganese were the only metals detected at concentrations exceeding HHRB action levels but below the UTL. The beryllium and arsenic concentrations appear to be naturally occurring throughout Kirtland AFB; the manganese concentrations appear to be naturally occurring at this site.
- The analytical results at ST-313 are not indicative of a contaminant release from this site.

Recommendations

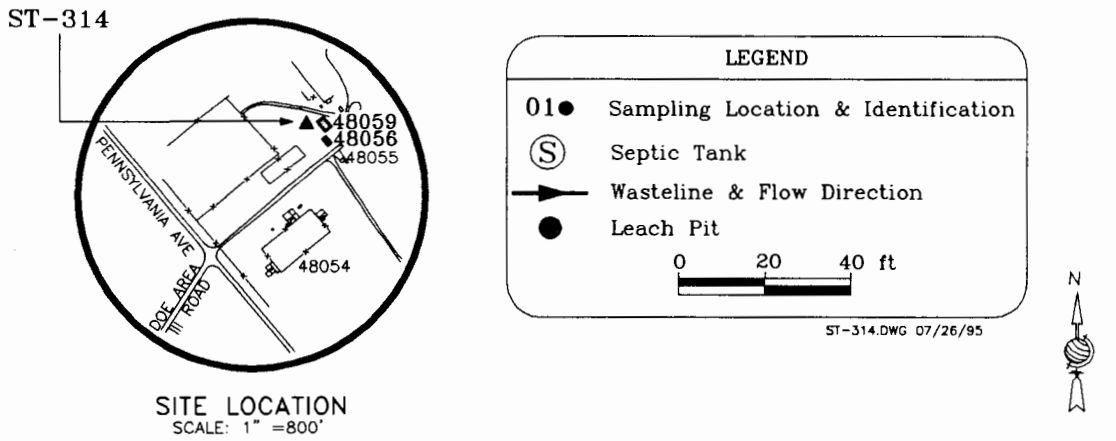
- Based on the findings of the RFI, no further action is necessary; therefore, ST-313 does not require further investigation. A No Further Action proposal should be prepared.

8.29 SWMU 10-21, Buildings 48056/48059, Septic Tank, Leach Pits, and Lines (ST-314)

8.29.1 Site Background and Environmental Setting

Septic tank ST-314 is located near Buildings 48056, 48059, and the Horse Riding Stables (the former Modernization of Radiation Effects Laboratory) in the northwest portion of Kirtland AFB (Figure 8-29). ST-314 was investigated on March 27 and May 5, 1995.

Based on engineering drawings and observed site conditions, inflow and outflow line lengths are approximately 60 ft and 70 ft, respectively. This tank discharges to three leach pits to the northwest. Potentially, the septic tank could have received contaminants from Buildings 48056 and 48059. Due to the leach pit's design, waste from ST-314 can be expected to have entered the surrounding soil.



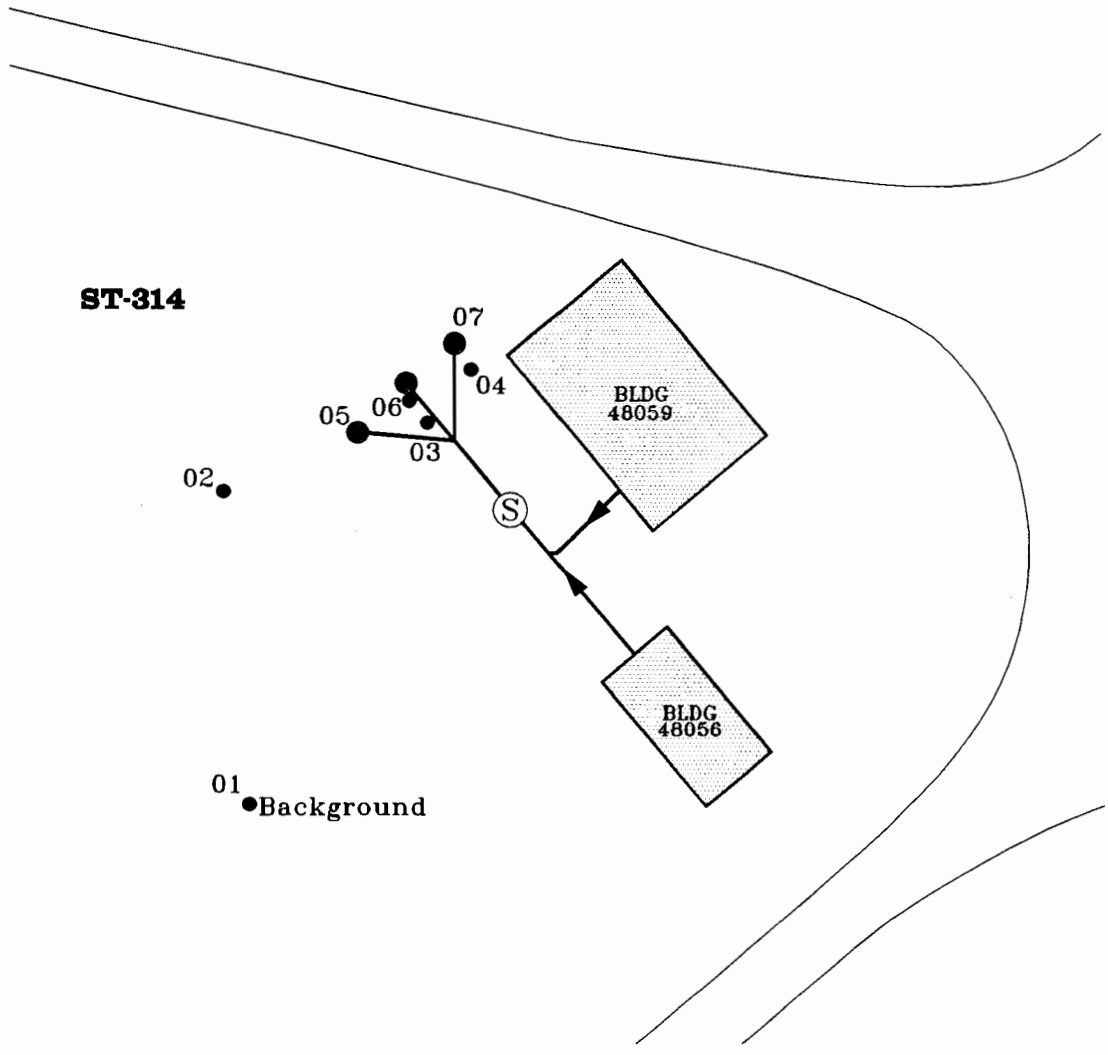


Figure 8-29. Soil Sampling Locations at SWMU 10-21, Buildings 48056/48059, Septic Tank, Leach Pits, and Lines (ST-314)

ST-314 is located in the urban/industrial zone, which is discussed in Section 2.0. The nearest production well to this site is KAFB-10, 6,500 ft west-southwest (Figure 2-11).

8.29.2 Study Area Investigation

The area of investigation was limited to the leach field at ST-314. Possible source materials in the septic tank were not investigated.

8.29.2.1 Previous Investigations

No previous investigations have been performed at this site.

8.29.2.2 Data Gaps

No information related to the past use of ST-314 was available. No data were available to determine the presence or absence of contaminants in the subsurface soil in the leach field.

8.29.2.3 RFI Field Investigation

The objective of this investigation was to determine if contamination is present in the subsurface soil in the leach pit area. On March 27, 1995, four boreholes were drilled and sampled using a Geoprobe. Borehole ST-314C-01 was drilled southwest of the leach pit area to collect background concentration data for this site. This borehole was assumed to be in an area away from any known or suspected contamination. ST-314C-02, ST-314C-03, and ST-314C-04 were drilled near the leach pit area. Based on engineering drawings and observed field conditions, the leach pit lines were determined to be 3-ft below grade. The sample interval at each borehole extended from the depth of the leach pit lines to 5 ft below the leach pit lines. From this interval, two samples were collected: one at a depth equal to the base of the leach pit lines, the other from 3 ft below the base of the leach pit lines.

After further records research, the actual leach pit area was accurately delineated and Kirtland AFB determined additional investigations were needed. Deeper samples were collected to better characterize the leach pits. On May 10, 1995, four boreholes were drilled and sampled using a Geoprobe. Another ST-314C-01 was drilled in an adjacent hole, 1 ft south of the original, borehole and to a deeper depth that would correspond to the new depths that the leach pits would be sampled at. Two boreholes, ST-314C-05 and ST-314C-07, were drilled in the leach pit area and ST-314C-06 was drilled adjacent to the leach pit since it was covered by a metal plate 3 ft in diameter.

Sampling operations and sample handling procedures are described in Section 3.0. Borehole locations and depths of the samples that were sent to the laboratory are listed in Table 8-57. Borehole logs are in Appendix C.

Table 8-57. Boreholes and Samples Analyzed from SWMU 10-21, Buildings 48056/48059, Septic Tank, Leach Pits, and Lines (ST-314)

Borehole	Borehole Location	Sample Depth (ft)
ST-314C-01	Background borehole	3-8[a] and 15-20
ST-314C-02	Near Leach Pit	3–8[b]
ST-314C-03	Near Leach Pit	3–5
ST-314C-04	Near Leach Pit	3–5
ST-314C-05	In the leach pit	15–20[c]
ST-314C-06	Adjacent to the leach pit	15–20[c]
ST-314C-07	In the leach pit	15–20[c,d]

a. Both 2-ft sections of the 5-ft interval were used due to the collection of a MS/MSD sample.
b. Both 2-ft sections of the 5-ft interval were used due to the collection of a replicate sample.
c. Both 2-ft sections of the 5-ft interval were used due to the quantities of soil needed.
d. A replicate sample was obtained in an adjacent borehole 1-ft east of the original borehole.

8.29.2.4 Laboratory Analysis

Ten soil samples, including two replicates, were analyzed for VOCs, SVOCs, TPH as GRO and DRO, metals, mercury, gross alpha and beta (the expected contaminants associated with normal operations at this building), soil pH, and soil moisture. In addition, four of the soil samples were analyzed for radium-226 and 228. The four brass tubes in each 2-ft sample interval were field-screened for possible contamination using a beta-gamma meter and a FID (as per health and safety requirements). No elevated readings were measured with these instruments.

8.29.3 Site Characteristics

8.29.3.1 Geology

The ST-314 area is underlain by unconsolidated alluvial sediment that is predominantly very fine-grained to fine-grained sand to approximately 13 ft; from 13 to 20 ft, it is mostly fine-grained to very coarse, well-graded sand. Four 20-ft boreholes and three 8-ft boreholes were drilled at ST-314. No boreholes penetrated into the Santa Fe Group sediments that presumably underlie this area. A discussion of the general geology at Kirtland AFB is presented in Section 3.0.

As a result of leach field installation, it is probable that backfill material is present in the leach field area. Borehole logs for this area are presented in Appendix C.

8.29.3.2 Hydrogeology

This site is on the edge of the HR2 saturated zone setting as defined by SNL studies (Figure 2-9) (SNL, 1994). HR2 straddles the Tijeras/Hubbell Springs/Sandia Fault complex. The saturated zone hydrogeology is characterized by the juxtaposition of higher permeability Santa Fe Group sediments against low permeability Paleozoic and Precambrian bedrock (Thorn *et al.,* 1993). Santa Fe Group

sediments are faulted down to the west across the fault. Very little is known about groundwater flow in this region except that a steep gradient exists across the fault zone. East of the fault zone, the static water elevation is estimated at 5,710 ft amsl (Figure 2-7).

Groundwater beneath ST-314 is estimated to be approximately 320 ft below the surface (Figure 2-10). This area may serve as a recharge area for the Albuquerque basin aquifer with groundwater movement west across the fault (SNL, 1994). A more detailed discussion of the hydrogeology at Kirtland AFB is presented in Section 2.5.

8.29.4 Nature and Extent of Contamination

The following section describes the extent of contamination based on sampling results. Analytical results for soil samples collected and submitted for analysis from ST-314 are summarized in Table 8-58, where only the reportable concentrations of detected analytes are listed. Full analytical results are presented in Appendix F. Laboratory validation reports are in Appendix K.

Organic Compounds

The VOC analyte methylene chloride (0.035 to 0.036 mg/kg) was detected in ST-314C-05, ST-314C-06, and, ST-314C-07 from 15 to 20 ft below grade. These concentrations were below the HHRB action level of 85 mg/kg.

The SVOC analytes phenol and bis(2-ethylhexyl)phthalate were detected in one or more of the soil samples submitted for analysis at ST-314. Phenol (0.82 and 1.4 mg/kg) was detected in the 3- to 5-ft depth sample at ST-314C-01, the background borehole, and ST-314C-03. Bis(2-ethylhexyl)phthalate (2.6 mg/kg) was detected only in the 15- to 20-ft sample from borehole ST-314C-01. All concentrations were below the HHRB action levels (Table 8-58).

Petroleum Hydrocarbons

No gasoline range hydrocarbons were detected in any of the soil samples submitted for analysis at ST-314. Diesel range hydrocarbons (5.1 to 17.0 mg/kg) were detected in all soil samples except those at ST-314C-03 and ST-314C-04. All concentrations were below the NMED action level of 100 mg/kg.

Metals

Arsenic and beryllium were the only metals detected at concentrations above the HHRB action levels in soil samples from ST-314 (Table 8-58). Arsenic (0.9 to 5.7 mg/kg) was detected in all samples collected. All concentrations were above the HHRB action level of 0.37 mg/kg, but were below the 6.5 mg/kg UTL. Beryllium (0.31 to 0.72 mg/kg) was detected in eight of ten samples collected at ST-314 above the HHRB action level of 0.15 mg/kg, but was below the 0.84 mg/kg UTL. Beryllium and arsenic concentrations exceeding HHRB action levels appear to be naturally occurring throughout Kirtland AFB as discussed in Section 4.2.2.

Table 8-58. Summary of Reportable Concentrations for Soil Analyses at SWMU 10-21, Buildings 48056/48059, Septic Tank, Leach Pits, and Lines (ST-314)[1] (Concentrations mg/kg)

Chemical Class	Analyte	HHRB Action Level[2]	PQL UTL	Borehole Number and Sample Depth Interval (ft)					
				ST314C-01		*ST314C-02*		*ST314C-03*	*ST314C-04*
				3–8	15–20	3–8 FR	3–8	3–5	3–5
VOC	Methylene chloride	85.0	0.005	ND	ND	ND	ND	ND	ND
SVOC	Bis(2-ethylhexyl)phthalate	46.0	0.70	ND	2.6	ND	ND	ND	ND
	Phenol	47,000	0.30	0.82	ND	ND	ND	1.4	ND
TPH	Diesel fraction	100	10.0	5.1	17.0	5.2	5.5	ND	ND
METALS	Aluminum	78,000	14,700	10,000	8,280	11,500	10,100	12,000	12,200
	Arsenic	0.37	6.5	5.7	2.5	4.7	5.2	3.2	2.8
	Barium	5,500	735	109	152	326	216	88.6	205
	Beryllium	0.15	0.84	0.53	0.41	0.52	0.54	0.72	0.67
	Cadmium	39.0	N/A	ND	0.92	0.84	0.64	1.6	ND
	Calcium	N/A	121,000	63,000	41,700	41,000	122,000	17,500	57,200
	Chromium, total	390	21.6	13.8	13.9	11.3	9.2	21.8	10.0
	Cobalt	4,700	15.4	7.6	7.3	7.1	5.1	7.7	7.6
	Copper	2,900	223	157	139	59.7	24.7	28.8	32.0
	Iron	N/A	23,800	15,300	17,900	15,000	11,900	15,700	14,200
	Lead	400	17.5	6.1	2.8	6.7	5.5	7.9	6.2
	Magnesium	N/A	10,400	5,230	4,570	5,810	5,740	4,770	5,430
	Manganese	390	549	216	327	261	221	173	274
	Mercury	23.0	N/A	ND	ND	ND	ND	ND	ND
	Molybdenum	390	N/A	ND	66.0	ND	ND	ND	ND
	Nickel	1,600	188	12.9	137	12.5	11.6	12.1	10.6
	Potassium	N/A	3,590	1,700	1,530	2,080	1,540	2,170	2,080
	Silver	390	N/A	ND	ND	ND	ND	2.8	ND
	Sodium	N/A	787	177	134	308	201	220	202
	Thallium	N/A	N/A	0.11	ND	0.12	0.11	0.13	ND
	Vanadium	550	55.3	31.9	38.1	37.1	30.3	27.2	27.5
	Zinc	23,000	114	81.0	66.5	50.9	29.3	62.1	44.1
RAD	Gross alpha	N/A	N/A	ND	ND	ND	ND	ND	ND
	Gross beta	N/A	N/A	ND	21.0	ND	ND	ND	ND
	Radium-226	N/A	N/A	ND	0.70	ND	ND	ND	ND
OTHER	pH			8.4	7.8	8.6	8.2	8.2	8.2
	Moisture (%)			5.5	2.0	4.7	6.6	16.4	10.3

Table 8-58. Summary of Reportable Concentrations for Soil Analyses at SWMU 10-21, Buildings 48056/48059, Septic Tank, Leach Pits, and Lines (ST-314)[1] (Concentrations mg/kg) (Continued)

Chemical Class	Analyte	HHRB Action Level[2]	PQL UTL	Borehole Number and Sample Depth Interval (ft)			
				ST314C-05	*ST314C-06*	*ST314C-07*	
				15–20	15–20	15–20 FR	15–20
VOC	Methylene chloride	85.0	0.005	0.035	0.036	ND	0.036
SVOC	Bis(2-ethylhexyl)phthalate	46.0	0.70	ND	ND	ND	ND
	Phenol	47,000	0.30	ND	ND	ND	ND
TPH	Diesel fraction	100	10.0	12.0	10.0	12.0	11.0
METALS	Aluminum	78,000	5,170	5,170	3,690	7,860	3,810
	Arsenic	0.37	1.5	1.5	0.90	1.5	0.60
	Barium	5,500	123	123	46.1	130	37.6
	Beryllium	0.15	0.31	0.31	ND	0.35	ND
	Cadmium	39.0	0.73	0.73	0.52	ND	ND
	Calcium	N/A	21,800	21,800	62,200	31,400	40,200
	Chromium, total	390	9.6	9.6	6.5	6.8	6.6
	Cobalt	4,700	7.4	7.4	4.4	6.9	4.7
	Copper	2,900	36.9	36.9	70.7	26.2	489
	Iron	N/A	10,400	10,400	8,610	13,100	7,350
	Lead	400	5.6	5.6	6.3	6.0	3.4
	Magnesium	N/A	3,760	3,760	2,920	4,660	2,720
	Manganese	390	253	253	169	258	187
	Mercury	23.0	0.66	0.66	ND	0.10	ND
	Molybdenum	390	ND	ND	ND	ND	ND
	Nickel	1,600	77.4	77.4	5.6	10.4	7.8
	Potassium	N/A	809	809	597	1,390	594
	Silver	390	ND	ND	ND	ND	ND
	Sodium	N/A	93.0	93.0	67.8	101	83.0
	Thallium	N/A	ND	ND	ND	ND	ND
	Vanadium	550	22.7	22.7	12.7	27.2	13.8
	Zinc	23,000	32.8	32.8	49.6	35.9	183
RAD	Gross alpha	N/A	N/A	14.0	ND	13.0	15.0
	Gross beta	N/A	N/A	22.0	23.0	22.0	24.0
	Radium-226	N/A	N/A	0.90	1.2	1.0	0.60
OTHER	pH			7.5	7.6	7.7	7.4
	Moisture (%)			3.8	3.0	13.1	2.6

FOOTNOTES

1	Complete laboratory analytical results and method detection limits are presented in Appendix K.
2	Action level of RCRA Proposed Rule Subpart S (55 *FR* 30814, 7/27/90).
*	TPH action level is 100 mg/kg adopted from NMED UST regulations (NMED, 1990). SW-8015 analyzes volatile and semivolatile petroleum hydrocarbon fractions separately. The total concentration of the two fractions analyzed under SW-8015 will be used to assess compliance with stipulated action levels for the purpose of this RFI.
#	Denotes TCLP analysis, results in mg/l.
--	No Data.
FR	Field Replicate.
HHRB	Human health risk based.
J	Estimated value.
N/A	Not Applicable.
NA	Not Analyzed.
ND	Not detected above the method detection limit.
pCi/g	picocuries per gram.
PQL	Practical quantitation limits (defines VOC, SVOC, and TPH).
R	Reject NDs due to interference.
RAD	Radionuclides.
RE	Resample.
SVOC	Semivolatile organic compounds.
TPH	Total petroleum hydrocarbons.
U	Accept data (positive results may be influenced by lab contamination).
UJ	Estimated nondetect.
UTL	Upper tolerance limits (defines metals).
VOC	Volatile organic compounds.

Gross Alpha and Gross Beta

A screening level analysis was performed on gross alpha and gross beta data generated from soil samples collected at ST-314 to determine if radiological materials had been released to subsurface soil. A comparison of sample and background population arithmetic means was performed to determine if the sample and background populations were equal. Background data for this comparison included the single background sampling borehole ST-314C-01 (collected during the Stage 2B RFI), data collected at radioactive burial site RB-11 during the Appendix IV-1 RFI, and data collected by SNL (Kirtland AFB, 1994). The analysis determined with 95-percent confidence that the background and site data sets are from the same population. Therefore, it is concluded that there have not been any releases of alpha or beta emitting radionuclides to subsurface soil at this site.

Soil pH and Moisture

Soil pH ranged from 7.4 to 8.6 in these samples. Soil moisture values ranged from 2.0 to 16.4 percent (Table 8-58).

8.29.5 Conclusions and Recommendations

Conclusions

- One VOC and two SVOCs were detected in the soil samples submitted for analysis from this site; all concentrations were below the HHRB action levels.
- No gasoline range hydrocarbons were detected. Diesel range hydrocarbons were detected in several of the soil samples submitted for analysis. The concentrations did not exceed the NMED action level of 100 mg/kg. The diesel range hydrocarbon concentrations (5.1 to 17.0 mg/kg) were similar to concentrations detected in background samples analyzed during the Appendix III RFI, and are not indicative of a release.
- Arsenic and beryllium were the only metals detected at concentrations exceeding HHRB action levels; these concentrations appear to be naturally occurring throughout Kirtland AFB.
- The analytical results at ST-314 are not indicative of a contaminant release from this site.

Recommendations

- Based on the findings of the RFI, no further action is necessary; therefore, ST-314 does not require further investigation. A No Further Action proposal should be prepared.

8.30 SWMU 10-21, Building 30102, Abandoned Septic Tank and Lines (ST-315)

8.30.1 Site Background and Environmental Setting

Septic tank ST-315 is an abandoned system 440 ft northwest of Building 30102 in the central portion of Kirtland AFB (Figure 8-30). ST-315 was investigated on February 27, 1995.

Based on engineering drawings and observed site conditions, the inflow line length to the septic tank is approximately 450 ft. Potentially, the septic tank could have received contaminants from a facility and could have overflowed and entered the surrounding soil.

ST-315 is near the entrance to the MWSA. This site, isolated from the urban/industrial environmental zone, is at the foot of the Manzano Mountains on the east boundary of the Albuquerque-Belen Basin. No production wells exist near this site (Figure 2-11).

8.30.2 Study Area Investigation

The area of investigation was limited to the soil surrounding the septic tank. Possible source materials in the septic tank were not investigated.

8.30.2.1 Previous Investigations

No previous investigations have been performed at this site.

8.30.2.2 Data Gaps

No information related to the past use of ST-315 was available. No data were available to determine the presence or absence of contaminants in the subsurface soil in the leach field.

8.30.2.3 RFI Field Investigation

The objective of this investigation was to determine if contamination is present in the subsurface soil adjacent to the septic tank. On February 27, 1995, three boreholes were drilled and sampled using a Geoprobe. Borehole ST-315C-01 was drilled northeast of the septic tank to collect background concentration data for this site. This borehole was assumed to be in an area away from any known or suspected contamination. All other boreholes were drilled adjacent to the septic tank. Based on engineering drawings and observed field conditions, the septic tank base was determined to be 3 ft below grade. The sample interval at each borehole extended from the depth of the septic tank to 5 ft below the septic tank. From this interval, two samples were collected: one at a depth equal to the base of the septic tank, the other from 3 ft below the base of the septic tank. Only the sample collected at the depth of the septic tank base was submitted for laboratory analysis.

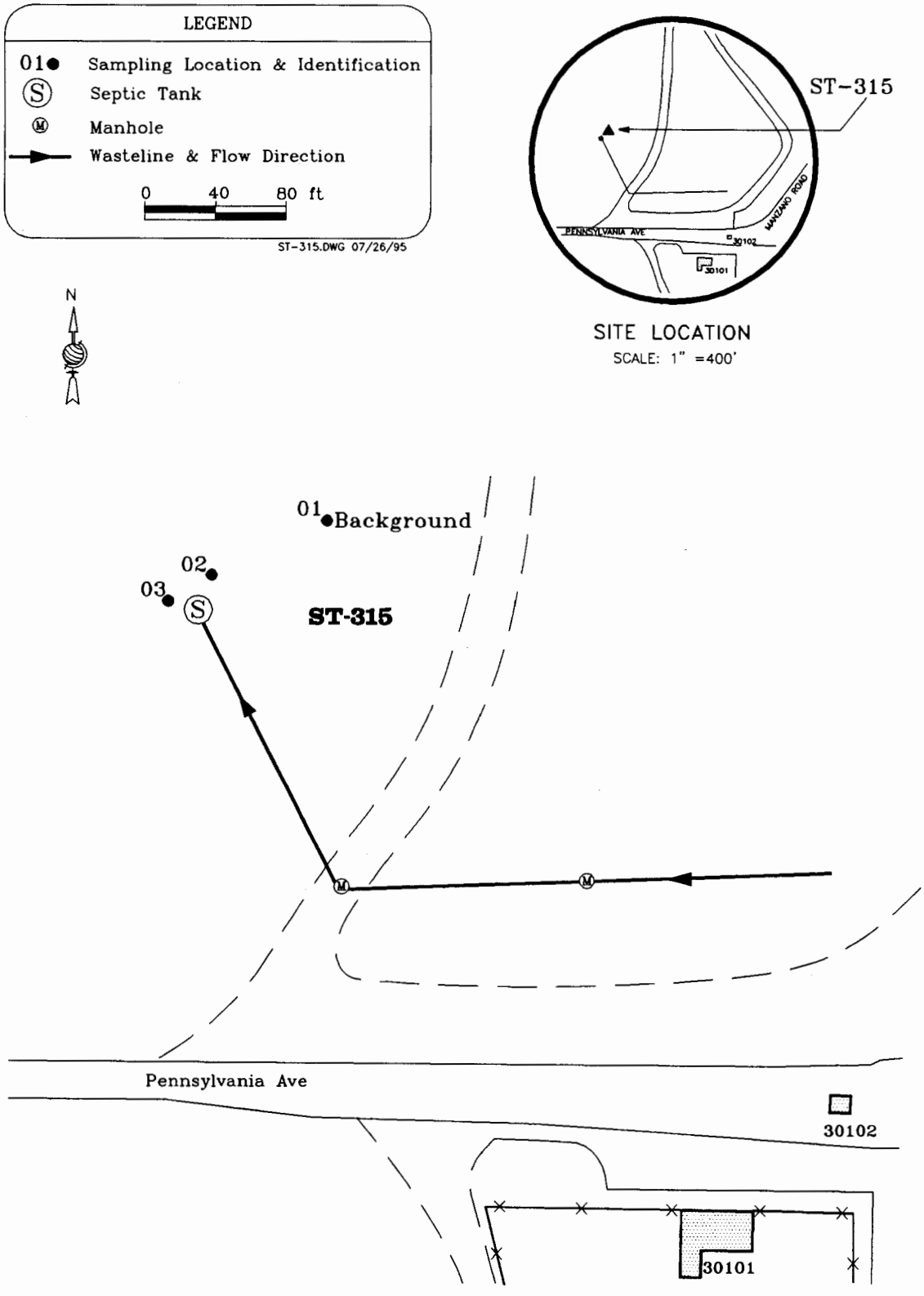


Figure 8-30. Soil Sampling Locations at SWMU 10-21, Building 30102, Abandoned Septic Tank and Lines (ST-315)

Sampling operations and sample handling procedures are described in Section 3.0. Borehole locations and the sample interval that was sent to the laboratory are listed in Table 8-59. Borehole logs are in Appendix C.

Table 8-59. Boreholes and Samples Analyzed from SWMU 10-21, Building 30102, Abandoned Septic Tank and Lines (ST-315)

Borehole	Borehole Location	Sample Depth (ft)
ST-315C-01	Background borehole	3–5
ST-315C-02	Near the septic tank	3–5
ST-315C-03	Near the septic tank	3–5

8.30.2.4 Laboratory Analysis

Three soil samples were analyzed for VOCs, SVOCs, TPH as DRO and GRO, metals, mercury (the expected contaminants associated with normal operations at this building), soil pH, and soil moisture. The four brass tubes in each 2-ft sample interval were field-screened for possible contamination using a beta-gamma meter and a FID. No elevated readings were measured with these instruments.

8.30.3 Site Characteristics

8.30.3.1 Geology

The ST-315 area is underlain by unconsolidated alluvial sediment that is predominantly very fine-grained to fine-grained sand with some fine gravel. Three 8-ft boreholes were drilled at ST-315. No boreholes penetrated into the Santa Fe Group sediments that presumably underlie this area. A discussion of the general geology at Kirtland AFB is presented in Section 2.4.

As a result of septic tank installation, it is probable that backfill material is present in the septic tank area. Borehole logs for this area are presented in Appendix C.

8.30.3.2 Hydrogeology

This site is in the HR2 saturated zone setting as defined by SNL studies (Figure 2-9) (SNL, 1994). HR2 straddles the Tijeras/Hubbell Springs/Sandia Fault complex. The saturated zone hydrogeology is characterized by the juxtaposition of higher permeability Santa Fe Group sediments against low permeability Paleozoic and Precambrian bedrock (Thorn *et al.*, 1993). Santa Fe Group sediments are faulted down to the west across the faults. Very little is known about groundwater flow in this region except that a steep gradient exists across the fault zone. East of the fault zone, the static water elevation is estimated at 5,710 ft amsl; however, it drops to 4,920–4,935 ft amsl at Sandia Technical Area III (Figure 2-7).

Groundwater beneath ST-315 is estimated to be approximately 320 ft below the surface (Figure 2-10). This area may serve as a recharge area for the Albuquerque Basin aquifer with groundwater movement

west across the fault (SNL, 1994). A more detailed discussion of the hydrogeology at Kirtland AFB is presented in Section 2.5.

8.30.4 Nature and Extent of Contamination

The following section describes the extent of contamination based on sampling results. Analytical results for soil samples collected and submitted for analysis from ST-315 are summarized in Table 8-60, where only the reportable concentrations of detected analytes are listed. Full analytical results are presented in Appendix F. Laboratory validation reports are in Appendix K.

Organic Compounds

No VOC or SVOC analytes were detected in any of the soil samples submitted for analysis at ST-315.

Petroleum Hydrocarbons

No gasoline or diesel range hydrocarbons were detected in any of the soil samples submitted for analysis at ST-315.

Metals

Arsenic and beryllium were the only metals detected at concentrations above the HHRB action levels in the soil samples submitted for analysis from ST-315 (Table 8-60). Arsenic (1.7 to 2.7 mg/kg) was detected in all samples collected at a concentration above the HHRB action level of 0.37 mg/kg, but was below the 6.5 mg/kg UTL. Beryllium (0.32 to 0.41 mg/kg) was detected in all samples collected at ST-315 above the HHRB action level of 0.15 mg/kg, but was below the 0.84 mg/kg UTL. These concentrations appear to be naturally occurring throughout Kirtland AFB as discussed in Section 4.2.2.

Soil pH and Moisture

Soil pH ranged from 8.3 to 9.3 in these samples. Soil moisture values ranged from 3.6 to 5.3 percent (Table 8-60).

8.30.5 Conclusions and Recommendations

Conclusions

- No VOCs or SVOCs were detected in the soil samples submitted for analysis from this site.
- No gasoline or diesel range hydrocarbons were detected at ST-315.

Table 8-60. Summary of Reportable Concentrations for Soil Analyses at SWMU 10-21, Building 30102, Abandoned Septic Tank and Lines (ST-315)[1] (Concentrations mg/kg)

Chemical Class	Analyte	HHRB Action Level[2]	PQL UTL	Borehole Number and Sample Depth Interval (ft)		
				ST315C-01	*ST315C-02*	*ST315C-03*
				3–5	3–5	3–5
METALS	Aluminum	78,000	14,700	12,500	10,700	9,560
	Arsenic	0.37	6.5	2.7	1.7	1.8
	Barium	5,500	735	289	123	94.4
	Beryllium	0.15	0.84	0.41	0.32	0.32
	Cadmium	39.0	N/A	0.73	0.63	ND
	Calcium	N/A	121,000	39,700	19,300	11,400
	Chromium, total	390	21.6	19.3	33.3	32.7
	Cobalt	4,700	15.4	12.4	13.2	13.3
	Copper	2,900	223	103	33.2	26.4
	Iron	N/A	23,800	17,600	16,000	17,000
	Lead	400	17.5	5.4	5.8	7.0
	Magnesium	N/A	10,400	7,350	7,240	7,280
	Manganese	390	549	241	298	306
	Nickel	1,600	188	23.7	29.9	30.5
	Potassium	N/A	3,590	2,590	2,270	2,060
	Sodium	N/A	787	369	336	299
	Thallium	N/A	N/A	ND	ND	0.13
	Vanadium	550	55.3	43.4	33.6	33.9
	Zinc	23,000	114	58.0	39.5	35.1
OTHER	pH			9.3	8.9	8.3
	Moisture (%)			3.6	5.3	5.1

FOOTNOTES

1	Complete laboratory analytical results and method detection limits are presented in Appendix K.
2	Action level of RCRA Proposed Rule Subpart S (55 *FR* 30814, 7/27/90).
*	TPH action level is 100 mg/kg adopted from NMED UST regulations (NMED, 1990). SW-8015 analyzes volatile and semivolatile petroleum hydrocarbon fractions separately. The total concentration of the two fractions analyzed under SW-8015 will be used to assess compliance with stipulated action levels for the purpose of this RFI.
#	Denotes TCLP analysis, results in mg/l.
--	No Data.
FR	Field Replicate.
HHRB	Human health risk based.
J	Estimated value.
N/A	Not Applicable.
NA	Not Analyzed.
ND	Not detected above the method detection limit.
pCi/g	picocuries per gram.
PQL	Practical quantitation limits (defines VOC, SVOC, and TPH).
R	Reject NDs due to interference.
RAD	Radionuclides.
RE	Resample.
SVOC	Semivolatile organic compounds.
TPH	Total petroleum hydrocarbons.
U	Accept data (positive results may be influenced by lab contamination).
UJ	Estimated nondetect.
UTL	Upper tolerance limits (defines metals).
VOC	Volatile organic compounds.

- Arsenic and beryllium were the only metals detected at concentrations exceeding HHRB action levels; those concentrations appear to be naturally occurring throughout Kirtland AFB.
- The analytical results at ST-315 are not indicative of a contaminant release from this site.

Recommendations

- Based on the findings of the RFI, no further action is necessary; therefore, ST-315 does not require further investigation. A No Further Action proposal should be prepared.

8.31 SWMU 10-21, Buildings 57003/57012, Septic Tank, Leach Field, and Lines (ST-316)

8.31.1 Site Background and Environmental Setting

Septic tank ST-316 is located southeast of Buildings 57003 and 57012, a warehouse and a science laboratory at the former Civil Engineering Research Facility, in the south-central portion of Kirtland AFB (Figure 8-31). ST-316 was investigated on February 28, 1995.

Based on engineering drawings and observed site conditions, inflow and outflow line lengths to the septic tank and leach field are estimated to be approximately 160 ft and 15 ft, respectively. This tank discharges to a leach field to the southeast with a drainage area approximately 70 ft long and 36 ft wide. Potentially, the septic tank could have received contaminants from Buildings 57013 and 57012. Due to the leach field's design, waste from ST-316 can be expected to have entered the surrounding soil.

Buildings 57003 and 57012 are on the Hubbell Bench, on the east boundary of the Albuquerque-Belen Basin (USAF, 1993c). The nearest production well to the site is KAFB-10 (Figure 2-11), 17,500 ft northwest, which is controlled and operated by DOE and SNL.

8.31.2 Study Area Investigation

The area of investigation was limited to the leach field at ST-316. Possible source materials in the septic tank were not investigated.

8.31.2.1 Previous Investigations

No previous investigations have been performed at this site.

8.31.2.2 Data Gaps

No information related to the past use of ST-316 was available. No data were available to determine the presence or absence of contaminants in the subsurface soil in the leach field.

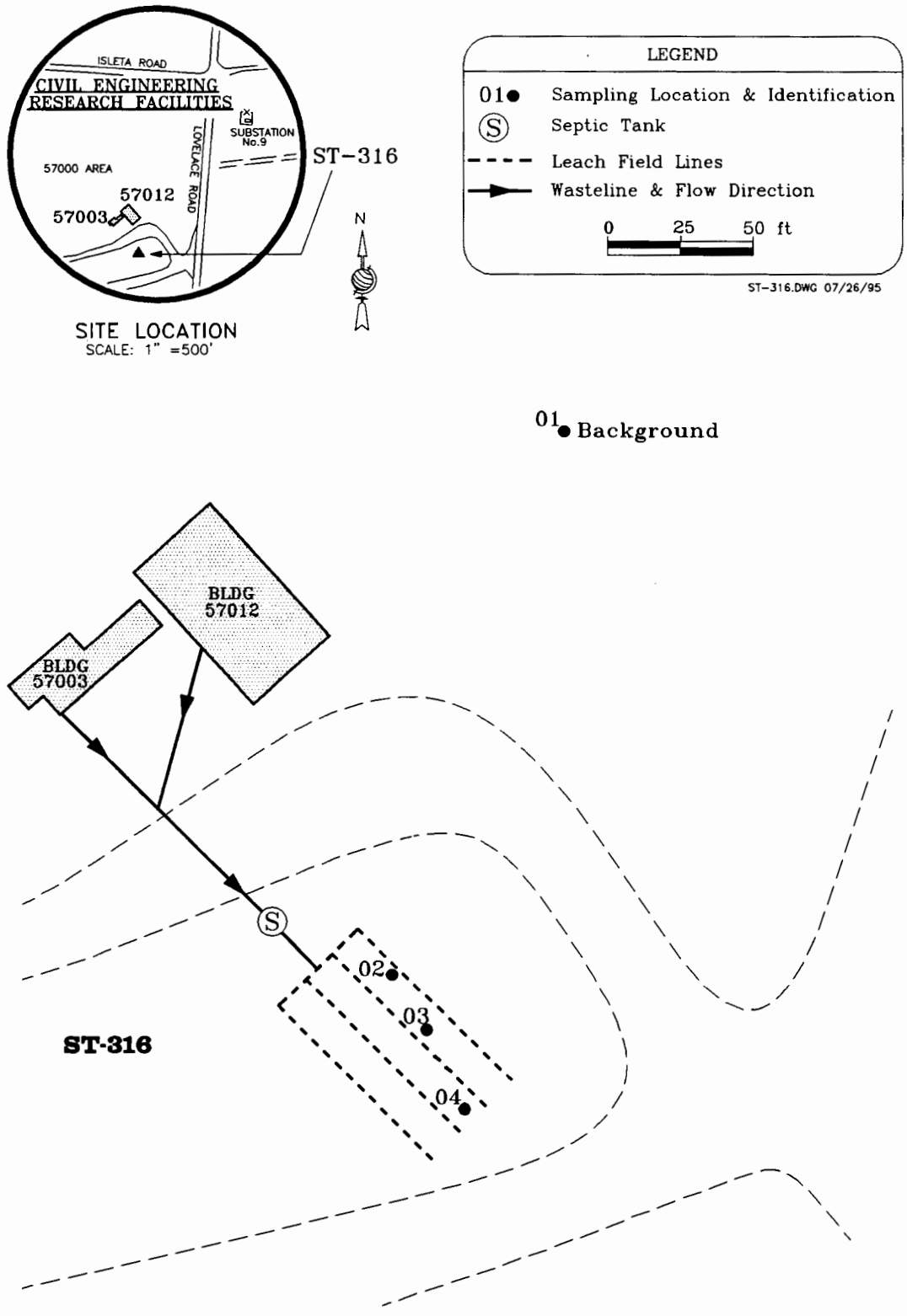


Figure 8-31. Soil Sampling Locations at SWMU 10-21, Buildings 57003/57012, Septic Tank, Leach Field, and Lines (ST-316)

8.31.2.3 RFI Field Investigation

The objective of this investigation was to determine if contamination is present in the subsurface soil in the leach field area. On February 28, 1995, four boreholes were drilled and sampled using a Geoprobe. Borehole ST-316C-01 was drilled north of the leach field area to collect background concentration data for this site. This borehole was assumed to be in an area away from any known or suspected contamination. All other boreholes were drilled in the leach field area. Based on engineering drawings and observed field conditions, the leach field lines were determined to be 5 ft below grade. The sample interval at each borehole extended from the depth of the leach field line to 5 ft below the leach field line. From this interval, two samples were collected: one at a depth equal to the base of the leach field line, the other from 3 ft below the base of the leach field line. Only the sample collected at the depth of the leach field line was submitted for laboratory analysis.

Sampling operations and sample handling procedures are described in Section 3.0. Borehole locations and the sample interval that was sent to the laboratory are listed in Table 8-61. Borehole logs are in Appendix C.

Table 8-61. Boreholes and Samples Analyzed from SWMU 10-21, Buildings 57003/57012, Septic Tank, Leach Field, and Lines (ST-316)

Borehole	Borehole Location	Sample Depth (ft)
ST-316C-01	Background borehole	5–7
ST-316C-02	In the leach field area	5–7
ST-316C-03	In the leach field area	5–7
ST-316C-04	In the leach field area	5–7

8.31.2.4 Laboratory Analysis

Four soil samples were analyzed for VOCs, SVOCs, TPH as DRO and GRO, metals, mercury (the expected contaminants associated with normal operations at this building), soil pH, and soil moisture. The four brass tubes in each 2-ft sample interval were field-screened for possible contamination using a beta-gamma meter and a FID. No elevated readings were measured with these instruments.

8.31.3 Site Characteristics

8.31.3.1 Geology

The ST-316 area is underlain by unconsolidated alluvial sediment that is predominantly very fine-grained to fine-grained sand. Four 10-ft boreholes were drilled at ST-316. No boreholes penetrated into the Santa Fe Group sediments that presumably underlie this area. A discussion of the general geology at Kirtland AFB is presented in Section 2.4.

As a result of leach field installation, it is probable that backfill material is present in the leach field area. Borehole logs for this area are presented in Appendix C.

8.31.3.2 Hydrogeology

ST-316 is on the western edge of the HR3 saturated zone setting as defined by SNL studies (Figure 2-9). Bedrock in this area is inferred to be Permian- and Pennsylvanian-aged sedimentary rock. Near the mountains, bedrock is inferred to be Precambrian granite and metamorphic rock. Bedrock is covered by alluvial material, and the thickness of this cover presumably increases west away from the mountains. Depth to groundwater is estimated at 90 to 100 ft below grade (Figure 2-10) (SNL, 1994). Groundwater flow is west-northwest (Figure 2-7). The nearest production well is KAFB-10, nearly 3.5 mi northwest and potentially downgradient of the site (Figures 2-7 and 2-11). Hydraulic conductivity values based on testing range from 6.52 to 114.5 ft/day. A more detailed discussion of the hydrogeology at Kirtland AFB is presented in Section 2.5.

8.31.4 Nature and Extent of Contamination

The following section describes the extent of contamination based on sampling results. Analytical results for soil samples collected and submitted for analysis from ST-316 are summarized in Table 8-62, where only the reportable concentrations of detected analytes are listed. Full analytical results are presented in Appendix F. Laboratory validation reports are in Appendix K.

Organic Compounds

No VOC or SVOC analytes were detected in any of the soil samples submitted for analysis at ST-316.

Petroleum Hydrocarbons

No gasoline or diesel range hydrocarbons were detected in any of the boreholes at ST-316.

Metals

Arsenic and beryllium were the only metals detected at concentrations above the HHRB action levels in the soil samples from ST-316 (Table 8-62). Arsenic (3.1 to 7.3 mg/kg) was detected in all samples collected at a concentration above the HHRB action level of 0.37 mg/kg and exceeded the 6.5 mg/kg UTL in one borehole (ST-316C-01). Beryllium (0.31 and 0.42 mg/kg) was detected in two of the four samples collected at ST-316 above the HHRB action level of 0.15 mg/kg, but was below the 0.84 mg/kg UTL. These concentrations appear to be naturally occurring throughout Kirtland AFB as discussed in Section 4.2.2.

Soil pH and Moisture

Soil pH ranged from 8.0 to 8.5 in these samples. Soil moisture values ranged from 2.9 to 6.3 percent (Table 8-62).

Table 8-62. Summary of Reportable Concentrations for Soil Analyses at SWMU 10-21, Buildings 57003/57012, Septic Tank, Leach Field, and Lines (ST-316)[1] (Concentrations mg/kg)

Chemical Class	Analyte	HHRB Action Level[2]	UTL	Borehole Number and Sample Depth Interval (ft)			
				ST316C-01	*ST316C-02*	*ST316C-03*	*ST316C-04*
				5–7	5–7	5–7	5–7
METALS	Aluminum	78,000	14,700	5,730	5,300	8,020	5,690
	Arsenic	0.37	6.5	7.3	3.2	3.7	3.1
	Barium	5,500	735	387	156	137	80.8
	Beryllium	0.15	0.84	ND	0.31	0.42	ND
	Cadmium	39.0	N/A	ND	0.52	ND	0.51
	Calcium	N/A	121,000	154,000	62,400	32,700	62,400
	Chromium, total	390	21.6	7.3	5.7	6.7	7.2
	Cobalt	4,700	15.4	2.1	3.6	5.2	3.1
	Copper	2,900	223	61.9	27.9	9.1	14.5
	Iron	N/A	23,800	4,940	7,210	10,100	7,170
	Lead	400	17.5	4.8	8.0	8.4	7.2
	Magnesium	N/A	10,400	9,940	5,140	4,590	3,750
	Manganese	390	549	112	128	184	137
	Nickel	1,600	188	4.7	4.7	7.4	3.1
	Potassium	N/A	3,590	927	908	1,510	1,010
	Sodium	N/A	787	430	811	1,160	755
	Vanadium	550	55.3	24.8	17.1	24.2	19.6
	Zinc	23,000	114	33.7	35.5	28.5	25.4
OTHER	pH			8.3	8.5	8.0	8.4
	Moisture (%)			6.3	4.1	5.3	2.9

FOOTNOTES

1	Complete laboratory analytical results and method detection limits are presented in Appendix K.
2	Action level of RCRA Proposed Rule Subpart S (55 *FR* 30814, 7/27/90).
*	TPH action level is 100 mg/kg adopted from NMED UST regulations (NMED, 1990). SW-8015 analyzes volatile and semivolatile petroleum hydrocarbon fractions separately. The total concentration of the two fractions analyzed under SW-8015 will be used to assess compliance with stipulated action levels for the purpose of this RFI.
#	Denotes TCLP analysis, results in mg/l.
--	No Data.
FR	Field Replicate.
HHRB	Human health risk based.
J	Estimated value.
N/A	Not Applicable.
NA	Not Analyzed.
ND	Not detected above the method detection limit.
pCi/g	picocuries per gram.
PQL	Practical quantitation limits (defines VOC, SVOC, and TPH).
R	Reject NDs due to interference.
RAD	Radionuclides.
RE	Resample.
SVOC	Semivolatile organic compounds.
TPH	Total petroleum hydrocarbons.
U	Accept data (positive results may be influenced by lab contamination).
UJ	Estimated nondetect.
UTL	Upper tolerance limits (defines metals).
VOC	Volatile organic compounds.

8.31.5 Conclusions and Recommendations

Conclusions

- No VOCs or SVOCs were detected in the soil samples collected from this site.
- No gasoline or diesel range hydrocarbons were detected at ST-316.
- Arsenic and beryllium were the only metals detected at concentrations exceeding HHRB action levels; these concentrations appear to be naturally occurring throughout Kirtland AFB.
- The analytical results at ST-316 are not indicative of a contaminant release from this site.

Recommendations

- Based on the findings of the RFI, no further action is necessary; therefore, ST-316 does not require further investigation. A No Further Action proposal should be prepared.

8.32 SWMU 10-21, Building 57011, Septic Tank, Leach Field, and Lines (ST-317)

8.32.1 Site Background and Environmental Setting

Septic tank ST-317 is east of Building 57011, a science laboratory at the former Civil Engineering Research Facility, in the south-central portion of Kirtland AFB (Figure 8-32). ST-317 was investigated on February 28, 1995.

Based on engineering drawings, septic tank inflow and outflow line lengths are approximately 20 ft and 390 ft, respectively. This tank discharges to a leach field to the south-southwest with a drainage area approximately 50 ft x 60 ft. Potentially, the septic tank could have received contaminants from Building 57011. Due to the leach field's design, waste from ST-317 can be expected to have entered the surrounding soil.

Building 57011 is on the Hubbell Bench, on the east boundary of the Albuquerque-Belen Basin (USAF, 1993c). The nearest production well to the site is KAFB-10 (Figure 2-11), which is approximately 19,000 ft northwest and is controlled and operated by DOE and SNL.

8.32.2 Study Area Investigation

The area of investigation was limited to the leach field at ST-317. Possible source materials in the septic tank were not investigated.

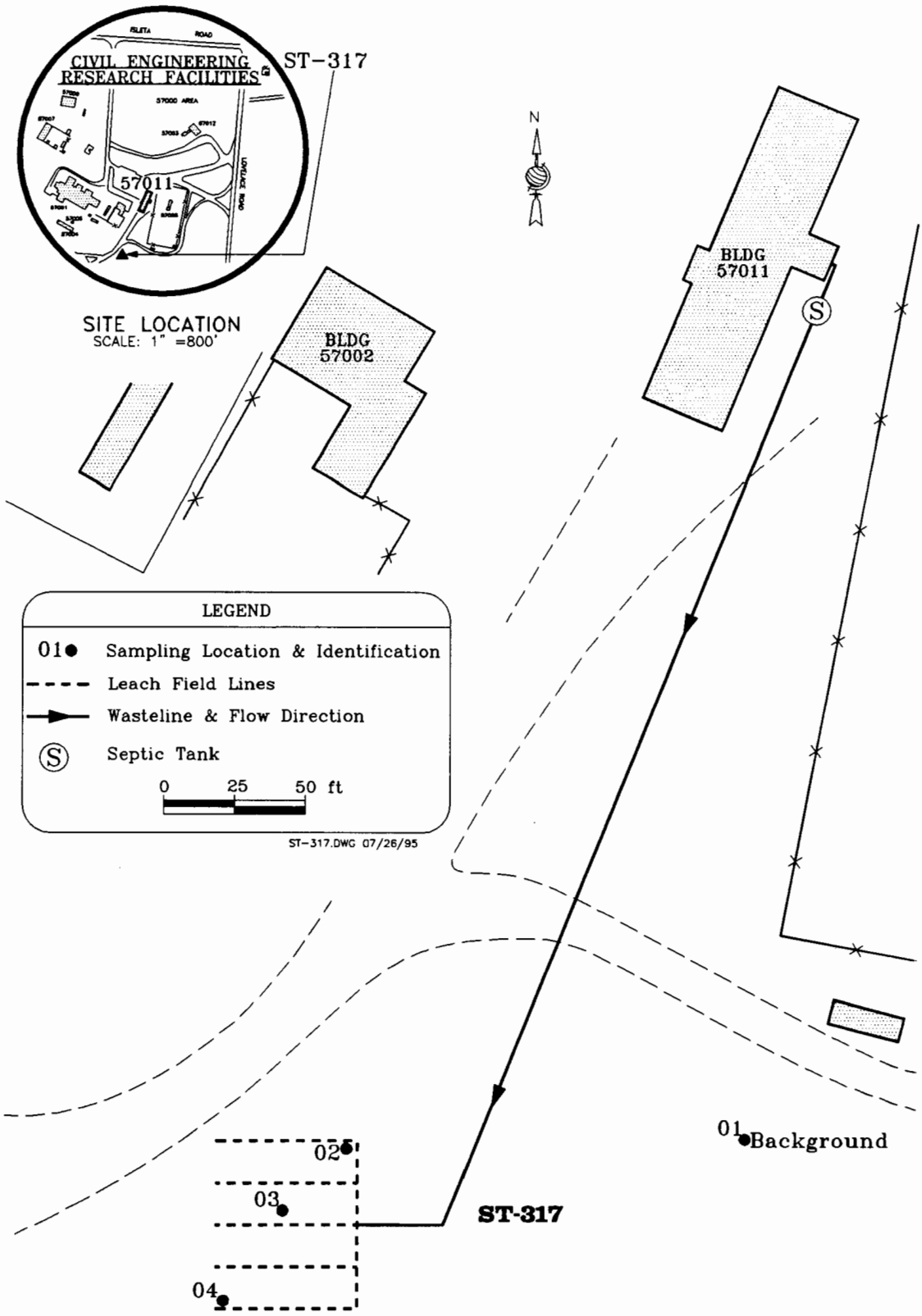


Figure 8-32. Soil Sampling Locations at SWMU 10-21, Building 57011, Septic Tank, Leach Field, and Lines (ST-317)

8.32.2.1 Previous Investigations

No previous investigations have been performed at this site.

8.32.2.2 Data Gaps

No information related to the past use of ST-317 was available. No data were available to determine the presence or absence of contaminants in the subsurface soil in the leach field.

8.32.2.3 RFI Field Investigation

The objective of this investigation was to determine if contamination is present in the subsurface soil in the leach field area. On February 28, 1995, four boreholes were drilled and sampled using a Geoprobe. Borehole ST-317C-01 was drilled east of the leach field area to collect background concentration data for this site. This borehole was assumed to be in an area away from any known or suspected contamination. All other boreholes were drilled in the leach field area. Based on engineering drawings and observed field conditions, the leach field lines were determined to be 2 ft below grade. The sample interval at each borehole extended from the depth of the leach field line to 5 ft below the leach field line. From this interval, two samples were collected: one at a depth equal to the base of the leach field line, the other from 3 ft below the base of the leach field line. Only one sample from this interval was submitted for laboratory analysis.

Sampling operations and sample handling procedures are described in Section 3.0. Borehole locations and the sample interval that was sent to the laboratory are listed in Table 8-63. Borehole logs are in Appendix C.

Table 8-63. Boreholes and Samples Analyzed from SWMU 10-21, Building 57011, Septic Tank, Leach Field, and Lines (ST-317)

Borehole	Borehole Location	Sample Depth (ft)
ST-317C-01	Background Borehole	2–4
ST-317C-02	In the leach field area	2–4
ST-317C-03	In the leach field area	4–8[a]
ST-317C-04	In the leach field area	7–9[b]

a. A MS/MSD sample was also collected at this interval.

b. A replicate sample was also retrieved at a borehole 1-ft west of borehole 04.

8.32.2.4 Laboratory Analysis

Five soil samples, including one replicate, were analyzed for VOCs, SVOCs, TPH as GRO and DRO, metals, mercury (the expected contaminants associated with normal operations at this building), soil pH, and soil moisture. The four brass tubes in each 2-ft sample interval were field-screened for possible contamination using a beta-gamma meter and a FID. No elevated readings were measured with these instruments.

8.32.3 Site Characteristics

8.32.3.1 Geology

The ST-317 area is underlain by unconsolidated alluvial sediment that is predominantly very fine-grained to fine-grained sand in the 2-to 7-ft range and sandy gravel in the 7- to 9-ft interval. Two 7-ft, one 9-ft and one 8-ft boreholes were drilled at ST-317. No boreholes penetrated into the Santa Fe Group sediments that presumably underlie this area. A discussion of the general geology at Kirtland AFB is presented in Section 2.4.

As a result of leach field installation, it is probable that backfill material is present in the leach field area. Borehole logs for this area are presented in Appendix C.

8.32.3.2 Hydrogeology

ST-318 is on the western edge of the HR3 saturated zone setting as defined by SNL studies (Figure 2-9). Bedrock in this area is inferred to be Permian- and Pennsylvanian-aged sedimentary rock. Near the mountains, bedrock is inferred to be Precambrian granite and metamorphic rock. Bedrock is covered by alluvial material and the thickness of this cover presumably increases west away from the mountains. Depth to groundwater is estimated at 90 to 100 ft below grade (Figure 2-10) (SNL, 1994). Groundwater flow is west-northwest (Figure 2-7). The nearest production well is KAFB-10, nearly 4 mi northwest and potentially downgradient of the site (Figures 2-7 and 2-11). Hydraulic conductivity values based on testing range from 6.52 to 114.5 ft/day. A more detailed discussion of the hydrogeology at Kirtland AFB is presented in Section 2.5.

8.32.4 Nature and Extent of Contamination

The following section describes the extent of contamination based on sampling results. Analytical results for soil samples collected and submitted for analysis from ST-317 are summarized in Table 8-64, where only the reportable concentrations of detected analytes are listed. Full analytical results are presented in Appendix F. Laboratory validation reports are in Appendix K.

Organic Compounds

No VOC or SVOC analytes were detected in any of the soil samples submitted for analysis at ST-317.

Petroleum Hydrocarbons

No gasoline range hydrocarbons were detected in any of the soil samples submitted for analysis at ST-317. Diesel range hydrocarbons (7.1 to 8.9 mg/kg) were detected in all samples except those from ST-317C-04. These concentrations were below the NMED action level of 100 mg/kg.

Table 8-64. Summary of Reportable Concentrations for Soil Analyses at SWMU 10-21, Building 57011, Septic Tank, Leach Field, and Lines (ST-317)[1] (Concentrations mg/kg)

Chemical Class	Analyte	HHRB Action Level[2]	PQL UTL	Borehole Number and Sample Depth Interval (ft)				
				ST317C-01	*ST317C-02*	*ST317C-03*	*ST317C-04*	
				2–4	2–4	4–8	7–9 FR	7–9
TPH	Diesel fraction	100	10.0	8.9	7.7	7.1	ND	ND
METALS	Aluminum	78,000	14,700	7,200	7,900	6,360	7,920	5,070
	Arsenic	0.37	6.5	4.9	7.9	3.4	7.3	3.2
	Barium	5,500	735	481	586	391	385	118
	Beryllium	0.15	0.84	0.33	0.33	ND	0.33	ND
	Cadmium	39.0	N/A	ND	ND	0.92	ND	ND
	Calcium	N/A	121,000	102,000	77,200	104,000	102,000	57,300
	Chromium, total	390	21.6	6.6	7.3	5.8	7.4	5.1
	Cobalt	4,700	15.4	3.3	5.5	3.0	4.3	2.9
	Copper	2,900	223	30.2	23.5	46.8	108	79.9
	Iron	N/A	23,800	5,700	7,700	5,740	7,400	5,510
	Lead	400	17.5	30.6	6.4	4.7	5.5	5.1
	Magnesium	N/A	10,400	9,460	10,500	6,410	7,650	3,470
	Manganese	390	549	88.6	118	79.2	118	141
	Nickel	1,600	188	5.8	5.0	4.3	5.9	3.0
	Potassium	N/A	3,590	1,550	1,130	1,220	1,160	893
	Sodium	N/A	787	395	1,170	410	1,170	574
	Vanadium	550	55.3	32.5	45.9	17.9	38.9	18.1
	Zinc	23,000	114	23.9	28.0	31.7	53.5	46.0
OTHER	pH			9.0	8.7	8.7	7.9	7.8
	Moisture (%)			8.6	9.8	1.8	9.7	6.4

FOOTNOTES

1	Complete laboratory analytical results and method detection limits are presented in Appendix K.
2	Action level of RCRA Proposed Rule Subpart S (55 *FR* 30814, 7/27/90).
*	TPH action level is 100 mg/kg adopted from NMED UST regulations (NMED, 1990). SW-8015 analyzes volatile and semivolatile petroleum hydrocarbon fractions separately. The total concentration of the two fractions analyzed under SW-8015 will be used to assess compliance with stipulated action levels for the purpose of this RFI.
#	Denotes TCLP analysis, results in mg/l.
--	No Data.
FR	Field Replicate.
HHRB	Human health risk based.
J	Estimated value.
N/A	Not Applicable.
NA	Not Analyzed.
ND	Not detected above the method detection limit.
pCi/g	picocuries per gram.
PQL	Practical quantitation limits (defines VOC, SVOC, and TPH).
R	Reject NDs due to interference.
RAD	Radionuclides.
RE	Resample.
SVOC	Semivolatile organic compounds.
TPH	Total petroleum hydrocarbons.
U	Accept data (positive results may be influenced by lab contamination).
UJ	Estimated nondetect.
UTL	Upper tolerance limits (defines metals).
VOC	Volatile organic compounds.

Metals

Arsenic and beryllium were the only metals detected at concentrations above the HHRB action levels in the soil samples submitted for analysis from ST-317 (Table 8-64). Arsenic (3.2 to 7.9 mg/kg) was detected in all samples collected at concentrations above the HHRB action level of 0.37 mg/kg, and exceeded the 6.5 mg/kg UTL in two samples. Beryllium (0.33 mg/kg) was detected in three of the five samples collected at ST-317 above the HHRB action level of 0.15 mg/kg, but was below the 0.84 mg/kg UTL. These concentrations appear to be naturally occurring throughout Kirtland AFB as discussed in Section 4.2.2.

Soil pH and Moisture

Soil pH ranged from 7.8 to 9.0 in these samples. Soil moisture values ranged from 1.8 to 9.8 percent (Table 8-64).

8.32.5 Conclusions and Recommendations

Conclusions

- No VOCs or SVOCs were detected in the soil samples submitted for analysis from this site.
- No gasoline range hydrocarbons were detected. Diesel range hydrocarbons were detected in three soil samples at this site. The concentrations did not exceed the NMED action level of 100 mg/kg. The diesel range hydrocarbons (7.1 to 8.9 mg/kg) detected in the samples were similar to the concentrations detected in background samples analyzed during the Appendix III RFI, and are not indicative of a release.
- Arsenic and beryllium were the only metals detected at concentrations exceeding HHRB action levels; these concentrations appear to be naturally occurring throughout Kirtland AFB.
- The analytical results at ST-317 are not indicative of a contaminant release from this site.

Recommendations

- Based on the findings of the RFI, no further action is necessary; therefore, ST-317 does not require further investigation. A No Further Action proposal should be prepared.

8.33 SWMU 10-21, Building 37200, Septic Tank, Leach Field, and Lines (ST-318)

8.33.1 Site Background and Environmental Setting

Septic tank ST-318 is 95 ft west-northwest of Building 37200, an inspection shop, in the central portion of Kirtland AFB (Figure 8-33). ST-318 was investigated on March 22, 1995.

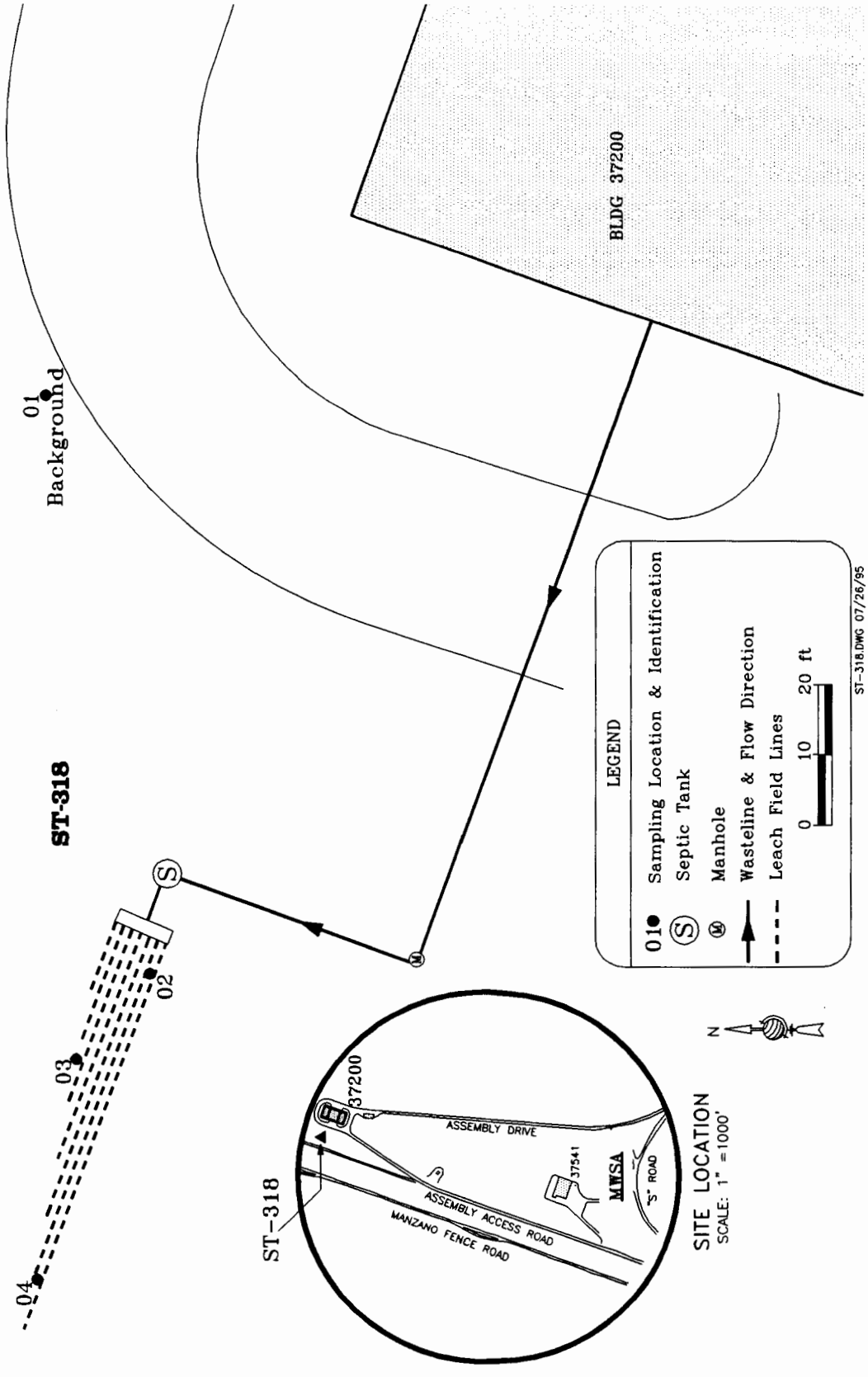


Figure 8-33. Soil Sampling Locations at SWMU 10-21, Building 37200, Septic Tank, Leach Field, and Lines (ST-318)

Based on engineering drawings and observed site conditions, septic tank inflow and outflow line lengths are approximately 130 ft and 5 ft, respectively. This tank discharges to a leach field to the west having a drainage area approximately 60 ft x 7 ft. Potentially, the septic tank could have received contaminants from Building 37200. Due to the leach field's design, wastes from ST-318 can be expected to have entered the surrounding soil.

Building 37200 is on the MWSA. This site is isolated from the urban/industrial environmental zone and is at the foot of the Manzano Mountains on the east boundary of the Albuquerque-Belen Basin. No production wells exist near this site (Figure 2-11).

8.33.2 Study Area Investigation

The area of investigation was limited to the leach field at ST-318. Possible source materials in the septic tank were not investigated.

8.33.2.1 Previous Investigations

No previous investigations have been performed at this site.

8.33.2.2 Data Gaps

No information related to the past use of ST-318 was available. No data were available to determine the presence or absence of contaminants in the subsurface soil in the leach field.

8.33.2.3 RFI Field Investigation

The objective of this investigation was to determine if contamination is present in the subsurface soil in the leach field area. On March 22, 1995, four boreholes were drilled and sampled using a Geoprobe. Borehole ST-318C-01 was drilled west of the leach field area to collect background concentration data for this site. This borehole was assumed to be in an area away from any known or suspected contamination. All other boreholes were drilled in the leach field area. Based on engineering drawings and observed field conditions, the leach field lines were determined to be 3 ft below grade. The sample interval at each borehole extended from the depth of the leach field line to 5 ft below the leach field line. From this interval, two samples were collected: one at a depth equal to the base of the leach field line, the other from 3 ft below the base of the leach field line. Only one sample from this interval was submitted for laboratory analysis.

Sampling operations and sample handling procedures are described in Section 3.0. Borehole locations and the sample interval that was sent to the laboratory are listed in Table 8-65. Borehole logs are in Appendix C.

Table 8-65. Boreholes and Samples Analyzed from SWMU 10-21, Building 37200, Septic Tank, Leach Field, and Lines (ST-318)

Borehole	Borehole Location	Sample Depth (ft)
ST-318C-01	Background Borehole	3–5
ST-318C-02	In the leach field area	3–5
ST-318C-03	In the leach field area	3–8[a]
ST-318C-04	In the leach field area	3–5

a. Both 2-ft sections of the 5-ft interval were used due to the collection of a replicate sample.

8.33.2.4 Laboratory Analysis

Five soil samples, one replicate, were analyzed for VOCs, SVOCs, TPH as GRO and DRO, metals, mercury (the expected contaminants associated with normal operations at this building), soil pH, and soil moisture. The four brass tubes in each 2-ft sample interval were field-screened for possible contamination using a beta-gamma meter and a FID. No elevated readings were measured with these instruments.

8.33.3 Site Characteristics

8.33.3.1 Geology

The ST-318 area is underlain by unconsolidated alluvial sediment and weathered granite. The sediments are predominantly very fine-grained to very coarse, well-graded sand. Four 8-ft boreholes were drilled at ST-318. No boreholes penetrated into the Santa Fe Group sediments that presumably underlie this area. A discussion of the general geology at Kirtland AFB is presented in Section 2.4.

As a result of leach field installation, it is probable that backfill material is present in the leach field area. Borehole logs for this area are presented in Appendix C.

8.33.3.2 Hydrogeology

This site is in the HR2 saturated zone setting as defined by SNL studies (Figure 2-9) (SNL, 1994). HR2 straddles the Tijeras/Hubbell Springs/Sandia Fault complex. The saturated zone hydrogeology is characterized by the juxtaposition of higher permeability Santa Fe Group sediments against low permeability Paleozoic and Precambrian bedrock (Thorn *et al.*, 1993). Santa Fe Group sediments are faulted down to the west across the faults. Very little is known about groundwater flow in this region except that a steep gradient exists across the fault zone. East of the fault zone, the static water elevation is estimated at 5,710 ft amsl (Figure 2-7).

Groundwater beneath ST-318 is estimated to be approximately 320 ft below the surface (Figure 2-10). This area may serve as a recharge area for the Albuquerque Basin aquifer with groundwater movement

west across the fault (SNL, 1994). A more detailed discussion of the hydrogeology at Kirtland AFB is presented in Section 2.5.

8.33.4 Nature and Extent of Contamination

The following section describes the extent of contamination based on sampling results. Analytical results for soil samples collected and submitted for analysis from ST-318 are summarized in Table 8-66, where only the reportable concentrations of detected analytes are listed. Full analytical results are presented in Appendix F. Laboratory validation reports are in Appendix K.

Organic Compounds

No VOC or SVOC analytes were detected in any of the soil samples submitted for analysis at ST-318.

Petroleum Hydrocarbons

No gasoline range hydrocarbons were detected in any of the soil samples submitted for analysis at ST-318. Diesel range hydrocarbons (4.4 to 5.0 mg/kg) were detected in three of the five samples; ST-318C-03, both the normal and replicate sample, and ST-318C-04. These concentrations were below the NMED action level of 100 mg/kg.

Metals

Arsenic, beryllium, and manganese were the only metals detected at concentrations above the HHRB action levels in the soil samples submitted for analysis from ST-318 (Table 8-66). Arsenic (0.81 to 1.0 mg/kg) was detected in two of the five samples collected. Both concentrations were above the HHRB action level of 0.37 mg/kg, but were below the 6.5 mg/kg UTL. Beryllium (0.53 to 0.81 mg/kg) was detected in all samples collected at ST-318 above the HHRB action level of 0.15 mg/kg, but was below the 0.84 mg/kg UTL. Beryllium and arsenic concentrations exceeding HHRB action levels appear to be naturally occurring throughout Kirtland AFB as discussed in Section 4.2.2.

Manganese (551 to 1,090 mg/kg) was detected in all samples above the HHRB action level of 390 mg/kg and the UTL of 549 mg/kg. These manganese concentrations are believed to be naturally occurring and are probably related to the underlying geology of this site which is predominantly weathered granite.

Soil pH and Moisture

Soil pH ranged from 8.0 to 8.4 in these samples. Soil moisture values ranged from 0.9 to 5.8 percent (Table 8-66).

Table 8-66. Summary of Reportable Concentrations for Soil Analyses at SWMU 10-21, Building 37200, Septic Tank, Leach Field, and Lines (ST-318)[1] (Concentrations mg/kg)

Chemical Class	Analyte	HHRB Action Level[2]	PQL UTL	Borehole Number and Sample Depth Interval (ft)				
				ST318C-01	*ST318C-02*	*ST318C-03*		*ST318C-04*
				3–5	3–5	3–8 FR	3–8	3–5
TPH	Diesel fraction	100	10.0	ND	ND	5.0	4.4	5.0
METALS	Aluminum	78,000	14,700	10,300	10,200	16,300	13,100	9,630
	Arsenic	0.37	6.5	0.81	ND	1.0	ND	ND
	Barium	5,500	735	182	154	221	121	175
	Beryllium	0.15	0.84	0.53	0.71	0.61	0.81	0.53
	Cadmium	39.0	N/A	0.63	0.71	1.0	1.2	0.53
	Calcium	N/A	121,000	12,900	13,200	15,500	11,700	12,200
	Chromium, total	390	21.6	5.0	4.2	4.9	5.6	5.0
	Cobalt	4,700	15.4	14.3	15.5	25.2	18.6	13.0
	Copper	2,900	223	43.3	772	64.5	202	20.9
	Iron	N/A	23,800	24,200	25,700	45,200	31,800	20,900
	Lead	400	17.5	9.9	16.3	13.5	29.1	12.5
	Magnesium	N/A	10,400	7,710	9,700	14,000	11,300	6,680
	Manganese	390	549	614	712	1,090	871	551
	Nickel	1,600	188	6.8	4.7	10.6	8.8	7.3
	Potassium	N/A	3,590	3,860	437	1,400	2,540	3,520
	Sodium	N/A	787	96.4	86.7	115	111	45.2
	Thallium	N/A	N/A	0.19	ND	ND	0.20	0.21
	Vanadium	550	55.3	40.1	42.7	68.6	49.5	34.6
	Zinc	23,000	114	86.4	329	555	184	66.9
OTHER	pH			8.4	8.2	8.1	8.0	8.4
	Moisture (%)			5.4	0.90	2.2	1.2	5.8

FOOTNOTES

1	Complete laboratory analytical results and method detection limits are presented in Appendix K.
2	Action level of RCRA Proposed Rule Subpart S (55 *FR* 30814, 7/27/90).
*	TPH action level is 100 mg/kg adopted from NMED UST regulations (NMED, 1990). SW-8015 analyzes volatile and semivolatile petroleum hydrocarbon fractions separately. The total concentration of the two fractions analyzed under SW-8015 will be used to assess compliance with stipulated action levels for the purpose of this RFI.
#	Denotes TCLP analysis, results in mg/l.
--	No Data.
FR	Field Replicate.
HHRB	Human health risk based.
J	Estimated value.
N/A	Not Applicable.
NA	Not Analyzed.
ND	Not detected above the method detection limit.
pCi/g	picocuries per gram.
PQL	Practical quantitation limits (defines VOC, SVOC, and TPH).
R	Reject NDs due to interference.
RAD	Radionuclides.
RE	Resample.
SVOC	Semivolatile organic compounds.
TPH	Total petroleum hydrocarbons.
U	Accept data (positive results may be influenced by lab contamination).
UJ	Estimated nondetect.
UTL	Upper tolerance limits (defines metals).
VOC	Volatile organic compounds.

8.33.5 Conclusions and Recommendations

Conclusions

- No VOCs or SVOCs were detected in the soil samples submitted for analysis from this site.
- No gasoline range hydrocarbons were detected. Diesel range hydrocarbons were detected in three of the samples at this site. The concentration did not exceed the NMED action level of 100 mg/kg. The diesel range hydrocarbons (4.4 to 5.0 mg/kg) detected in the samples were similar to the concentrations detected in background samples analyzed during the Appendix III RFI, and are not indicative of a release.
- Arsenic, beryllium, and manganese were the only metals detected at concentrations exceeding HHRB action levels. These beryllium and arsenic concentrations appear to be naturally occurring throughout Kirtland AFB. The manganese concentrations appear to be naturally occurring at this site.
- The analytical results at ST-318 are not indicative of a contaminant release at this site.

Recommendations

- Based on the findings of the RFI, no further action is necessary; therefore, ST-318 does not require further investigation. A No Further Action proposal should be prepared.

8.34 SWMU 10-21, Building 37541, Septic Tank, Leach Field, and Lines (ST-319)

8.34.1 Site Background and Environmental Setting

Septic tank ST-319 is located 100 ft north-northwest of Building 37541, a physics science laboratory, in the central portion of Kirtland AFB (Figure 8-34). ST-319 was investigated on March 21, 1995.

Based on engineering drawings and observed site conditions, septic tank inflow and outflow line lengths are approximately 130 ft and 25 ft, respectively. This tank discharges to a leach field to the west with a drainage area approximately 190 ft x 8 ft. Potentially, the septic tank could have received contaminants from Building 37541. Due to the leach field's design, waste from ST-319 can be expected to have entered the surrounding soil.

Building 37541 is at the MWSA. This site is isolated from the urban/industrial environmental zone and is at the foot of the Manzano Mountains on the east boundary of the Albuquerque-Belen Basin. No production wells exist near this site (Figure 2-11).

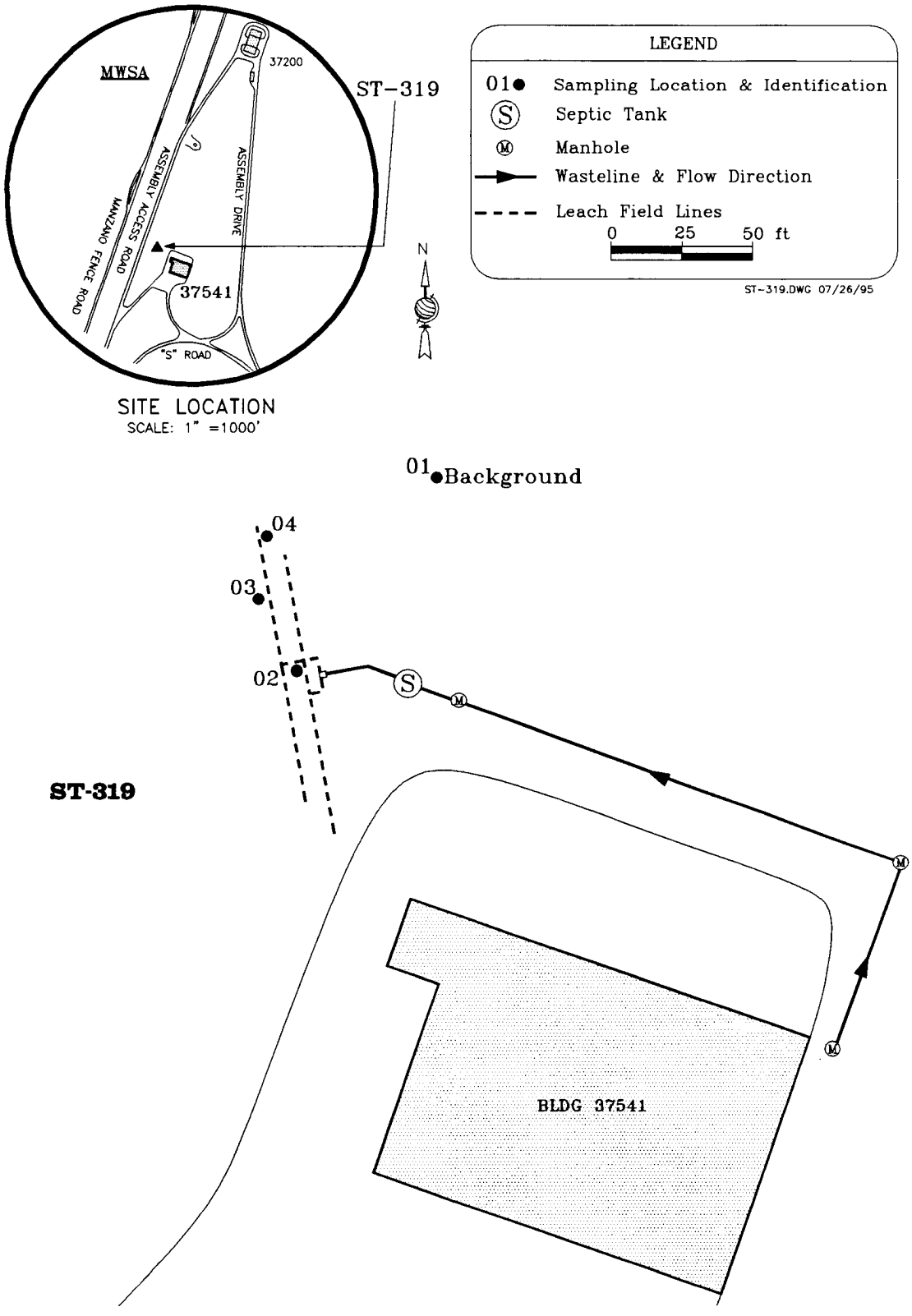


Figure 8-34. Soil Sampling Locations at SWMU 10-21, Building 37541, Septic Tank, Leach Field, and Lines (ST-319)

8.34.2 Study Area Investigation

The area of investigation was limited to the leach field at ST-319. Possible source materials in the septic tank were not investigated.

8.34.2.1 Previous Investigations

No previous investigations have been performed at this site.

8.34.2.2 Data Gaps

No information related to the past use of ST-319 was available. No data were available to determine the presence or absence of contaminants in the subsurface soil in the leach field.

8.34.2.3 RFI Field Investigation

The objective of this investigation was to determine if contamination is present in the subsurface soil in the leach field area. On March 21, 1995, four boreholes were drilled and sampled using a Geoprobe. Borehole ST-319C-01 was drilled northeast of the leach field area to collect background concentration data for this site. This borehole was assumed to be in an area away from any known or suspected contamination. All other boreholes were drilled in the leach field area. Based on engineering drawings and observed field locations, the leach field lines were determined to be 3 ft below grade. The sample interval at each borehole extended from the depth of the leach field line to 5 ft below the leach field line. From this interval, two samples were collected: one at a depth equal to the base of the leach field line, the other from 3 ft below the base of the leach field line. Only one sample from this interval was submitted for laboratory analysis.

Sampling operations and sample handling procedures are described in Section 3.0. Borehole locations and the sample interval that was sent to the laboratory are listed in Table 8-67. Borehole logs are in Appendix C.

Table 8-67. Boreholes and Samples Analyzed from SWMU 10-21, Building 37541, Septic Tank, Leach Field, and Lines (ST-319)

Borehole	Borehole Location	Sample Depth (ft)
ST-319C-01	Background borehole	3–5
ST-319C-02	In the leach field area	3–5
ST-319C-03	In the leach field area	3–5
ST-319C-04	In the leach field area	5–7[a]

a. A 5 to 7-ft sample interval was retrieved due to poor recovery between 3 and 5 ft and refusal at 8 ft.

8.34.2.4 Laboratory Analysis

Four soil samples were analyzed for VOCs, SVOCs, TPH as DRO and GRO, metals, mercury (the expected contaminants associated with normal operations at this building), soil pH, and soil moisture. The four brass tubes in each 2-ft sample interval were field-screened for possible contamination using a beta-gamma meter and a FID. No elevated readings were measured with these instruments.

8.34.3 Site Characteristics

8.34.3.1 Geology

The ST-319 area is underlain by unconsolidated alluvial sediment and weathered granite. The sediment is predominantly gravelly, well-graded sand with weathered granite at approximately 6.5 ft. Three 6.5-ft boreholes and one 7-ft borehole were drilled at ST-319. No boreholes penetrated into the Santa Fe Group sediments that presumably underlie this area. A discussion of the general geology at Kirtland AFB is presented in Section 2.4.

As a result of leach field installation, it is probable that backfill material is present in the leach field area. Borehole logs for this area are presented in Appendix C.

8.34.3.2 Hydrogeology

This site is in the HR2 saturated zone setting as defined by SNL studies (Figure 2-9) (SNL, 1994). HR2 straddles the Tijeras/Hubbell Springs/Sandia Fault complex. The saturated zone hydrogeology is characterized by the juxtaposition of higher permeability Santa Fe Group sediments against low permeability Paleozoic and Precambrian bedrock (Thorn *et al.,* 1993). Santa Fe Group sediments are faulted down to the west across the faults. Very little is known about groundwater flow in this region except that a steep gradient exists across the fault zone. East of the fault zone, the static water elevation is estimated at 5,710 ft amsl (Figure 2-7).

Groundwater beneath ST-319 is estimated to be approximately 320 ft below the surface (Figure 2-10). This area may serve as a recharge area for the Albuquerque Basin aquifer with groundwater movement west across the fault (SNL, 1994). A more detailed discussion of the hydrogeology at Kirtland AFB is presented in Section 2.5.

8.34.4 Nature and Extent of Contamination

The following section describes the extent of contamination based on sampling results. Analytical results for soil samples collected and submitted for analysis from ST-319 are summarized in Table 8-68, where only the reportable concentrations of detected analytes are listed. Full analytical results are presented in Appendix F. Laboratory validation reports are in Appendix K.

Table 8-68. Summary of Reportable Concentrations for Soil Analyses at SWMU 10-21, Building 37541, Septic Tank, Leach Field, and Lines (ST-319)[1] (Concentrations mg/kg)

Chemical Class	Analyte	HHRB Action Level[2]	PQL UTL	Borehole Number and Sample Depth Interval (ft)			
				ST319C-01	*ST319C-02*	*ST319C-03*	*ST319C-04*
				3–5	3–5	3–5	5–7
METALS	Aluminum	78,000	14,700	10,600	9,190	14,900	7,830
	Arsenic	0.37	6.5	0.99	ND	ND	ND
	Barium	5,500	735	79.8	109	231	76.0
	Beryllium	0.15	0.84	0.62	0.52	0.41	0.40
	Cadmium	39.0	N/A	1.1	ND	1.6	ND
	Calcium	N/A	121,000	19,900	9,860	14,900	8,120
	Chromium, total	390	21.6	4.4	5.3	5.4	5.9
	Cobalt	4,700	15.4	20.7	12.9	24.1	12.0
	Copper	2,900	223	600	39.6	97.7	74.4
	Iron	N/A	23,800	28,200	24,100	40,000	21,500
	Lead	400	17.5	3.3	9.0	5.1	4.8
	Magnesium	N/A	10,400	9,950	6,640	12,800	6,360
	Manganese	390	549	645	527	1,020	471
	Nickel	1,600	188	6.1	7.8	8.6	14.4
	Potassium	N/A	3,590	1,010	2,920	8,410	2,030
	Sodium	N/A	787	95.5	48.9	134	47.0
	Thallium	N/A	N/A	ND	0.18	0.63	0.15
	Vanadium	550	55.3	62.7	40.5	71.9	35.5
	Zinc	23,000	114	265	74.0	139	71.7
OTHER	pH			8.2	8.2	7.7	7.9
	Moisture (%)			3.0	3.9	1.5	1.1

FOOTNOTES

1	Complete laboratory analytical results and method detection limits are presented in Appendix K.
2	Action level of RCRA Proposed Rule Subpart S (55 *FR* 30814, 7/27/90).
*	TPH action level is 100 mg/kg adopted from NMED UST regulations (NMED, 1990). SW-8015 analyzes volatile and semivolatile petroleum hydrocarbon fractions separately. The total concentration of the two fractions analyzed under SW-8015 will be used to assess compliance with stipulated action levels for the purpose of this RFI.
#	Denotes TCLP analysis, results in mg/l.
--	No Data.
FR	Field Replicate.
HHRB	Human health risk based.
J	Estimated value.
N/A	Not Applicable.
NA	Not Analyzed.
ND	Not detected above the method detection limit.
pCi/g	picocuries per gram.
PQL	Practical quantitation limits (defines VOC, SVOC, and TPH).
R	Reject NDs due to interference.
RAD	Radionuclides.
RE	Resample.
SVOC	Semivolatile organic compounds.
TPH	Total petroleum hydrocarbons.
U	Accept data (positive results may be influenced by lab contamination).
UJ	Estimated nondetect.
UTL	Upper tolerance limits (defines metals).
VOC	Volatile organic compounds.

Organic Compounds

No VOC or SVOC analytes were detected in any of the soil samples submitted for analysis at ST-319.

Petroleum Hydrocarbons

No gasoline or diesel range hydrocarbons were detected in any of the soil samples submitted for analysis at ST-319.

Metals

Arsenic, beryllium, and manganese were the only metals detected at concentrations above the HHRB action levels in the soil samples submitted for analysis from ST-319 (Table 8-68). Arsenic (0.99 mg/kg) was detected in ST-319C-01, the background borehole, at a concentration above the HHRB action level of 0.37 mg/kg, but below the 6.5 mg/kg UTL. Beryllium (0.40 to 0.62 mg/kg) was detected in all samples collected at ST-319 above the HHRB action level of 0.15 mg/kg, but was below the 0.84 mg/kg UTL. Beryllium and arsenic concentrations exceeding HHRB action levels appear to be naturally occurring throughout Kirtland AFB as discussed in Section 4.2.2.

Manganese (471 to 1,020 mg/kg) was detected all samples above the HHRB action level of 390 mg/kg and in two samples above the 549 mg/kg UTL. These concentrations are believed to be naturally occurring and are probably related to the underlying geology of this site, which is predominantly weathered granite.

Soil pH and Moisture

Soil pH ranged from 7.7 to 8.2 in these samples. Soil moisture values ranged from 1.1 to 3.9 percent (Table 8-68).

8.34.5 Conclusions and Recommendations

Conclusions

- No VOCs or SVOCs were detected in the soil samples submitted for analysis from this site.
- No gasoline or diesel range hydrocarbons were detected at ST-319.
- Arsenic, beryllium, and manganese were the only metals detected at concentrations exceeding HHRB action levels. These beryllium and arsenic concentrations appear to be naturally occurring throughout Kirtland AFB. The manganese concentrations appear to be naturally occurring at this site.
- The analytical results at ST-319 are not indicative of a contaminant release from this site.

Recommendations

- Based on the findings of the RFI, no further action is necessary; therefore, ST-319 does not require further investigation. A No Further Action proposal should be prepared.

8.35 SWMU 10-21, Building 20149, Septic Tank, Leach Field, and Lines (ST-320)

8.35.1 Site Background and Environmental Setting

ST-320 is located near an enclosed facility (Building 20149) housing a transformer, in the northwest portion of Kirtland AFB (Figure 8-35). ST-320 was investigated on May 9, 1995.

Based on observed site conditions (heavy vegetation) the leach field drainage area is estimated to be approximately 25 ft x 25 ft. The septic tank could not be verified by field inspection or engineering drawings. Potentially, the septic tank could have received contaminants from past operations at Building 20149. Due to the leach field's design, waste from ST-320 can be expected to have entered the surrounding soil.

ST-320 is located in the urban/industrial zone, which is discussed in Section 2.0. The nearest production wells to this site are KAFB-3, 3,700 ft north-northwest, and KAFB-1, 2,900 ft south-southwest (Figure 2-11).

8.35.2 Study Area Investigation

The area of investigation was limited to the leach field at ST-320. Possible source materials in the septic tank were not investigated.

8.35.2.1 Previous Investigations

No previous investigations have been performed at this site.

8.35.2.2 Data Gaps

No information related to the past use of ST-320 was available. No data were available to determine the presence or absence of contaminants in the subsurface soil in the leach field. The engineering drawings did not indicate the location of the septic tank at ST-320.

8.35.2.3 RFI Field Investigation

The objective of this investigation was to determine if contamination is present in the subsurface soil in the leach field area. On May 9, 1995, four boreholes were drilled and sampled using a Geoprobe. Borehole ST-320C-01 was drilled southeast of the leach field area to collect background concentration

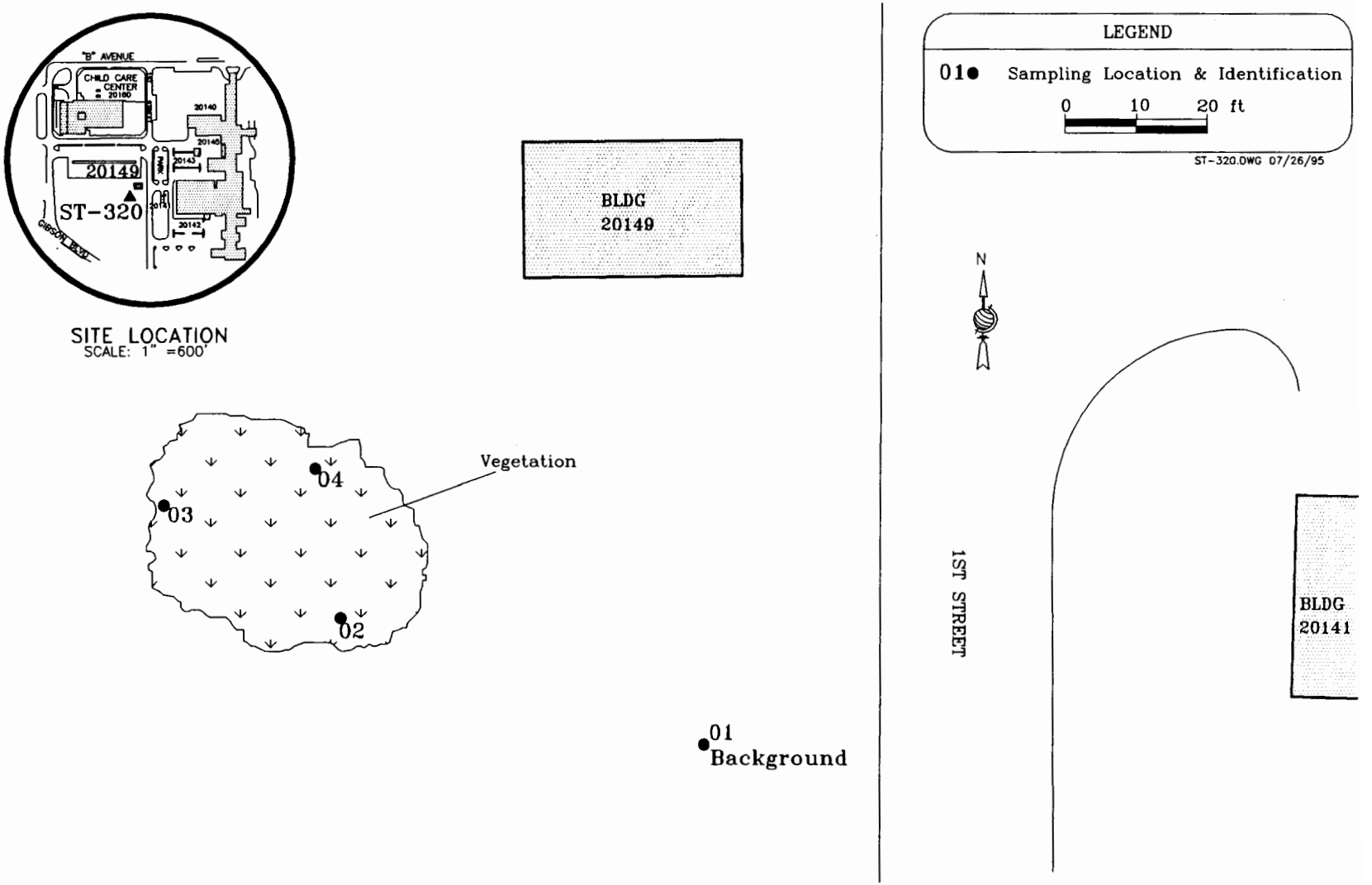


Figure 8-35. Sampling Locations at SWMU 10-21, Building 20149, Septic Tank, Leach Field, and Lines (ST-320)

data for this site. This borehole was assumed to be in an area away from any known or suspected contamination. All other boreholes were drilled in the leach field area. Based on typical leach field depths and observed field conditions, the leach field lines were determined to be 3 ft below grade. The upper and lower 2-ft sections of the 5-ft interval below the base of the leach field lines were collected. If elevated FID readings were observed, the interval with the highest readings was submitted for laboratory analysis. Otherwise, only the 2-ft interval closest to the potential contamination source was submitted.

Sampling operations and sample handling procedures are described in Section 3.0. Borehole locations and the sample interval that was sent to the laboratory are listed in Table 8-69. Borehole logs are in Appendix C.

Table 8-69. Boreholes and Samples collected at SWMU 10-21, Building 20149, Septic Tank, Leach Field, and Lines (ST-320)

Borehole	Borehole Location	Sample Depth (ft)
ST-320C-01	Background borehole	3–5
ST-320C-02	In the leach field area	3–5
ST-320C-03	In the leach field area	3–5
ST-320C-04	In the leach field area	3–5

8.35.2.4 Laboratory Analysis

Four soil samples were analyzed for VOCs, SVOCs, TPH as GRO and DRO, metals, mercury (the expected contaminants associated with normal operations at this building), soil pH, and soil moisture. The four brass tubes in each 2-ft sample interval were field-screened for possible contamination using a beta-gamma meter and a FID (as per health and safety requirements). No elevated readings were measured with these instruments.

8.35.3 Site Characteristics

8.35.3.1 Geology

The ST-320 area is underlain by unconsolidated alluvial sediment that is predominantly very fine-grained to fine-grained sand in the 3- to 5-ft interval and gravelly, well-graded sand in the 6- to 8-ft interval. Four 8-ft boreholes were drilled at ST-320. No boreholes penetrated into the Santa Fe Group sediments that presumably underlie this area. A discussion of the general geology at Kirtland AFB is presented in Section 2.4.

As a result of leach field installation, it is probable that backfill material is present in the leach field area. Borehole logs for this area are presented in Appendix C.

8.35.3.2 Hydrogeology

Groundwater beneath this area is found within the Upper Santa Fe sediments and is generally thought to be unconfined in the upper portion of the aquifer. This area is within the HR1 saturated zone setting as defined by SNL studies (Figure 2-9) (SNL, 1994). Hydrogeologic characterization in this portion of Kirtland AFB is complicated by the presence of numerous production wells (Figure 2-11). It is probable that uniform groundwater conditions do not exist in this region. Local cones of depression associated with groundwater withdrawal have altered the groundwater flow direction in the vicinity of the well fields (Figure 2-7).

The gradient is probably north at this site. Two production wells are located in this area of Kirtland AFB: KAFB-2 is downgradient 3,500 ft west-northwest and KAFB-14 is cross-gradient 3,800 ft north (Figures 2-7 and 2-11). Depth to groundwater is estimated to be about 350 ft below grade (Figure 2-10); however, shallower perched water zones may occur. Hydraulic conductivity within HR1 is estimated at 2 to 171 ft/day (SNL, 1994). A general discussion of the hydrogeology at Kirtland AFB is presented in Section 2.5.

8.35.4 Nature and Extent of Contamination

The following section describes the extent of contamination based on sampling results. Analytical results for soil samples collected and submitted for analysis from ST-320 are summarized in Table 8-70, where only the reportable concentrations of detected analytes are listed. Full analytical results are presented in Appendix F. Laboratory validation reports are in Appendix K.

Organic Compounds

No VOC analytes were detected in any of the soil samples submitted for analysis at ST-320.

Bis(2-ethylhexyl)phthalate (0.36 and 0.71 mg/kg) was the only SVOC analyte detected in ST-320C-02 and ST-320C-03; the concentrations were below the HHRB action level of 46 mg/kg.

Petroleum Hydrocarbons

No gasoline range hydrocarbons were detected in any of the soil samples submitted for analysis at ST-320. Diesel range hydrocarbons (4.5 and 5.2 mg/kg) were detected in ST-320C-02 and ST-320C-03. Both concentrations were below the NMED action level of 100 mg/kg.

Metals

Arsenic and beryllium were the only metals detected at concentrations above the HHRB action levels in the soil samples from ST-320 (Table 8-70). Arsenic (2.6 to 5.3 mg/kg) was detected in all four samples at concentrations above the HHRB action level of 0.37 mg/kg, but below the 6.5 mg/kg UTL. Beryllium (0.31 to 0.41 mg/kg) was detected in all samples collected at ST-320 above the HHRB action level of 0.15 mg/kg, but below the 0.84 mg/kg UTL. Beryllium and arsenic concentrations exceeding HHRB action levels appear to be naturally occurring throughout Kirtland AFB as discussed in Section 4.2.2.

Table 8-70. Summary of Reportable Concentrations for Soil Analyses at SWMU 10-21, Building 20149, Septic Tank, Leach Field, and Lines (ST-320)[1] (Concentrations mg/kg)

Chemical Class	Analyte	HHRB Action Level[2]	PQL UTL	Borehole Number and Sample Depth Interval (ft)			
				ST320C-01 3–5	*ST320C-02* 3–5	*ST320C-03* 3–5	*ST320C-04* 3–5
SVOCS	Bis(2-ethylhexyl)phthalate	46.0	0.70	ND	0.71	0.36	ND
TPH	Diesel fraction	100	10.0	ND	5.2	4.5	ND
METALS	Aluminum	78,000	14,700	8,990	7,710	8,600	8,690
	Arsenic	0.37	6.5	5.3	4.0	3.4	2.6
	Barium	5,500	735	284	567	193	229
	Beryllium	0.15	0.84	0.33	0.31	0.32	0.41
	Cadmium	39.0	N/A	ND	0.52	ND	0.52
	Calcium	N/A	121,000	105,000	65,100	26,000	48,700
	Chromium, total	390	21.6	8.9	9.2	9.3	8.6
	Cobalt	4,700	15.4	5.4	6.3	4.3	7.6
	Copper	2,900	223	51.5	27.7	53.0	22.2
	Iron	N/A	23,800	10,800	11,300	11,900	13,600
	Lead	400	17.5	5.6	5.9	5.9	6.1
	Magnesium	N/A	10,400	6,160	7,390	4,910	6,840
	Manganese	390	549	119	193	157	223
	Nickel	1,600	188	17.7	7.4	7.9	8.6
	Potassium	N/A	3,590	1,830	1,820	1,670	2,050
	Sodium	N/A	787	872	473	1,060	604
	Vanadium	550	55.3	29.1	39.8	43.4	36.1
	Zinc	23,000	114	40.0	34.9	38.2	37.4
RAD	Thallium	N/A	N/A	ND	ND	ND	0.10
OTHER	pH			8.2	7.5	8.7	8.7
	Moisture (%)			8.9	4.3	4.9	3.5

FOOTNOTES

1	Complete laboratory analytical results and method detection limits are presented in Appendix K.
2	Action level of RCRA Proposed Rule Subpart S (55 *FR* 30814, 7/27/90).
*	TPH action level is 100 mg/kg adopted from NMED UST regulations (NMED, 1990). SW-8015 analyzes volatile and semivolatile petroleum hydrocarbon fractions separately. The total concentration of the two fractions analyzed under SW-8015 will be used to assess compliance with stipulated action levels for the purpose of this RFI.
#	Denotes TCLP analysis, results in mg/l.
--	No Data.
FR	Field Replicate.
HHRB	Human health risk based.
J	Estimated value.
N/A	Not Applicable.
NA	Not Analyzed.
ND	Not detected above the method detection limit.
pCi/g	picocuries per gram.
PQL	Practical quantitation limits (defines VOC, SVOC, and TPH).
R	Reject NDs due to interference.
RAD	Radionuclides.
RE	Resample.
SVOC	Semivolatile organic compounds.
TPH	Total petroleum hydrocarbons.
U	Accept data (positive results may be influenced by lab contamination).
UJ	Estimated nondetect.
UTL	Upper tolerance limits (defines metals).
VOC	Volatile organic compounds.

Soil pH and Moisture

Soil pH ranged from 7.5 to 8.7 in these samples. Soil moisture values ranged from 3.5 to 8.9 percent (Table 8-70).

8.35.5 Conclusions and Recommendations

Conclusions

- No VOCs were detected in the soil samples submitted for analysis from this site.
- One SVOC was detected in the soil samples submitted for analysis at ST-320; the concentrations were below the HHRB action level.
- No gasoline range hydrocarbons were detected. Diesel range hydrocarbons were detected in two of the samples at this site. The concentrations did not exceed the NMED action level of 100 mg/kg. The diesel range hydrocarbon concentrations (4.5 to 5.2 mg/kg) detected in the samples were similar to those detected in background samples analyzed during the Appendix III RFI, and are not indicative of a release.
- Arsenic and beryllium were the only metals detected at concentrations exceeding HHRB action levels; these concentrations appear to be naturally occurring throughout Kirtland AFB.
- The analytical results at ST-320 are not indicative of a contaminant release at this site.

Recommendations

- Based on the findings of the RFI, no further action is necessary; therefore, ST-320 does not require further investigation. A No Further Action proposal should be prepared.

8.36 SWMU 10-21, Buildings 37507/37508/37513, Septic Tank, Leach Field, and Lines (ST-322)

8.36.1 Site Background and Environmental Setting

Septic tank ST-322 is located west of Buildings 37507, 37508, and 37513, inspection shops, in the central portion of Kirtland AFB (Figure 8-36). ST-322 was investigated on March 13, 1995.

Based on engineering drawings and observed site conditions, septic tank inflow and outflow line lengths are approximately 510 ft and 15 ft, respectively. This tank discharges to a leach field to the west with a drainage area approximately 200 ft x 10 ft. Potentially, the septic tank could have received contaminants from Buildings 37507, 37508, and 37513. Due to the leach field's design, waste from ST-322 can be expected to have entered the surrounding soil.

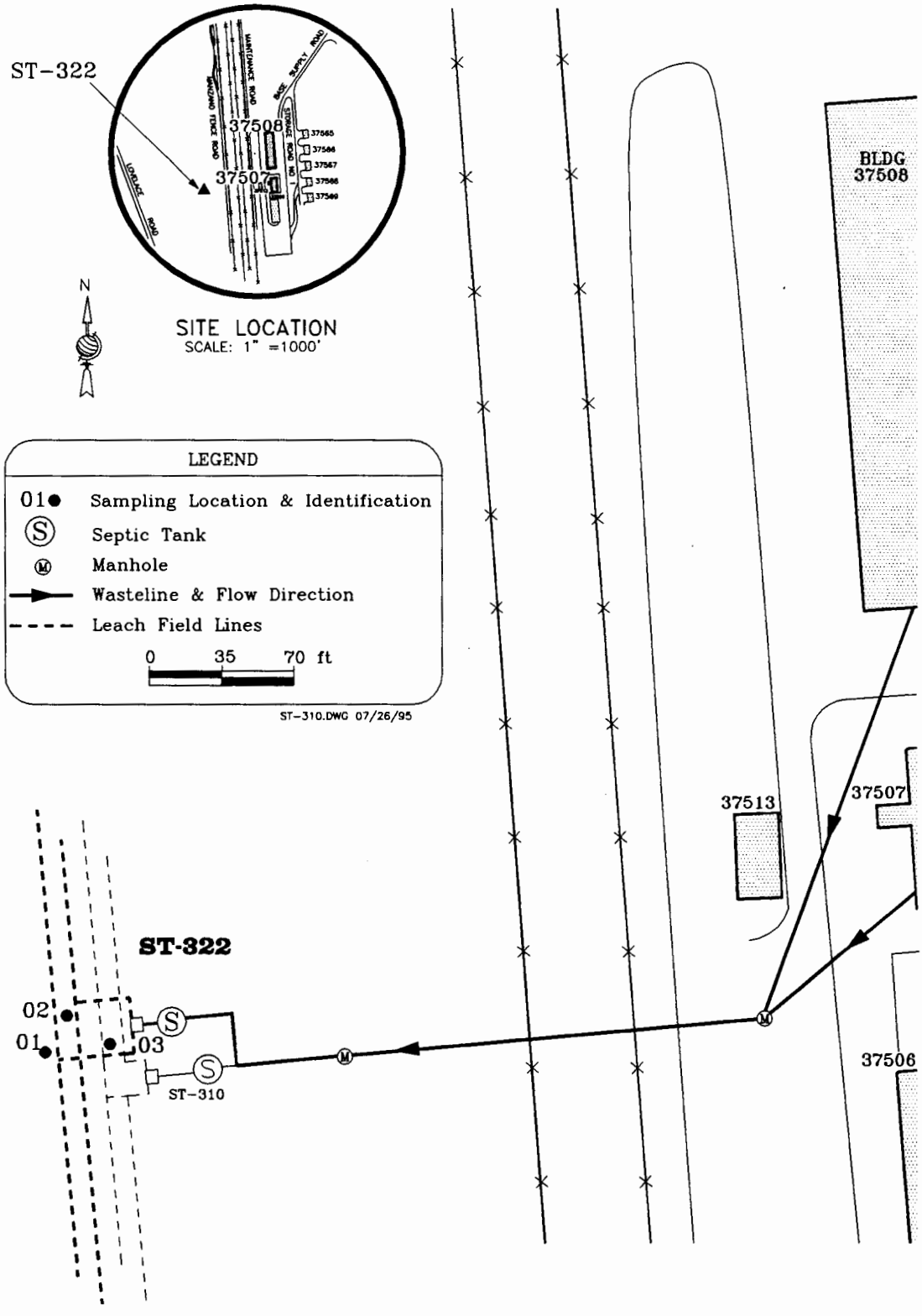


Figure 8-36. Soil Sampling Locations at SWMU 10-21, Buildings 37507/37508/37513, Septic Tank, Leach Field, and Lines (ST-322)

Buildings 37507, 37508, and 37513 are located on the MWSA. This site is isolated from the urban/industrial environmental zone and is at the foot of the Manzano Mountains on the east boundary of the Albuquerque-Belen Basin. No production wells exist near this site (Figure 2-11).

8.36.2 Study Area Investigation

The area of investigation was limited to the leach field at ST-322. Possible source materials in the septic tank were not investigated.

8.36.2.1 Previous Investigations

No previous investigations have been performed at this site.

8.36.2.2 Data Gaps

No information related to the past use of ST-322 was available. No data were available to determine the presence or absence of contaminants in the subsurface soil in the leach field.

8.36.2.3 RFI Field Investigation

The objective of this investigation was to determine if contamination is present in the subsurface soil in the leach field area. On March 13, 1995, three boreholes were drilled and sampled using a Geoprobe. Borehole ST-310C-01 (Figure 8-25 in Section 8.25) was drilled north-northeast of the leach field area to collect background concentration data for this site. This borehole was assumed to be in an area away from any known or suspected contamination. All other boreholes were drilled in the leach field area. Based on engineering drawings and observed field conditions, the leach field lines were determined to be 4 ft below grade. The sample interval at each borehole extended from the depth of the leach field line to 5 ft below the leach field line. From this interval, two samples were collected: one at a depth equal to the base of the leach field line, the other from 3 ft below the base of the leach field line. Only one sample from this interval was submitted for laboratory analysis.

Sampling operations and sampling handling procedures are described in Section 3.0. Borehole locations and the sample interval that was sent to the laboratory is listed in Table 8-71. Borehole logs are in Appendix C.

Table 8-71. Boreholes and Samples Analyzed from SWMU 10-21, Buildings 37507/37508/37513, Septic Tank, Leach Field, and Lines (ST-322)

Borehole	Borehole Location	Sample Depth (ft)
ST-322C-01	In the leach field area	4–9[a]
ST-322C-02	In the leach field area	4–6
ST-322C-03	In the leach field area	4–6

a. Both 2-ft sections of the 5-ft interval were used due to the collection of a replicate sample.

8.36.2.4 Laboratory Analysis

Four soil samples, one replicate and three normal, were analyzed for VOCs, SVOCs, TPH as DRO and GRO, metals, mercury (the expected contaminants associated with normal operations at this building), soil pH, and soil moisture. The four brass tubes in each 2-ft sample interval were field-screened for possible contamination using a beta-gamma meter and a FID. No elevated readings were measured with these instruments.

8.36.3 Site Characteristics

8.36.3.1 Geology

The ST-322 area is underlain by unconsolidated alluvial sediment that is predominantly very fine-grained to very coarse-grained, well-graded sand with some fine gravel. Three 9-ft boreholes were drilled at ST-322. No boreholes penetrated into the Santa Fe Group sediments that presumably underlie this area. A discussion of the general geology at Kirtland AFB is presented in Section 2.4.

As a result of leach field installation, it is probable that backfill material is present in the leach field area. Borehole logs for this area are presented in Appendix C.

8.36.3.2 Hydrogeology

This site is in the HR2 saturated zone setting as defined by SNL studies (Figure 2-9) (SNL, 1994). HR2 straddles the Tijeras/Hubbell Springs/Sandia Fault complex. The saturated zone hydrogeology is characterized by the juxtaposition of higher permeability Santa Fe Group sediments against low permeability Paleozoic and Precambrian bedrock (Thorn *et al.*, 1993). Santa Fe Group sediments are faulted down to the west across the faults. Very little is known about groundwater flow in this region except that a steep gradient exists across the fault zone. East of the fault zone, the static water elevation is estimated at 5,710 ft amsl (Figure 2-7).

Groundwater beneath ST-322 is estimated to be approximately 320 ft below the surface (Figure 2-10). This area may serve as a recharge area for the Albuquerque Basin aquifer with groundwater movement west across the fault (SNL, 1994). A more detailed discussion of the hydrogeology at Kirtland AFB is presented in Section 2.5.

8.36.4 Nature and Extent of Contamination

The following section describes the extent of contamination based on sampling results. Analytical results for soil samples collected and submitted for analysis from ST-322 are summarized in Table 8-72, where only the reportable concentrations of detected analytes are listed. Full analytical results are presented in Appendix F. Laboratory validation reports are in Appendix K.

Organic Compounds

No VOC or SVOC analytes were detected in any of the soil samples submitted for analysis at ST-322.

The SVOC analytes di-n-butylphthalate and benzyl butyl phthalate were detected in one or more of the soil samples submitted for analysis at ST-322. Di-n-butylphthalate (1.3 to 2.7 mg/kg) was detected in all samples collected. Benzyl butyl phthalate (0.69 to 0.88 mg/kg) was detected in three of the four samples submitted. All concentrations were below HHRB action levels (Table 8-72).

Petroleum Hydrocarbons

No gasoline or diesel range hydrocarbons were detected in any of the soil samples submitted for analysis at ST-322.

Metals

Arsenic and beryllium were the only metals detected at concentrations above the HHRB action levels in the soil samples submitted for analysis from ST-322 (Table 8-72). Arsenic (1.6 to 2.8 mg/kg) was detected in all samples collected. These concentrations were above the HHRB action level of 0.37 mg/kg, but were below the 6.5 mg/kg UTL. Beryllium (0.42 to 0.65 mg/kg) was detected in all samples collected at ST-322 above the HHRB action level of 0.15 mg/kg, but all concentrations were below the 0.84 mg/kg UTL. These concentrations appear to be naturally occurring throughout Kirtland AFB as discussed in Section 4.2.2.

Soil pH and Moisture

Soil pH ranged from 7.4 to 7.7 in these samples. Soil moisture values ranged from 5.2 to 8.0 percent (Table 8-72).

8.36.5 Conclusions and Recommendations

Conclusions

- No VOCs were detected in the soil samples submitted for analysis from this site.

Table 8-72. Summary of Reportable Concentrations for Soil Analyses at SWMU 10-21, Building 37507/37508/37513, Septic Tank, Leach Field, and Lines (ST-322)[1] (Concentrations mg/kg)

Chemical Class	Analyte	HHRB Action Level[2]	PQL UTL	Borehole Number and Sample Depth Interval (ft)			
				ST322C-01		*ST322C-02*	*ST322C-03*
				4–9 FR	4–9	4–6	4–6
SVOC	Benzyl butyl phthalate	16,000	1.3	0.88	ND	0.69	0.73
	Di-n-butylphthalate	7,800	0.70	1.5	2.4	2.7	1.3
METALS	Aluminum	78,000	14,700	8,270	9,360	12,700	10,000
	Arsenic	0.37	6.5	2.5	2.0	2.8	1.6
	Barium	5,500	735	78.9	83.2	96.5	103
	Beryllium	0.15	0.84	0.42	0.43	0.65	0.43
	Calcium	N/A	121,000	11,200	14,300	11,200	23,900
	Chromium, total	390	21.6	12.4	11.5	15.8	12.3
	Cobalt	4,700	15.4	7.0	8.3	9.6	8.4
	Copper	2,900	223	14.6	16.0	20.4	22.6
	Iron	N/A	23,800	11,200	12,500	13,700	13,400
	Lead	400	17.5	6.4	5.8	7.7	4.5
	Magnesium	N/A	10,400	4,180	4,710	4,980	5,050
	Manganese	390	549	234	255	287	252
	Nickel	1,600	188	8.8	9.2	11.3	11.7
	Potassium	N/A	3,590	1,580	1,840	1,850	1,760
	Sodium	N/A	787	98.9	112	212	98.0
	Thallium	N/A	N/A	ND	ND	0.16	ND
	Vanadium	550	55.3	22.8	25.2	28.0	28.6
	Zinc	23,000	114	29.5	32.8	37.7	35.3
OTHER	pH			7.7	7.4	7.6	7.7
	Moisture (%)			5.2	6.7	8.0	7.1

FOOTNOTES

1	Complete laboratory analytical results and method detection limits are presented in Appendix K.
2	Action level of RCRA Proposed Rule Subpart S (55 *FR* 30814, 7/27/90).
*	TPH action level is 100 mg/kg adopted from NMED UST regulations (NMED, 1990). SW-8015 analyzes volatile and semivolatile petroleum hydrocarbon fractions separately. The total concentration of the two fractions analyzed under SW-8015 will be used to assess compliance with stipulated action levels for the purpose of this RFI.
#	Denotes TCLP analysis, results in mg/l.
--	No Data.
FR	Field Replicate.
HHRB	Human health risk based.
J	Estimated value.
N/A	Not Applicable.
NA	Not Analyzed.
ND	Not detected above the method detection limit.
pCi/g	picocuries per gram.
PQL	Practical quantitation limits (defines VOC, SVOC, and TPH).
R	Reject NDs due to interference.
RAD	Radionuclides.
RE	Resample.
SVOC	Semivolatile organic compounds.
TPH	Total petroleum hydrocarbons.
U	Accept data (positive results may be influenced by lab contamination).
UJ	Estimated nondetect.
UTL	Upper tolerance limits (defines metals).
VOC	Volatile organic compounds.

- Two SVOCs were detected in the soil samples submitted for analysis at ST-322; all concentrations were below the HHRB action levels.
- No gasoline or diesel range hydrocarbons were detected in any of the samples.
- Arsenic and beryllium were the only metals detected at concentrations exceeding HHRB action levels; these concentrations appear to be naturally occurring throughout Kirtland AFB.
- The analytical results at ST-322 are not indicative of a contaminant release from this site.

Recommendations

- Based on the findings of the RFI, no further action is necessary; therefore, ST-322 does not require further investigation. A No Further Action proposal should be prepared.

8.37 SWMU 10-21, Building 29042, Septic Tank and Lines (ST-323)

8.37.1 Site Background and Environmental Setting

Septic tank ST-323 is north of Building 29042, a science laboratory, in the south-central portion of Kirtland AFB (Figure 8-37). ST-323 was investigated on March 1, 1995.

Based on engineering drawings and observed site conditions, the outflow line length to the septic tank is estimated at approximately 30 ft. Neither engineering drawings nor site conditions revealed the location of any associated leach fields. Potentially, the septic tank could have received contaminants from Building 29042 and could have overflowed and entered the surrounding soil.

Building 29042 is on the Hubbell Bench, on the east boundary of the Albuquerque-Belen Basin (USAF, 1993c). The nearest production well to the site is KAFB-10 (Figure 2-11), which is approximately 17,500 ft northwest and is controlled and operated by DOE and SNL.

8.37.2 Study Area Investigation

The area of investigation was limited to the soil surrounding septic tank ST-323. Possible source materials in the septic tank were not investigated.

8.37.2.1 Previous Investigations

No previous investigations have been performed at this site.

8.37.2.2 Data Gaps

No information related to the past use of ST-323 was available. No data were available to determine the presence or absence of contaminants in the subsurface soil in the leach field.

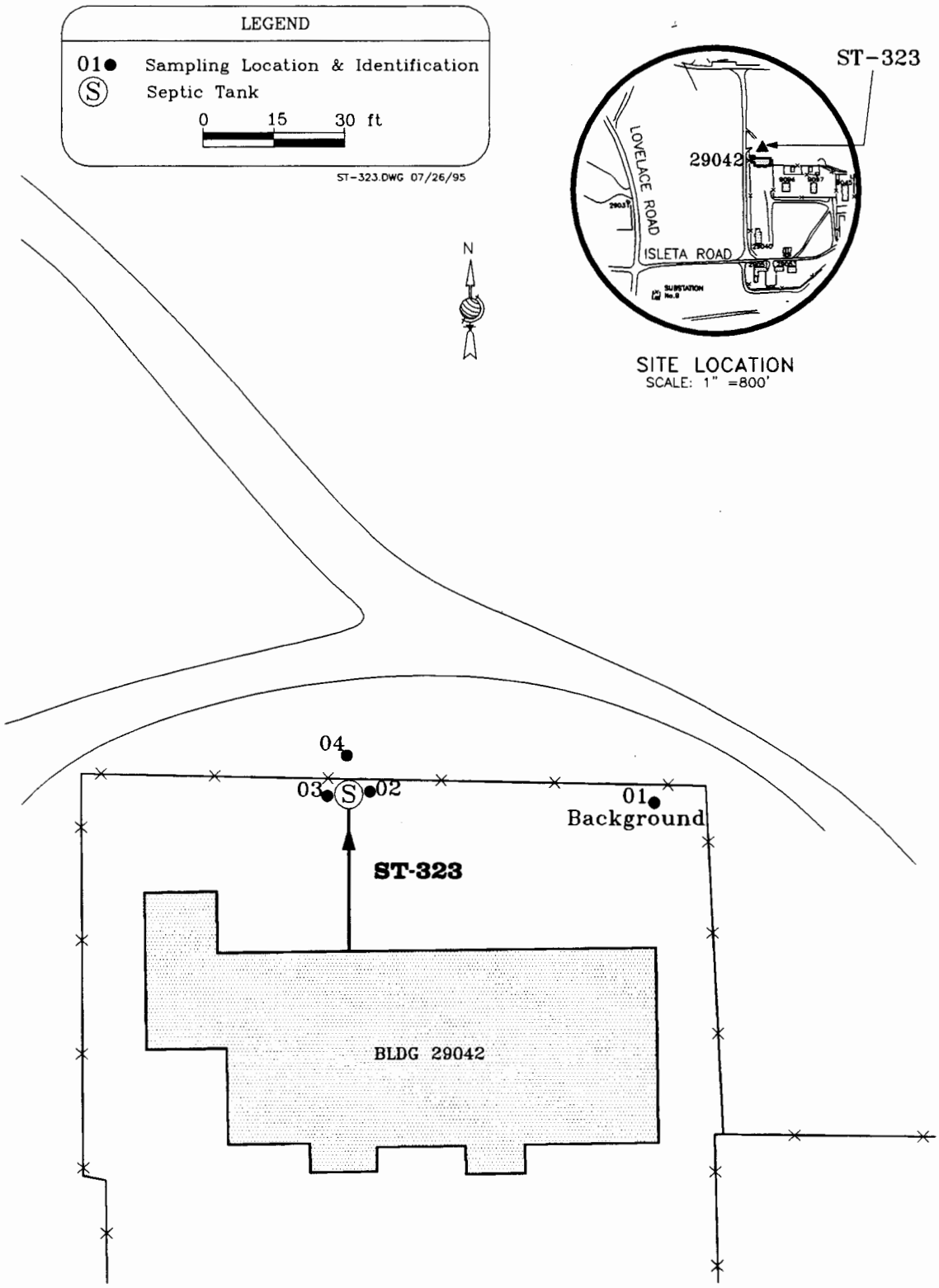


Figure 8-37. Soil Sampling Locations at SWMU 10-21, Building 29042, Septic Tank and Lines (ST-323)

8.37.2.3 RFI Field Investigation

The objective of this investigation was to determine if contamination is present in the subsurface soil adjacent to the septic tank. On March 1, 1995, four boreholes were drilled and sampled using a Geoprobe. Borehole ST-323C-01 was drilled east of the septic tank to collect background concentration data for this site. This borehole was assumed to be in an area away from any known or suspected contamination. All other boreholes were drilled adjacent to the septic tank. Based on engineering drawings and field observation the bottom of the septic tank was at 5 ft below grade. The sample interval at each borehole extended from the base of the septic tank to 5 ft below the base of the septic tank. From this interval, two samples were collected: one at a depth equal to the base of the septic tank, the other from 3 ft below the base of the septic tank. Only one sample interval from this interval was submitted for laboratory analysis.

Sampling operations and sample handling procedures are described in Section 3.0 . Borehole locations and the sample interval that was sent to the laboratory are listed in Table 8-73. Borehole logs are in Appendix C.

Table 8-73. Boreholes and Samples Analyzed from SWMU 10-21, Building 29042, Septic Tank and Lines (ST-323)

Borehole	Borehole Location	Sample Depth (ft)
ST-323C-01	Background borehole	5–7
ST-323C-02	Adjacent to the septic tank	5–7
ST-323C-03	Adjacent to the septic tank	5–7
ST-323C-04	Adjacent to the septic tank	5–7

8.37.2.4 Laboratory Analysis

Four soil samples were analyzed for VOCs, SVOCs, TPH as DRO and GRO, metals, mercury (the expected contaminants associated with normal operations at this building), soil pH, and soil moisture. The four brass tubes in each 2-ft sample interval were field-screened for possible contamination using a beta-gamma meter and a FID (as per health and safety requirements). No elevated readings were measured with these instruments.

8.37.3 Site Characteristics

8.37.3.1 Geology

The ST-323 area is underlain by unconsolidated alluvial sediment that is predominantly very fine-grained to fine-grained sand at the 5- to 7-ft depth and fine-grained to very coarse, well-graded sand with some gravel at 8 to 10 ft. Four 10-ft boreholes were drilled at ST-323. No boreholes penetrated into the Santa Fe Group sediments that presumably underlie this area. A discussion of the general geology at Kirtland AFB is presented in Section 2.4.

As a result of leach field installation, it is probable that backfill material is present adjacent to the septic tank. Borehole logs for this area are presented in Appendix C.

8.37.3.2 Hydrogeology

ST-323 is on the western edge of the HR3 saturated zone setting as defined by SNL studies (Figure 2-9). Bedrock in this area is inferred to be Permian- and Pennsylvanian-aged sedimentary rock. Near the mountains, bedrock is inferred to be Precambrian granite and metamorphic rock. Bedrock is covered by alluvial material, and the thickness of this cover presumably increases west away from the mountains. Depth to groundwater is estimated at 90 to 100 ft below grade (Figure 2-10) (SNL, 1994). Groundwater flow is west-northwest (Figure 2-6). The nearest production well is KAFB-10, nearly 3.5 mi northwest and potentially downgradient of the site (Figures 2-7 and 2-11). Hydraulic conductivity values based on testing range from 6.52 to 114.5 ft/day. A more detailed discussion of the hydrogeology at Kirtland AFB is presented in Section 2.5.

8.37.4 Nature and Extent of Contamination

The following section describes the extent of contamination based on sampling results. Analytical results for soil samples collected and submitted for analysis from ST-323 are summarized in Table 8-74, where only the reportable concentrations of detected analytes are listed. Full analytical results are presented in Appendix F. Laboratory validation reports are in Appendix K.

Organic Compounds

No VOC or SVOC analytes were detected in any of the soil samples submitted for analysis at ST-323.

Petroleum Hydrocarbons

No gasoline or diesel range hydrocarbons were detected in any of the soil samples submitted for analysis at ST-323.

Metals

Arsenic, beryllium, and manganese were the only metals detected at concentrations above the HHRB action levels in soil samples from ST-323 (Table 8-74). Arsenic (2.0 to 4.5 mg/kg) was detected in all samples submitted for analysis; all concentrations were above the HHRB action level of 0.37 mg/kg, but were below the 6.5 mg/kg UTL. Beryllium (0.31 to 0.51 mg/kg) was detected in all samples collected at ST-323 above the HHRB action level of 0.15 mg/kg, but below the 0.84 mg/kg UTL. Beryllium and arsenic concentrations exceeding HHRB action levels appear to be naturally occurring throughout Kirtland AFB as discussed in Section 4.2.2.

Table 8-74. Summary of Reportable Concentrations for Soil Analyses at SWMU 10-21, Building 29042, Septic Tank, and Lines (ST-323)[1] (Concentrations mg/kg)

Chemical Class	Analyte	HHRB Action Level[2]	PQL UTL	Borehole Number and Sample Depth Interval (ft)			
				ST323C-01 5–7	*ST323C-02* 5–7	*ST323C-03* 5–7	*ST323C-04* 5–7
METALS	Aluminum	78,000	14,700	4,440	5,370	6,710	5,020
	Arsenic	0.37	6.5	2.0	4.2	4.5	4.3
	Barium	5,500	735	47.8	223	231	369
	Beryllium	0.15	0.84	0.31	0.51	0.32	0.31
	Cadmium	39.0	N/A	0.61	0.51	ND	ND
	Calcium	N/A	121,000	30,400	37,900	36,900	38,500
	Chromium, total	390	21.6	4.8	23.2	5.2	6.3
	Cobalt	4,700	15.4	3.5	7.0	3.4	3.5
	Copper	2,900	223	31.7	51.4	13.5	31.3
	Iron	N/A	23,800	8,540	8,990	8,270	6,170
	Lead	400	17.5	4.6	29.5	5.6	6.3
	Magnesium	N/A	10,400	3,500	2,430	4,210	3,560
	Manganese	390	549	180	508	132	272
	Molybdenum	390	N/A	5.4	ND	ND	ND
	Nickel	1,600	188	8.1	20.7	3.9	3.8
	Potassium	N/A	3,590	810	1,030	1,360	1,020
	Sodium	N/A	787	489	265	799	443
	Thallium	N/A	N/A	ND	0.13	ND	ND
	Vanadium	550	55.3	12.6	21.8	21.3	17.3
	Zinc	23,000	114	39.7	75.2	27.7	27.0
OTHER	pH			8.8	8.2	8.5	8.1
	Moisture (%)			1.7	2.4	5.0	3.6

FOOTNOTES

1	Complete laboratory analytical results and method detection limits are presented in Appendix K.
2	Action level of RCRA Proposed Rule Subpart S (55 *FR* 30814, 7/27/90).
*	TPH action level is 100 mg/kg adopted from NMED UST regulations (NMED, 1990). SW-8015 analyzes volatile and semivolatile petroleum hydrocarbon fractions separately. The total concentration of the two fractions analyzed under SW-8015 will be used to assess compliance with stipulated action levels for the purpose of this RFI.
#	Denotes TCLP analysis, results in mg/l.
--	No Data.
FR	Field Replicate.
HHRB	Human health risk based.
J	Estimated value.
N/A	Not Applicable.
NA	Not Analyzed.
ND	Not detected above the method detection limit.
pCi/g	picocuries per gram.
PQL	Practical quantitation limits (defines VOC, SVOC, and TPH).
R	Reject NDs due to interference.
RAD	Radionuclides.
RE	Resample.
SVOC	Semivolatile organic compounds.
TPH	Total petroleum hydrocarbons.
U	Accept data (positive results may be influenced by lab contamination).
UJ	Estimated nondetect.
UTL	Upper tolerance limits (defines metals).
VOC	Volatile organic compounds.

Manganese (508 mg/kg) was detected in ST-323C-02 above the HHRB action level of 390 mg/kg, but below the 549 mg/kg UTL. This concentration is believed to be naturally occurring and is probably related to the underlying geology of this site.

Soil pH and Moisture

Soil pH ranged from 8.1 to 8.8 in these samples. Soil moisture values ranged from 1.7 to 5.0 percent (Table 8-74).

8.37.5 Conclusions and Recommendations

Conclusions

- No VOCs or SVOCs were detected in the soil samples submitted for analysis from this site.
- No diesel or gasoline range hydrocarbons were detected.
- Arsenic, beryllium, and manganese were the only metals detected at concentrations exceeding HHRB action levels. The beryllium and arsenic concentrations appear to be naturally occurring throughout Kirtland AFB; the manganese concentration appears to be naturally occurring at this site.
- The analytical results at ST-323 are not indicative of a contaminant release from this site.

Recommendations

- Based on the findings of the RFI, no further action is necessary; therefore, ST-323 does not require further investigation. A No Further Action proposal should be prepared.

8.38 SWMU 10-21, Building 29051, Septic Tank, Leach Field, and Lines (ST-324)

8.38.1 Site Background and Environmental Setting

Septic tank ST-324 is 40 ft west of Building 29051, an administrative office building, in the south-central portion of Kirtland AFB (Figure 8-38). ST-324 was investigated on March 1, 1995.

Based on engineering drawings and observed site conditions, septic tank inflow and outflow line lengths are approximately 110 ft and 10 ft, respectively. This tank discharges to a leach field to the west with a drainage area approximately 95 ft x 30 ft. Potentially, the septic tank could have received contaminants from Building 29051. Due to the leach field's design, waste from ST-324 can be expected to have entered the surrounding soil.

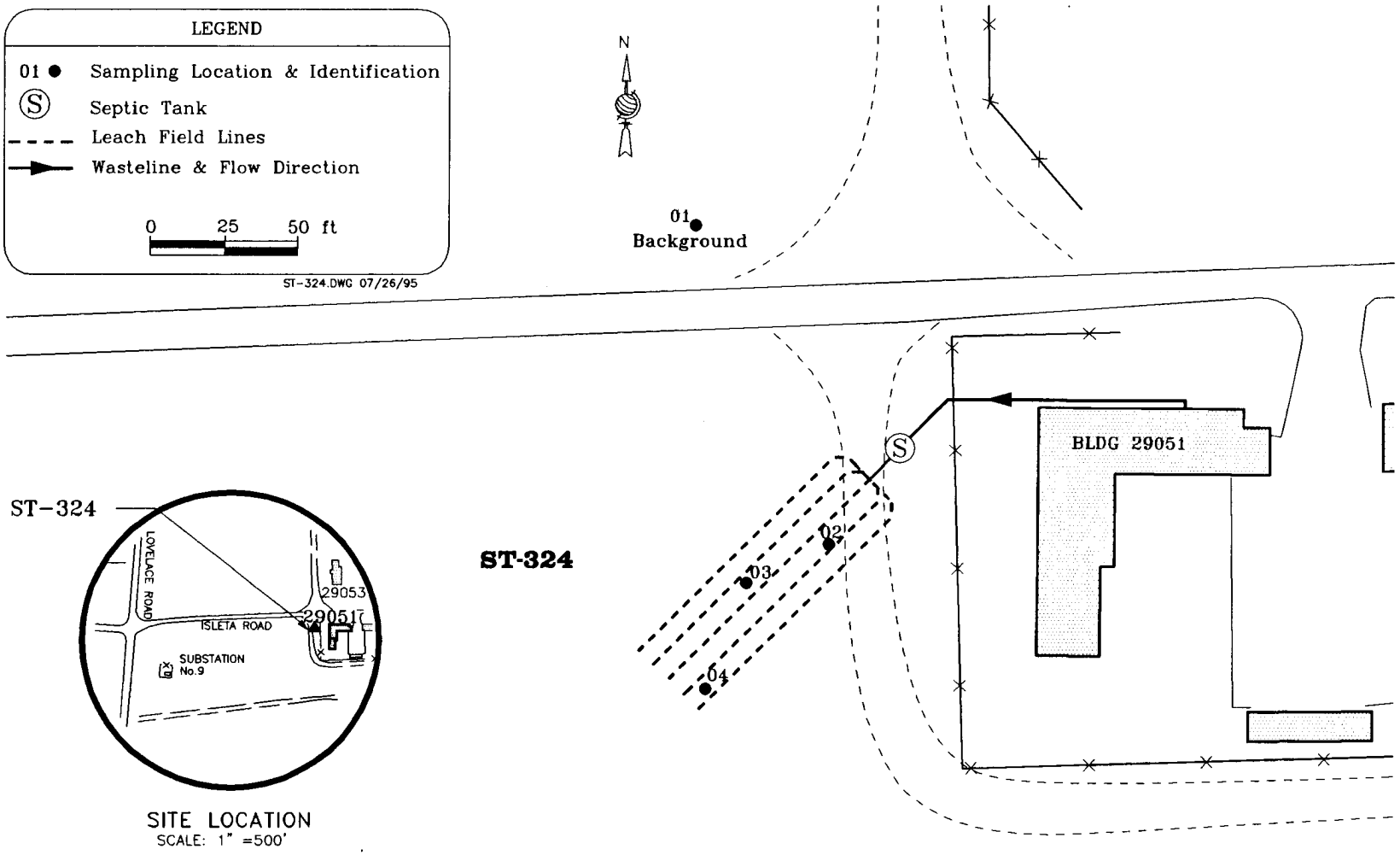


Figure 8-38. Soil Sampling Locations at SWMU 10-21, Building 29051, Septic Tank, Leach Field, and Lines (ST-324)

Building 29051 is on the Hubbell Bench, on the east boundary of the Albuquerque-Belen Basin (USAF, 1993). The nearest production well to the site is KAFB-10 (Figure 2-11), which is approximately 17,500 ft northwest, and is controlled and operated by DOE and SNL.

8.38.2 Study Area Investigation

The area of investigation was limited to the leach field at ST-324. Possible source materials in the septic tank were not investigated.

8.38.2.1 Previous Investigations

No previous investigations have been performed at this site.

8.38.2.2 Data Gaps

No information related to the past use of ST-324 was available. No data were available to determine the presence or absence of contaminants in the subsurface soil in the leach field.

8.38.2.3 RFI Field Investigation

The objective of this investigation was to determine if contamination is present in the subsurface soil in the leach field area. On March 1, 1995, four boreholes were drilled and sampled using a Geoprobe. Borehole ST-324C-01 was drilled north of the leach field area to collect background concentration data for this site. This borehole was assumed to be in an area away from any known or suspected contamination. All other boreholes were drilled in the leach field area. Based on engineering drawings and observed field conditions, the leach field lines were determined to be 3 ft below grade. The sample interval at each borehole extended from the depth of the leach field line to 5 ft below the leach field line. From this interval, two samples were collected: one at a depth equal to the base of the leach field line, the other from 3 ft below the base of the leach field line. Only one sample was submitted for laboratory analysis.

Sampling operations and sample handling procedures are described in Section 3.0. Borehole locations and the sample interval that was sent to the laboratory are listed in Table 8-75. Borehole logs are in Appendix C.

Table 8-75. Boreholes and Samples Analyzed from SWMU 10-21, Building 29051, Septic Tank, Leach Field, and Lines (ST-324)

Borehole	Borehole Location	Sample Depth (ft)
ST-324C-01	Background borehole	3–5
ST-324C-02	In the leach field area	3–5
ST-324C-03	In the leach field area	3–5
ST-324C-04	In the leach field area	3–5

8.38.3 Site Characteristics

8.38.2.4 Laboratory Analysis

Four soil samples were analyzed for VOCs, SVOCs, TPH as DRO and GRO, metals, mercury (the expected contaminants associated with normal operations at this building), soil pH, and soil moisture. The four brass tubes in each 2-ft sample interval were field-screened for possible contamination using a beta-gamma meter and a FID. No elevated readings were measured with these instruments.

8.38.3.1 Geology

The ST-324 area is underlain by unconsolidated alluvial sediment that is predominantly very fine-grained to fine-grained sand at the 3- to 5-ft depth and very fine-grained to very coarse, well-graded sand in the 6- to 8-ft interval. Four 8-ft boreholes were drilled at ST-324. No boreholes penetrated into the Santa Fe Group sediments that presumably underlie this area. A discussion of the general geology at Kirtland AFB is presented in Section 2.4.

As a result of leach field installation, it is probable that backfill material is present in the leach field area. Borehole logs for this area are presented in Appendix C.

8.38.3.2 Hydrogeology

ST-324 is on the western edge of the HR3 saturated zone setting as defined by SNL studies (Figure 2-9). Bedrock in this area is inferred to be Permian- and Pennsylvanian-aged sedimentary rock. Near the mountains, bedrock is inferred to be Precambrian granite and metamorphic rock. Bedrock is covered by alluvial material and the thickness of this cover presumably increases west away from the mountains. Depth to groundwater is estimated at 90 to 100 ft below grade (Figure 2-10) (SNL, 1994). Groundwater flow is west-northwest (Figure 2-6). The nearest production well is KAFB-10, nearly 3.5 mi northwest and potentially downgradient of the site (Figures 2-7 and 2-11). Hydraulic conductivity values based on testing range from 6.52 to 114.5 ft/day. A more detailed discussion of the hydrogeology at Kirtland AFB is presented in Section 2.5.

8.38.4 Nature and Extent of Contamination

The following section describes the extent of contamination based on sampling results. Analytical results for soil samples collected and submitted for analysis from ST-324 are summarized in Table 8-76, where only the reportable concentrations of detected analytes are listed. Full analytical results are presented in Appendix F. Laboratory validation reports are in Appendix K.

Organic Compounds

No VOC or SVOC analytes were detected in any of the soil samples submitted for analysis at ST-324.

Table 8-76. Summary of Reportable Concentrations for Soil Analyses at SWMU 10-21, Building 29051, Septic Tank, Leach Field, and Lines (ST-324)[1] (Concentrations mg/kg)

Chemical Class	Analyte	HHRB Action Level[2]	PQL UTL	Borehole Number and Sample Depth Interval (ft)			
				ST324C-01	*ST324C-02*	*ST324C-03*	*ST324C-04*
				3–5	3–5	3–5	3–5
TPH	Diesel fraction	100	10.0	5.0	4.7	5.2	6.8
METALS	Aluminum	78,000	14,700	9,630	7,200	6,950	5,010
	Arsenic	0.37	6.5	12.5	11.2	9.7	6.8
	Barium	5,500	735	307	94.5	431	648
	Beryllium	0.15	0.84	0.33	0.32	0.32	ND
	Cadmium	39.0	N/A	0.56	ND	ND	0.68
	Calcium	N/A	121,000	128,000	156,000	74,800	181,000
	Chromium, total	390	21.6	7.0	5.8	6.3	4.2
	Cobalt	4,700	15.4	3.5	2.5	3.2	4.0
	Copper	2,900	223	52.0	27.2	132	27.4
	Iron	N/A	23,800	7,320	6,080	7,110	3,700
	Lead	400	17.5	5.7	5.0	5.6	2.6
	Magnesium	N/A	10,400	12,500	11,400	7,080	14,900
	Manganese	390	549	108	94.0	101	41.9
	Nickel	1,600	188	6.1	3.2	3.7	3.1
	Potassium	N/A	3,590	1,660	1,310	1,190	607
	Sodium	N/A	787	1,880	649	967	1,050
	Thallium	N/A	N/A	ND	0.13	0.13	ND
	Vanadium	550	55.3	63.8	42.5	47.7	27.2
	Zinc	23,000	114	37.5	25.6	61.4	16.7
OTHER	pH			8.1	7.9	8.1	8.4
	Moisture (%)			10.2	6.5	5.9	12.2

FOOTNOTES

1	Complete laboratory analytical results and method detection limits are presented in Appendix K.
2	Action level of RCRA Proposed Rule Subpart S (55 *FR* 30814, 7/27/90).
*	TPH action level is 100 mg/kg adopted from NMED UST regulations (NMED, 1990). SW-8015 analyzes volatile and semivolatile petroleum hydrocarbon fractions separately. The total concentration of the two fractions analyzed under SW-8015 will be used to assess compliance with stipulated action levels for the purpose of this RFI.
#	Denotes TCLP analysis, results in mg/l.
--	No Data.
FR	Field Replicate.
HHRB	Human health risk based.
J	Estimated value.
N/A	Not Applicable.
NA	Not Analyzed.
ND	Not detected above the method detection limit.
pCi/g	picocuries per gram.
PQL	Practical quantitation limits (defines VOC, SVOC, and TPH).
R	Reject NDs due to interference.
RAD	Radionuclides.
RE	Resample.
SVOC	Semivolatile organic compounds.
TPH	Total petroleum hydrocarbons.
U	Accept data (positive results may be influenced by lab contamination).
UJ	Estimated nondetect.
UTL	Upper tolerance limits (defines metals).
VOC	Volatile organic compounds.

Petroleum Hydrocarbons

No gasoline range hydrocarbons were detected in any of the soil samples submitted for analysis at ST-324. Diesel range hydrocarbons (4.7 to 6.8 mg/kg) were detected in all samples collected. The concentrations were below the NMED action level of 100 mg/kg.

Metals

Arsenic and beryllium were the only metals detected at concentrations above the HHRB action levels in soil samples from ST-324 (Table 8-76). Arsenic (6.8 to 12.5 mg/kg) was detected in all samples submitted for analysis, including the background borehole ST-324C-01 (12.5 mg/kg), at concentrations above the HHRB action level of 0.37 mg/kg, and the 6.5 mg/kg UTL. Beryllium (0.32 to 0.33 mg/kg) was detected in three of the four samples collected at ST-324 above the HHRB action level of 0.15 mg/kg but below the 0.84 mg/kg UTL. Beryllium and arsenic concentrations exceeding HHRB action levels appear to be naturally occurring throughout Kirtland AFB as discussed in Section 4.2.2.

Soil pH and Moisture

Soil pH ranged from 7.9 to 8.4 in these samples. Soil moisture values ranged from 5.9 to 12.2 percent (Table 8-76).

8.38.5 Conclusions and Recommendations

Conclusions

- No VOCs or SVOCs were detected in the soil samples submitted for analysis from this site.
- No gasoline range hydrocarbons were detected. Diesel range hydrocarbons were detected in all the samples at this site. The concentrations did not exceed the NMED action level of 100 mg/kg. The diesel range hydrocarbon concentrations (4.7 to 6.8 mg/kg) detected in the samples were similar to those detected in background samples analyzed during the Appendix III RFI, and are not indicative of a release.
- Arsenic and beryllium were the only metals detected at concentrations exceeding HHRB action levels; these concentrations appear to be naturally occurring throughout Kirtland AFB.
- The analytical results at ST-324 are not indicative of a contaminant release at this site.

Recommendations

- Based on the findings of the RFI, no further action is necessary; therefore, ST-324 does not require further investigation. A No Further Action proposal should be prepared.

8.39 SWMU 10-21, Building 1032, Septic Tank, Leach Field, and Lines (ST-330)

8.39.1 Site Background and Environmental Setting

Septic tank ST-330 is 290 ft west of Building 1032, a petroleum operations administration building, in the northwest portion of Kirtland AFB (Figure 8-39). ST-330 was investigated on February 8, 1995.

Based on engineering drawings and observed site conditions, septic tank inflow and outflow line lengths are approximately 300 ft and 15 ft, respectively. This tank discharges to a leach field to the south with a drainage area of approximately 80 ft x 40 ft. Potentially, the septic tank could have received contaminants from Buildings 1032 and 1036, formerly a laboratory that is no longer connected to the sewer system. Due to the leach field's design, waste from ST-330 can be expected to have entered the surrounding soil.

ST-330 is located in the urban/industrial zone, which is discussed in Section 2.0. The nearest production wells to this site are KAFB-2, 2,500 ft southwest, and KAFB-14, 5,000 ft west-northwest (Figure 2-11).

8.39.2 Study Area Investigation

The area of investigation was limited to the leach field at ST-330. Possible source materials in the septic tank were not investigated.

8.39.2.1 Previous Investigations

No previous investigations have been performed at this site.

8.39.2.2 Data Gaps

No information related to the past use of ST-330 was available. No data were available to determine the presence or absence of contaminants in the subsurface soil in the leach field.

8.39.2.3 RFI Field Investigation

The objective of this investigation was to determine if contamination is present in the subsurface soil in the leach field area. On February 8, 1995, three boreholes were drilled and sampled using a Geoprobe. Borehole ST-341C-01, drilled during the Appendix III RFI non-wasteline investigation, was used for

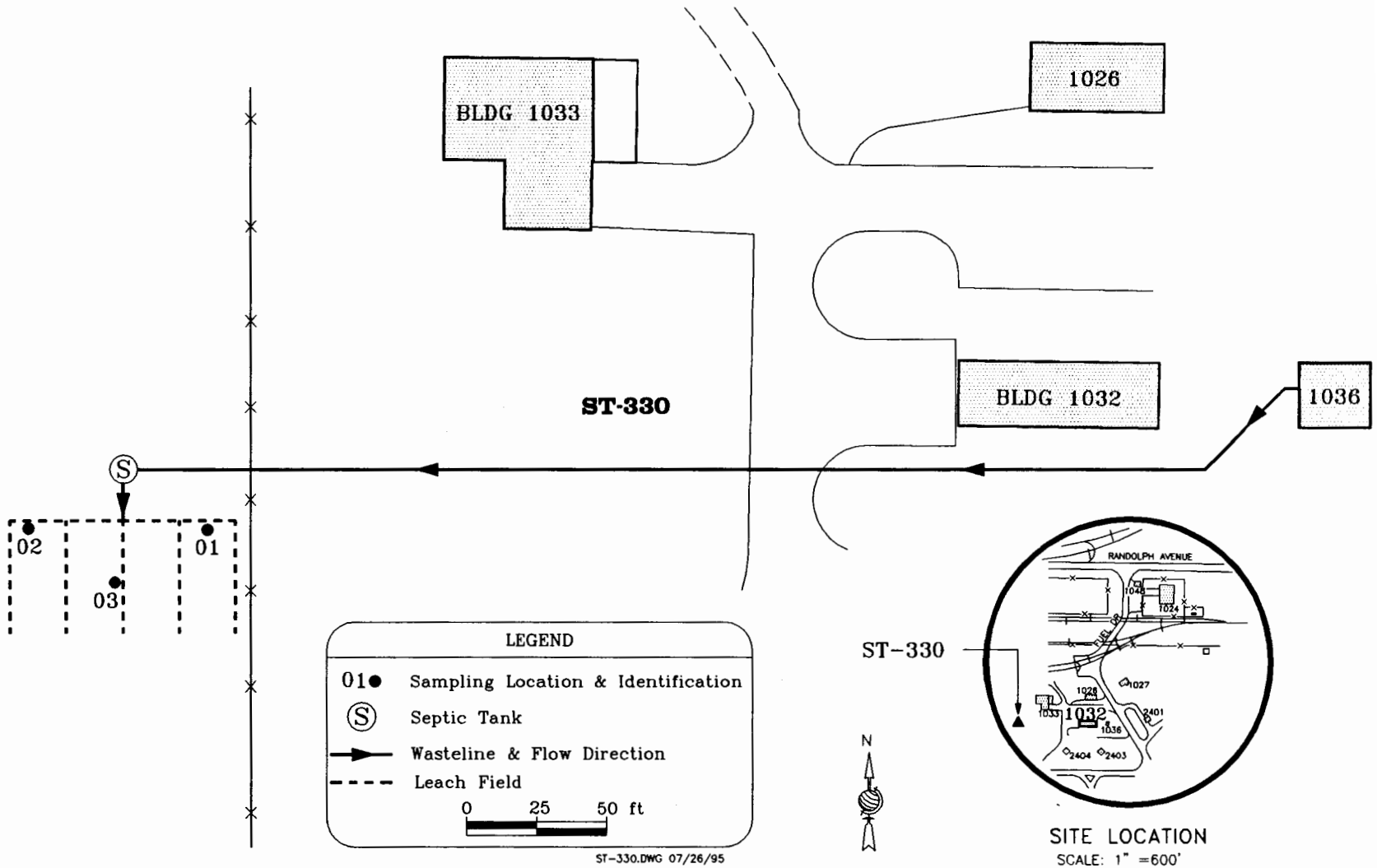


Figure 8-39. Soil Sampling Locations at SWMU 10-21, Building 1032, Septic Tank, Leach Field, and Lines (ST-330)

background concentration data for this site. This borehole was assumed to be in an area away from any known or suspected contamination. All boreholes were drilled in the leach field area. Based on engineering drawings and observed field locations, the leach field lines were determined to be 3 ft below grade. The sample interval at each borehole extended from the depth of the leach field line to 5 ft below the leach field line. From this interval, two samples were collected: one at a depth equal to the base of the leach field line, the other from 3 ft below the base of the leach field line. Only one sample was submitted for laboratory analysis.

Sampling operations and sample handling procedures are described in Section 3.0. Borehole locations and the sample interval that was sent to the laboratory are listed in Table 8-77. Borehole logs are in Appendix C.

Table 8-77. Boreholes and Samples Analyzed from SWMU 10-21, Building 1032, Septic Tank, Leach Field, and Lines (ST-330)

Borehole	Borehole Location	Sample Depth (ft)
ST-330C-01	In the leach field area	3–8[a]
ST-330C-02	In the leach field area	3–8[b]
ST-330C-03	In the leach field area	3–5

a. Both 2-ft sections of the 5-ft interval were used due to the collection of a MS/MSD sample.

b. Both 2-ft sections of the 5-ft interval were used due to the collection of a replicate sample.

8.39.2.4 Laboratory Analysis

Four soil samples, including one replicate sample, were analyzed for VOCs, SVOCs, TPH as DRO and GRO, metals, mercury (the expected contaminants associated with normal operations at this building), soil pH, and soil moisture. The four brass tubes in each 2-ft sample interval were field-screened for possible contamination using a beta-gamma meter and a FID. No elevated readings were measured with these instruments.

8.39.3 Site Characteristics

8.39.3.1 Geology

The ST-330 area is underlain by unconsolidated alluvial sediment that is predominantly very fine-grained to fine-grained sand. Three 8-ft boreholes were drilled at ST-330. No boreholes penetrated into the Santa Fe Group sediments that presumably underlie this area. A discussion of the general geology at Kirtland AFB is presented in Section 2.4.

As a result of leach field installation, it is probable that backfill material is present in the leach field area. Borehole logs for this area are presented in Appendix C.

8.39.3.2 Hydrogeology

Groundwater beneath this area is found within the Upper Santa Fe sediments and is generally thought to be unconfined in the upper portion of the aquifer. This area is within the HR1 saturated zone setting as defined by SNL studies (Figure 2-9) (SNL, 1994). Hydrogeologic characterization in this portion of Kirtland AFB is complicated by the presence of numerous production wells (Figure 2-11). It is probable that uniform groundwater conditions do not exist in this region. Local cones of depression associated with groundwater withdrawal have altered the groundwater flow direction in the vicinity of the well fields (Figure 2-7).

The gradient is probably northeast at this site. Two production wells are located in this area of Kirtland AFB: KAFB-2 is cross gradient 2,500 ft southwest and KAFB-14 is cross gradient 5,000 ft west-northwest (Figures 2-7 and 2-11). Depth to groundwater is estimated to be about 350 ft below grade (Figure 2-10); however, shallower perched water zones may occur. Hydraulic conductivity within HR1 is estimated at 2 to 171 ft/day (SNL, 1994). A general discussion of the hydrogeology at Kirtland AFB is presented in Section 2.5.

8.39.4 Nature and Extent of Contamination

The following section describes the extent of contamination based on sampling results. Analytical results for soil samples collected and submitted for analysis from ST-330 are summarized in Table 8-78, where only the reportable concentrations of detected analytes are listed. Full analytical results are presented in Appendix F. Laboratory validation reports are in Appendix K.

Organic Compounds

No VOC analytes were detected in any of the soil samples submitted for analysis at ST-330.

Di-n-butylphthalate and benzyl butyl phthalate were the only SVOC analytes detected in one or more of the soil samples submitted for analysis at ST-330. Di-n-butylphthalate (0.85 to 2.7 mg/kg) was detected in all samples submitted. Benzyl butyl phthalate (0.42 to 0.63 mg/kg) was detected in three of the four samples submitted. All concentrations were below HHRB action levels (Table 8-78).

Petroleum Hydrocarbons

No gasoline or diesel range hydrocarbons were detected in any of the soil samples submitted for analysis at ST-330.

Metals

Arsenic and beryllium were the only metals detected at concentrations above the HHRB action levels in the soil samples submitted for analysis from ST-330 (Table 8-78). Arsenic (2.2 to 4.5 mg/kg) was detected in all samples collected. These concentrations were above the HHRB action level of 0.37 mg/kg, but below the 6.5 mg/kg UTL. Beryllium (0.31 to 0.52 mg/kg) was detected in three of the four samples collected

Table 8-78. Summary of Reportable Concentrations for Soil Analyses at SWMU 10-21, Building 1032, Septic Tank, Leach Field, and Lines (ST-330)[1] (Concentrations mg/kg)

Chemical Class	Analyte	HHRB Action Level[2]	PQL UTL	Borehole Number and Sample Depth Interval (ft)			
				ST330C-01	*ST330C-02*		*ST330C-03*
				3–8	3–8 FR	3–8	3–5
SVOC	Benzyl butyl phthalate	16,000	1.3	ND	0.63	0.42	0.55
	Di-n-butylphthalate	7,800	0.70	0.85	1.8	2.7	2.7
METALS	Aluminum	78,000	14,700	7,450	4,190	7,890	4,350
	Arsenic	0.37	6.5	2.2	2.6	4.5	4.1
	Barium	5,500	735	266	155	271	313
	Beryllium	0.15	0.84	0.42	0.31	0.52	ND
	Cadmium	39.0	N/A	ND	ND	0.63	ND
	Calcium	N/A	121,000	48,000	44,000	40,700	147,000
	Chromium, total	390	21.6	7.7	5.8	10.0	4.8
	Cobalt	4,700	15.4	5.1	3.7	6.3	3.4
	Copper	2,900	223	37.5	58.0	56.4	25.8
	Iron	N/A	23,800	10,200	6,260	14,100	5,110
	Lead	400	17.5	4.5	3.3	6.9	2.3
	Magnesium	N/A	10,400	4,060	3,290	5,030	4,800
	Manganese	390	549	153	88.6	240	57.9
	Nickel	1,600	188	6.4	4.0	8.5	3.6
	Potassium	N/A	3,590	1,170	620	1,210	366
	Sodium	N/A	787	211	172	192	121
	Thallium	N/A	N/A	ND	ND	0.19	ND
	Vanadium	550	55.3	23.0	17.1	32.2	20.1
	Zinc	23,000	114	30.3	29.9	38.6	13.9
OTHER	pH			8.6	8.6	8.7	9.0
	Moisture (%)			4.0	3.1	4.4	3.5

FOOTNOTES

1	Complete laboratory analytical results and method detection limits are presented in Appendix K.
2	Action level of RCRA Proposed Rule Subpart S (55 *FR* 30814, 7/27/90).
*	TPH action level is 100 mg/kg adopted from NMED UST regulations (NMED, 1990). SW-8015 analyzes volatile and semivolatile petroleum hydrocarbon fractions separately. The total concentration of the two fractions analyzed under SW-8015 will be used to assess compliance with stipulated action levels for the purpose of this RFI.
#	Denotes TCLP analysis, results in mg/l.
--	No Data.
FR	Field Replicate.
HHRB	Human health risk based.
J	Estimated value.
N/A	Not Applicable.
NA	Not Analyzed.
ND	Not detected above the method detection limit.
pCi/g	picocuries per gram.
PQL	Practical quantitation limits (defines VOC, SVOC, and TPH).
R	Reject NDs due to interference.
RAD	Radionuclides.
RE	Resample.
SVOC	Semivolatile organic compounds.
TPH	Total petroleum hydrocarbons.
U	Accept data (positive results may be influenced by lab contamination).
UJ	Estimated nondetect.
UTL	Upper tolerance limits (defines metals).
VOC	Volatile organic compounds.

at ST-330 above the HHRB action level of 0.15 mg/kg, but below the 0.84 mg/kg UTL. Beryllium and arsenic concentrations exceeding HHRB action levels appear to be naturally occurring throughout Kirtland AFB as discussed in Section 4.2.2.

Soil pH and Moisture

Soil pH ranged from 8.6 to 9.0 in these samples. Soil moisture values ranged from 3.1 to 4.4 percent (Table 8-78).

8.39.5 Conclusions and Recommendations

Conclusions

- No VOCs were detected in the soil samples submitted for analysis from this site.
- Two SVOCs were detected in the soil samples collected at ST-330, but all concentrations were below the HHRB action levels.
- No gasoline or diesel range hydrocarbons were detected in any of the samples submitted for analysis.
- Arsenic and beryllium were the only metals detected at concentrations exceeding HHRB action levels; these concentrations appear to be naturally occurring throughout Kirtland AFB.
- The analytical results at ST-330 are not indicative of a contaminant release from this site.

Recommendations

- Based on the findings of the RFI, no further action is necessary; therefore, ST-330 does not require further investigation. A No Further Action proposal should be prepared.

8.40 SWMU 10-21, Building 66001, Septic Tank, Leach Field, and Lines (ST-333)

8.40.1 Site Background and Environmental Setting

Septic tank ST-333 is 5 ft south of Building 66001, a laser science laboratory, in the southeast portion of Kirtland AFB (Figure 8-40). ST-333 was investigated on March 2, 1995.

Based on engineering drawings and observed site conditions, septic tank inflow and outflow line lengths are approximately 5 ft and 210 ft, respectively. This tank discharges to a leach field to the south-southeast with a drainage area of approximately 95 ft x 40 ft. Potentially, the septic tank could have received contaminants from Building 66001. Due to the leach field's design, waste from ST-333 can be expected to have entered the surrounding soil.

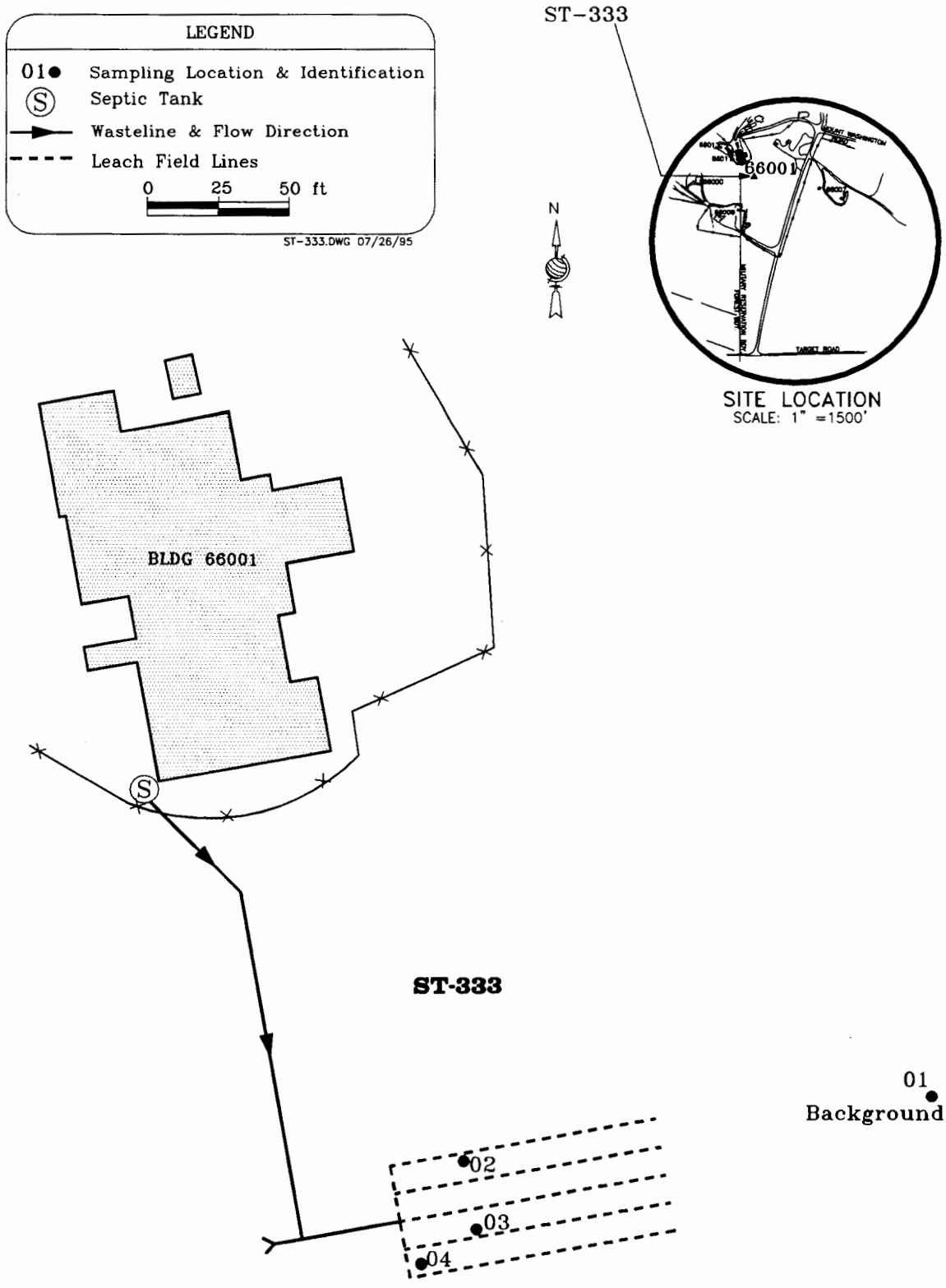


Figure 8-40. Soil Sampling Locations at SWMU 10-21, Building 66001, Septic Tank, Leach Field, and Lines (ST-333)

This site is isolated from the urban/industrial environmental zone and is close to the foot of the Manzano Mountains on the east boundary of the Albuquerque-Belen Basin. The are no production wells near this site (Figure 2-11).

8.40.2 Study Area Investigation

The area of investigation was limited to the leach field at ST-333. Possible source materials in the septic tank were not investigated.

8.40.2.1 Previous Investigations

No previous investigations have been performed at this site.

8.40.2.2 Data Gaps

No information related to the past use of ST-333 was available. No data were available to determine the presence or absence of contaminants in the subsurface soil in the leach field.

8.40.2.3 RFI Field Investigation

The objective of this investigation was to determine if contamination is present in the subsurface soil in the leach field area. On March 2, 1995, four boreholes were drilled and sampled using a Geoprobe. Borehole ST-333C-01 was drilled east of the leach field area to collect background concentration data for this site. This borehole was assumed to be in an area away from any known or suspected contamination. All other boreholes were drilled in the leach field area. Based on engineering drawings and observed field conditions, the leach field lines were determined to be 2 ft below grade. The sample interval at each borehole extended from the depth of the leach field line to 5 ft below the leach field line. From within this interval, two samples were collected: one at a depth equal to the base of the leach field line, the other from 3 ft below the base of the leach field line. Only one sample was submitted for laboratory analysis.

Sampling operations and sample handling procedures are described in Section 3.0. Borehole locations and the sample interval that was sent to the laboratory are listed in Table 8-79. Borehole logs are in Appendix C.

8.40.2.4 Laboratory Analysis

Five soil samples, including one replicate, were analyzed for VOCs, SVOCs, TPH as GRO and DRO, metals, mercury (the expected contaminants associated with normal operations at this building), soil pH, and soil moisture. The four brass tubes in each 2-ft sample interval were field-screened for possible contamination using a beta-gamma meter and a FID. No elevated readings were measured with these instruments.

Table 8-79. Boreholes and Samples Analyzed from SWMU 10-21, Building 66001, Septic Tank, Leach Field, and Lines (ST-333)

Borehole	Borehole Location	Sample Depth (ft)
ST-333C-01	Background borehole	2–4[a]
ST-333C-02	In the leach field area	2–4
ST-333C-03	In the leach field area	2–4
ST-333C-04	In the leach field area	2–4

a. A replicate sample was collected in addition to the normal sample in a borehole 1.5 ft south of the first boring.

8.40.3 Site Characteristics

8.40.3.1 Geology

The ST-333 area is underlain by unconsolidated alluvial sediment and weathered granite. The sediments are predominantly sandy fine gravel and well-graded sand to a depth of 4 ft. Weathered granite was consistently encountered at approximately 4 ft below grade and was impenetrable. Two 4-ft boreholes and two 3.5-ft boreholes were drilled at ST-333. No boreholes penetrated into the Santa Fe Group sediments that presumably underlie this area. A discussion of the general geology at Kirtland AFB is presented in Section 2.4.

As a result of leach field installation, it is probable that backfill material is present in the leach field area. Borehole logs for this area are presented in Appendix C.

8.40.3.2 Hydrogeology

ST-333 is in the HR3 saturated zone setting as defined by SNL studies (Figure 2-9). Bedrock in this area is inferred to be Permian- and Pennsylvanian-aged sedimentary rock. Near the mountains, bedrock is inferred to be Precambrian granite and metamorphic rock. Bedrock is covered by alluvial material, and the thickness of this cover presumably increases west, away from the mountains. Depth to groundwater is estimated at 90 to 100 ft below grade (Figure 2-10) (SNL, 1994). Groundwater flow is west-northwest (Figure 2-7). There are no production wells near this site (Figures 2-7 and 2-11). Hydraulic conductivity values based on testing range from 6.52 to 114.5 ft/day. A more detailed discussion of the hydrogeology at Kirtland AFB is presented in Section 2.5.

8.40.4 Nature and Extent of Contamination

The following section describes the extent of contamination based on sampling results. Analytical results for soil samples collected and submitted for analysis from ST-333 are summarized in Table 8-80, where only the reportable concentrations of detected analytes are listed. Full analytical results are presented in Appendix F. Laboratory validation reports are in Appendix K.

Table 8-80. Summary of Reportable Concentrations for Soil Analyses at SWMU 10-21, Building 66001, Septic Tank, Leach Field, and Lines (ST-333)[1] (Concentrations mg/kg)

Chemical Class	Analyte	HHRB Action Level[2]	PQL UTL	Borehole Number and Sample Depth Interval (ft)				
				ST333C-01		*ST333C-02*	*ST333C-03*	*ST333C-04*
				2–4 FR	2–4	2–4	2–4	2–4
SVOC	Di-n-butylphthalate	7,800	0.70	2.5	2.4	2.7	2.6	2.0
METALS	Aluminum	78,000	14,700	4,860	5,390	4,230	7,370	7,560
	Arsenic	0.37	6.5	2.9	4.8	1.9	2.7	7.3
	Barium	5,500	735	392	916	66.3	93.3	82.9
	Beryllium	0.15	0.84	ND	0.33	ND	0.32	0.30
	Cadmium	39.0	N/A	ND	ND	ND	0.53	0.81
	Calcium	N/A	121,000	99,200	94,700	42,300	24,600	37,200
	Chromium, total	390	21.6	4.5	4.8	2.2	5.1	2.9
	Cobalt	4,700	15.4	4.4	5.3	4.7	6.3	8.2
	Copper	2,900	223	21.3	274	88.5	292	264
	Iron	N/A	23,800	7,160	7,200	8,690	12,200	16,300
	Lead	400	17.5	3.6	5.5	3.2	6.7	1.7
	Magnesium	N/A	10,400	5,680	7,510	2,820	3,820	5,340
	Manganese	390	549	173	178	298	349	535
	Mercury	23.0	N/A	ND	0.12	ND	ND	ND
	Nickel	1,600	188	5.4	4.0	21.0	4.2	2.1
	Potassium	N/A	3,590	1,060	1,240	1,190	1,550	2,660
	Sodium	N/A	787	70.8	110	61.1	97.9	234
	Thallium	N/A	N/A	ND	0.13	0.14	0.11	0.28
	Vanadium	550	55.3	18.0	20.0	18.7	20.6	31.9
	Zinc	23,000	114	30.5	107	58.9	136	153
OTHER	pH			8.7	8.6	8.7	8.2	8.1
	Moisture (%)			7.2	9.2	4.7	6.3	1.2

FOOTNOTES

1	Complete laboratory analytical results and method detection limits are presented in Appendix K.
2	Action level of RCRA Proposed Rule Subpart S (55 *FR* 30814, 7/27/90).
*	TPH action level is 100 mg/kg adopted from NMED UST regulations (NMED, 1990). SW-8015 analyzes volatile and semivolatile petroleum hydrocarbon fractions separately. The total concentration of the two fractions analyzed under SW-8015 will be used to assess compliance with stipulated action levels for the purpose of this RFI.
#	Denotes TCLP analysis, results in mg/l.
--	No Data.
FR	Field Replicate.
HHRB	Human health risk based.
J	Estimated value.
N/A	Not Applicable.
NA	Not Analyzed.
ND	Not detected above the method detection limit.
pCi/g	picocuries per gram.
PQL	Practical quantitation limits (defines VOC, SVOC, and TPH).
R	Reject NDs due to interference.
RAD	Radionuclides.
RE	Resample.
SVOC	Semivolatile organic compounds.
TPH	Total petroleum hydrocarbons.
U	Accept data (positive results may be influenced by lab contamination).
UJ	Estimated nondetect.
UTL	Upper tolerance limits (defines metals).
VOC	Volatile organic compounds.

Organic Compounds

No VOC analytes were detected in any of the soil samples submitted for analysis at ST-333.

Di-n-butylphthalate (2.0 to 2.7 mg/kg) was the only SVOC analyte detected in samples submitted for analysis. All concentrations were below the HHRB action level of 7,800 mg/kg.

Petroleum Hydrocarbons

No gasoline or diesel range hydrocarbons were detected in any of the soil samples submitted for analysis at ST-333.

Metals

Arsenic, beryllium, and manganese were the only metals detected at concentrations above the HHRB action levels in the soil samples submitted for analysis from ST-333 (Table 8-80). Arsenic (1.9 to 7.3 mg/kg) was detected in all samples submitted. All concentrations were above the HHRB action level of 0.37 mg/kg, and one sample had a concentration above the 6.5 mg/kg UTL. Beryllium (0.30 to 0.33 mg/kg) was detected in three samples at concentrations above the HHRB action level of 0.15 mg/kg, but below the 0.84 mg/kg UTL. Beryllium and arsenic concentrations exceeding HHRB action levels appear to be naturally occurring throughout Kirtland AFB as discussed in Section 4.2.2.

Manganese (173 to 535 mg/kg) was detected in ST-333C-04 at a concentration above the HHRB action level of 390 mg/kg, but below the 549 mg/kg UTL. The manganese concentration is believed to be naturally occurring and is probably related to the underlying geology, which is predominantly weathered granite.

Soil pH and Moisture

Soil pH ranged from 8.1 to 8.7 in these samples. Soil moisture values ranged from 1.2 to 9.2 percent (Table 8-80).

8.40.5 Conclusions and Recommendations

Conclusions

- No VOCs were detected and one SVOC was detected in the soil samples submitted for analysis from this site. All concentrations were below HHRB action levels.
- No gasoline or diesel range hydrocarbons were detected in soil samples submitted for analysis.
- Arsenic, beryllium, and manganese were the only metals detected at concentrations exceeding HHRB action levels; these concentrations appear to be naturally occurring throughout Kirtland AFB.
- The analytical results at ST-333 are not indicative of a contaminant release from this site.

Recommendations

- Based on the findings of the RFI, no further action is necessary; therefore, ST-333 does not require further investigation. A No Further Action proposal should be prepared.

8.41 SWMU ST-340, Buildings 57001/57002, Septic Tank, Leach Field, and Lines (ST-340)

8.41.1 Site Background and Environmental Setting

Septic tank ST-340 is located near Buildings 57001 and 57002, a warehouse and a science laboratory at the former Civil Engineering Facility, in the south-central portion of Kirtland AFB (Figure 8-41). ST-340 was investigated on February 21, 1995.

Based on engineering drawings and observed site conditions, septic tank inflow and outflow line lengths are estimated to be approximately 410 ft and 20 ft, respectively. This tank discharges to a leach field to the northwest with a drainage area approximately 80 ft x 60 ft. Potentially, the septic tank could have received contaminants from Buildings 57001 and 57002. Due to the leach field's design, waste from ST-340 can be expected to have entered the surrounding soil.

Buildings 57001 and 57002 are on the Hubbell Bench, on the east boundary of the Albuquerque-Belen Basin (USAF, 1993c). The nearest production well to the site is KAFB-10 (Figure 2-11), which is approximately 18,000 ft northwest and is controlled and operated by DOE and SNL.

8.41.2 Study Area Investigation

The area of investigation was limited to the leach field at ST-340. Possible source materials in the septic tank were not investigated.

8.41.2.1 Previous Investigations

No previous investigations have been performed at this site.

8.41.2.2 Data Gaps

No information related to the past use of ST-340 was available. No data were available to determine the presence or absence of contaminants in the subsurface soil in the leach field.

8.41.2.3 RFI Field Investigation

The objective of this investigation was to determine if contamination is present in the subsurface soil in the leach field area. On February 21, 1995, four boreholes were drilled and sampled using a Geoprobe. Borehole ST-266C-01, collected during the Stage 2B RFI, was drilled northeast of the leach field area to

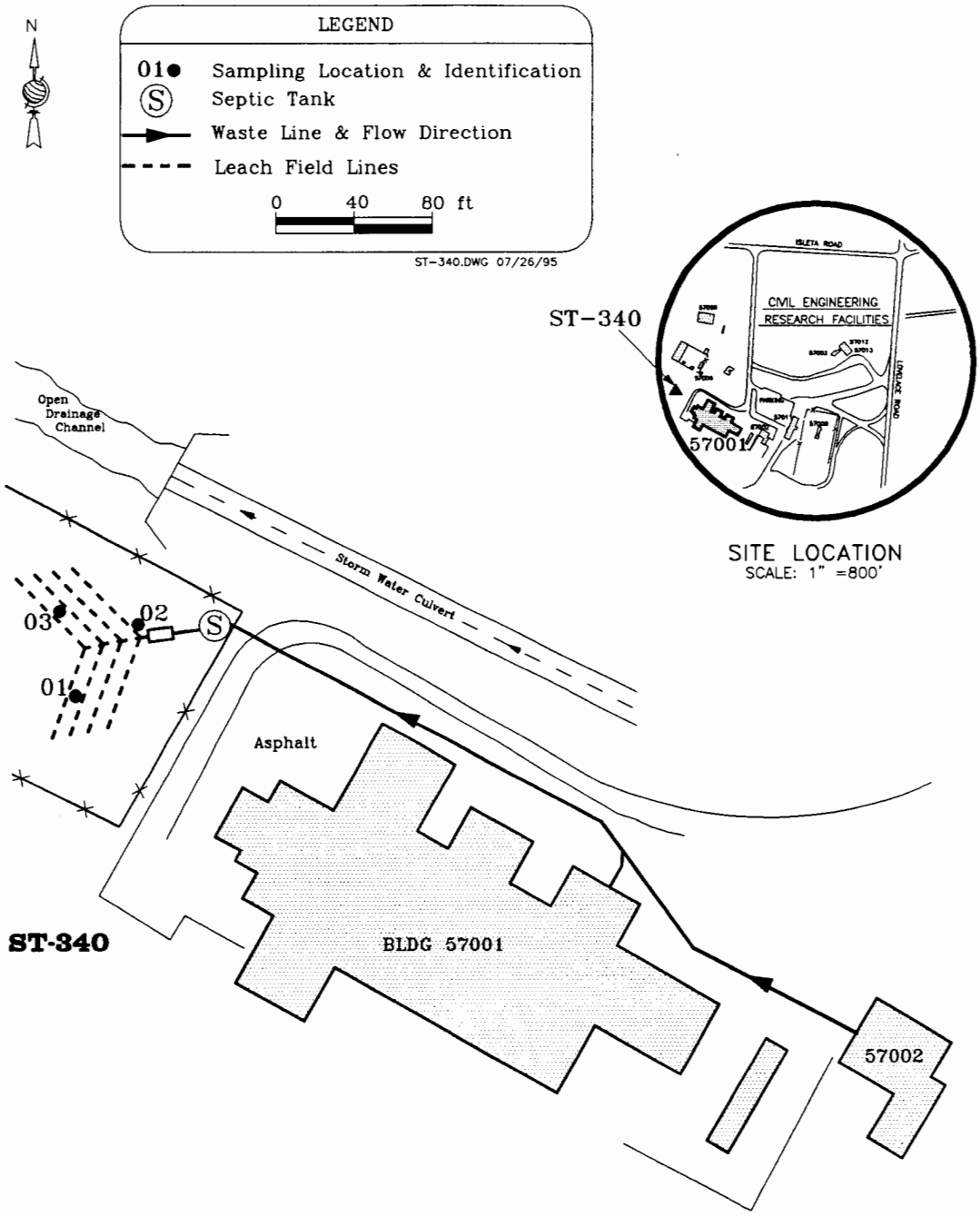


Figure 8-41. Soil Sampling Locations at SWMU ST-340, Buildings 57001/57002, Septic Tank, Leach Field, and Lines (ST-340)

collect background concentration data for this site. This borehole was assumed to be in an area away from any known or suspected contamination. All boreholes were drilled in the leach field area. Based on engineering drawings and observed field conditions, the leach field lines were determined to be 2 ft below grade. The sample interval at each borehole extended from the depth of the leach field line to 5 ft below the leach field line. From this interval, two samples were collected: one at a depth equal to the base of the leach field line, the other from 3 ft below the base of the leach field line. Only one sample was submitted for laboratory analysis.

Sampling operations and sample handling procedures are described in Section 3.0. Borehole locations and the sample interval that was sent to the laboratory are listed in Table 8-81. Borehole logs are in Appendix C.

Table 8-81. Boreholes and Samples Analyzed from SWMU ST-340, Buildings 57001/57002, Septic Tank, Leach Field, and Lines (ST-340)

Borehole	Borehole Location	Sample Depth (ft)
ST-340C-01	In the leach field area	2–4
ST-340C-02	In the leach field area	2–4
ST-340C-03	In the leach field area	5–10[a]

a. Both 2-ft sections of the 5-ft interval were used due to the collection of a replicate sample.

8.41.2.4 Laboratory Analysis

Four soil samples, including one replicate, were analyzed for VOCs, SVOCs, TPH as GRO and DRO, metals, mercury (the expected contaminants associated with normal operations at this building), soil pH, and soil moisture. The four brass tubes in each 2-ft sample interval were field-screened for possible contamination using a beta-gamma meter and a FID. No elevated readings were measured with these instruments.

8.41.3 Site Characteristics

8.41.3.1 Geology

The ST-340 area is underlain by unconsolidated alluvial sediment that is predominantly very fine-grained to fine-grained sand and well-graded sand. One 10-ft borehole and two 7-ft boreholes were drilled at ST-340. No boreholes penetrated into the Santa Fe Group sediments that presumably underlie this area. A discussion of the general geology at Kirtland AFB is presented in Section 2.4.

As a result of leach field installation, it is probable that backfill material is present in the leach field area. Borehole logs for this area are presented in Appendix C.

8.41.3.2 Hydrogeology

ST-340 is on the western edge of the HR3 saturated zone setting as defined by SNL studies (Figure 2-9). Bedrock in this area is inferred to be Permian- and Pennsylvanian-aged sedimentary rock. Near the mountains, bedrock is inferred to be Precambrian granite and metamorphic rock. Bedrock is covered by alluvial material and the thickness of this cover presumably increases west away from the mountains. Depth to groundwater is estimated at 90 to 100 ft below grade (Figure 2-10) (SNL, 1994). Groundwater flow is west-northwest (Figure 2-7). The nearest production well is KAFB-10, nearly 3.5 mi northwest and potentially downgradient of the site (Figures 2-7 and 2-11). Hydraulic conductivity values based on testing range from 6.52 to 114.5 ft/day. A more detailed discussion of the hydrogeology at Kirtland AFB is presented in Section 2.5.

8.41.4 Nature and Extent of Contamination

The following section describes the extent of contamination based on sampling results. Analytical results for soil samples collected and submitted for analysis from ST-340 are summarized in Table 8-82, where only the reportable concentrations of detected analytes are listed. Full analytical results are presented in Appendix F. Laboratory validation reports are in Appendix K.

Organic Compounds

Acetone (0.064 mg/kg) was the only VOC detected at ST-340. It was only detected in the 5- to 10-ft soil sample from ST-340C-03; the concentration was below the HHRB action level of 7,800 mg/kg.

No SVOC analytes were detected in any of the soil samples submitted for analysis at ST-340.

Petroleum Hydrocarbons

No gasoline or diesel range hydrocarbons were detected in any of the soil samples submitted for analysis at ST-340.

Metals

Arsenic and beryllium were the only metals detected at concentrations above the HHRB action levels in the soil samples submitted for analysis from ST-340 (Table 8-82). Arsenic (2.5 to 3.5 mg/kg) was detected in all samples above the HHRB action level of 0.37 mg/kg, but below the 6.5 mg/kg UTL. Beryllium (0.33 to 0.54 mg/kg) was detected in three of the four samples collected at ST-340 above the HHRB action level of 0.15 mg/kg, but was below the 0.84 mg/kg UTL. Beryllium and arsenic concentrations exceeding HHRB action levels appear to be naturally occurring throughout Kirtland AFB as discussed in Section 4.2.2.

Soil pH and Moisture

Soil pH ranged from 8.0 to 8.4 in these samples. Soil moisture values ranged from 4.7 to 8.3 percent (Table 8-82).

Table 8-82. Summary of Reportable Concentrations for Soil Analyses at SWMU ST-340, Buildings 57001/57002, Septic Tank, Leach Field, and Lines (ST-340)[1] (Concentrations mg/kg)

Chemical Class	Analyte	HHRB Action Level[2]	PQL UTL	Borehole Number and Sample Depth Interval (ft)			
				ST340C-01	*ST340C-02*	*ST340C-03*	
				2–4	2–4	5–10 FR	5–10
VOC	Acetone	7,800	0.10	ND	ND	ND	0.064
METALS	Aluminum	78,000	14,700	5,120	3,860	11,100	7,800
	Arsenic	0.37	6.5	3.4	3.1	3.5	2.5
	Barium	5,500	735	173	80.6	140	106
	Beryllium	0.15	0.84	0.33	ND	0.54	0.42
	Cadmium	39.0	N/A	0.65	0.53	0.64	0.52
	Calcium	N/A	121,000	120,000	74,400	47,000	54,900
	Chromium, total	390	21.6	7.4	5.8	9.0	9.2
	Cobalt	4,700	15.4	1.6	2.5	4.8	5.9
	Copper	2,900	223	24.0	12.6	28.6	38.9
	Iron	N/A	23,800	6,470	5,820	12,200	9,630
	Lead	400	17.5	6.5	7.3	13.4	7.2
	Magnesium	N/A	10,400	4,220	2,300	4,360	3,210
	Manganese	390	549	97.6	112	254	195
	Mercury	23.0	N/A	0.12	ND	ND	ND
	Nickel	1,600	188	3.3	5.0	8.1	28.4
	Potassium	N/A	3,590	1,180	817	2,190	2,120
	Sodium	N/A	787	137	125	553	99.0
	Thallium	N/A	N/A	0.12	ND	ND	ND
	Vanadium	550	55.3	17.0	12.7	27.3	20.3
	Zinc	23,000	114	27.8	31.3	43.9	44.9
OTHER	pH			8.2	8.0	8.4	8.1
	Moisture (%)			8.3	5.5	6.7	4.7

FOOTNOTES

1	Complete laboratory analytical results and method detection limits are presented in Appendix K.
2	Action level of RCRA Proposed Rule Subpart S (55 *FR* 30814, 7/27/90).
*	TPH action level is 100 mg/kg adopted from NMED UST regulations (NMED, 1990). SW-8015 analyzes volatile and semivolatile petroleum hydrocarbon fractions separately. The total concentration of the two fractions analyzed under SW-8015 will be used to assess compliance with stipulated action levels for the purpose of this RFI.
#	Denotes TCLP analysis, results in mg/l.
--	No Data.
FR	Field Replicate.
HHRB	Human health risk based.
J	Estimated value.
N/A	Not Applicable.
NA	Not Analyzed.
ND	Not detected above the method detection limit.
pCi/g	picocuries per gram.
PQL	Practical quantitation limits (defines VOC, SVOC, and TPH).
R	Reject NDs due to interference.
RAD	Radionuclides.
RE	Resample.
SVOC	Semivolatile organic compounds.
TPH	Total petroleum hydrocarbons.
U	Accept data (positive results may be influenced by lab contamination).
UJ	Estimated nondetect.
UTL	Upper tolerance limits (defines metals).
VOC	Volatile organic compounds.

8.41.5 Conclusions and Recommendations

Conclusions

- One VOC was detected in one soil sample at ST-340. The concentration was below the HHRB action level.
- No SVOCs were detected in the soil samples submitted for analysis from this site.
- No gasoline or diesel range hydrocarbons were detected at ST-340.
- Arsenic and beryllium were the only metals detected at concentrations exceeding HHRB action levels; the concentrations appear to be naturally occurring throughout Kirtland AFB.
- The analytical results at ST-340 are not indicative of a contaminant release from this site.

Recommendations

- Based on the findings of the RFI, no further action is necessary; therefore, ST-340 does not require further investigation. A No Further Action proposal should be prepared.

9.0 Sanitary Sewer Systems

The sanitary sewers on Kirtland Air Force Base serve both industrial and residential areas. Industrial areas served by the sanitary sewers include both DOE (Sandia National Laboratories) and Air Force facilities. The sanitary sewer systems discharge to the City of Albuquerque sanitary sewer system, which conveys the sewage to a POTW. The locations of the sanitary sewers on Kirtland AFB are shown on Figures 1-3 and 1-4.

This section of the Appendix III RFI addresses the eight sanitary sewers (A-H) identified in Module IV of the RCRA Part B Permit. The remaining portion of the base is either served internally by septic tanks and leach fields or by sanitary sewers belonging solely to the DOE. Table 9-1 provides a summary of the eight sanitary sewer systems. As shown on Figure 9-1, the nature of activities (residential or industrial) within the areas served by the sanitary sewer and the subsequent potential for transporting hazardous materials were the primary bases used to develop the investigative work plans. After the lines with the highest potential for handling hazardous materials were identified, strategic locations (with the highest potential for contamination) were identified as sampling locations. Factors considered in selecting sampling locations included location of line tie-ins from buildings known or suspected to have supported industrial or non-residential activities, location of SWMUs that discharge to the line, lateral tie-ins and elbows, locations where line repairs and/or replacements are known or suspected to have occurred, and distance between sampling locations. If the initial sampling and analysis as described in this work plan indicates contamination is present in the soil, the need for further action (i.e., acquiring additional data, corrective measures study, or corrective measures action) will be evaluated.

9.1 SWMU 10-1A, Sanitary Sewer A (ST-278)

9.1.1 Site Description and Environmental Setting

Sanitary sewer A (ST-278), designated as SWMU 10-1A in the Kirtland AFB RCRA Part B Permit, serves industrial and residential buildings on Kirtland AFB. Sanitary sewer A is approximately 12 mi of mapped line of varying diameters (12, 10, 8, 6, 4, and 3 in.) and consists of both reinforced concrete pipe and clay pipe. The general location of the lines associated with sanitary sewer A is shown on Figure 9-2.

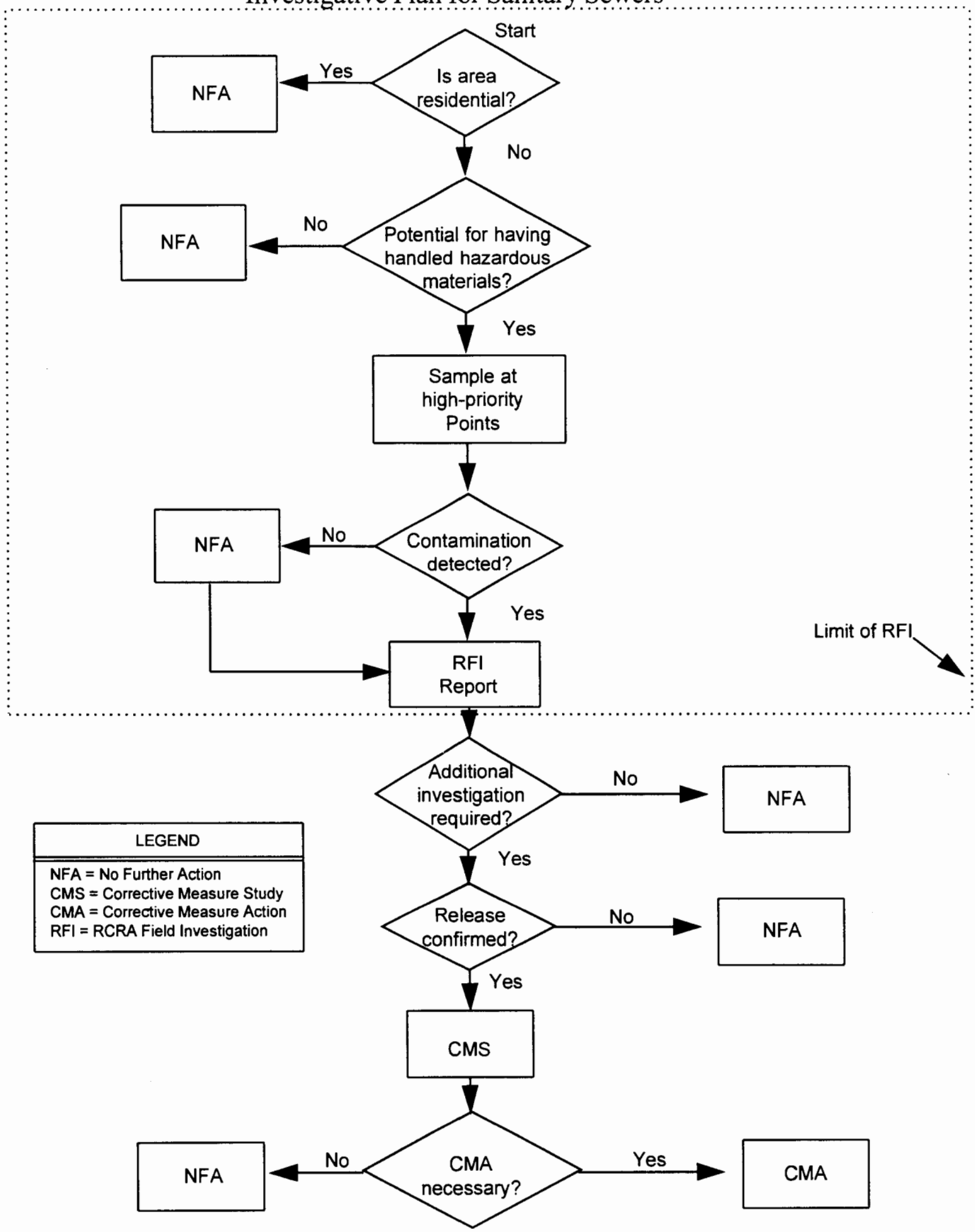
Sanitary sewer A serves buildings supporting automotive repair and maintenance, heavy equipment repair and maintenance, jet engine repair and maintenance, equipment washdown operations, and fueling operations. It is primarily located in the western part of the base south of Gibson Boulevard, but extends east to the NMANG area. Lateral lines from the main line of sanitary sewer A serve buildings in the flightline area. Numerous SWMUs (OWSs and area drains) in this area discharge to sanitary sewer A. The majority of the lines of sanitary sewer A service industrial buildings, with the exception of lines serving buildings numbered in the 800s. The lines serving the residential area tie-in to sanitary sewer A at manhole R4-7. Table 9-2 lists the buildings, associated SWMUs, and the numbers of sanitary sewer tie-in locations that have been mapped.

Sanitary sewer A is located in the urban/industrial zone. Three production wells are located near sanitary sewer A: KAFB-12 is 500 ft northeast, KAFB-13 is 200 ft west, and KAFB-14 is 50 ft south.

Table 9-1. Sanitary Sewer Systems

Sanitary Sewer Name	SWMU No. — Kirtland AFB No.	Type	Service	Location	Discharge Sampling Point	Comments
A	10-1A — ST-278	Industrial and residential	Kirtland AFB	Primarily located in the W part of the base but extends E to NMANG area; lines are S of Gibson Boulevard (Figure 8-2)	0097-NP-006	Sanitary sewer line A has manholes designated with R prefixes; the line services industrial buildings (with the exception of buildings numbered in the 800s, which are residential; the lines servicing residential dwellings tie into line A at manhole R4-7)
B	10-1B — ST-279	Residential	Kirtland AFB	Located in the W part of the base with portions both N and S of Gibson Boulevard	Residential area; no sampling point required	Sanitary sewer line B has manholes designated with S prefixes; the lines service only residential areas
C	10-1B — ST-280	Residential	Kirtland AFB	Located in the E part of the base; the system is bound by Conner Avenue to the N; portions by Hirsch and portions by Perimeter to the E; and Perimeter to the S and W	0097-NP-004	Sanitary sewer line C has manholes designated with prefixes C6; the line services only residential areas; flow from this line commingles with flow from line D at C6 where it is discharged to the city interceptor
D	10-1B — ST-281	Industrial	Kirtland AFB and Sandia	Located in the E part of the base; it extends from Kirtland Road to the W to Wyoming Boulevard to the E; it is bound by I Street to the N and extends S past M Street (Figure 8-3)	0097-NP-004	Sanitary sewer D has manholes designated from C7 to C26; closed gate valves are present between manholes C20-10 and C20-11 and between C20-10A and C20-10B, which separate line D from an unnamed line that services both Kirtland AFB buildings and DOE buildings; a valve also is present between manholes C26 and C27 but has been left partially open (~5 percent) allowing some flow from the unnamed line into D
E	10-1B — ST-282	Nonindustrial and residential	Kirtland AFB and Sandia	Extends from Louisiana to the W. Industrial portion runs below F Street and extends to First Street to the E; residential portion extends to Pennsylvania Street to the E and has lines extending S beyond Ridgecrest Drive (Figure 8-4)	0097-NP-003	Sanitary sewer E has manholes designated as A3 to A7. It consists of three independent lines that tie into manhole A3 where it is discharged into the city interceptor. Two of the lines service residential dwellings only; discharge from buildings supporting nonindustrial activities occurs up the line from manhole A7 (i.e., A7-1, A7-2, ... A7-6). Discharge from DOE Buildings 20220, 20221, and 20222 ties into this system beyond A7-4.
F	10-1B — ST-283	Industrial and residential	Kirtland AFB and Sandia	Sanitary sewer F extends from Louisiana Boulevard to the W and to the E boundary of Kirtland AFB; the residential portion of F is down the line from manhole B12-11 (Figure 8-5)	0097-NP-007	Discharge from DOE buildings occurs up the line from manhole B12-8 and from Building 20385 at manhole B10-1
G	10-1 — ST-284	Industrial and residential	Kirtland AFB	Sanitary sewer G is bound by Gibson Boulevard to the S, the boundary to the E, W, and N (Figure 8-6)	No sampling of the discharge from this line occurs	The only industrial contribution to this line is discharge from a grease trap at the hospital
H	10-1H — ST-327	Industrial and nonindustrial	MWSA	Situated at the SW portion of the MWSA and serves the Administrative area (Figure 8-7)	No sampling of the discharge from this line occurs	Two industrial contributions to this sanitary sewer exist. One is from ST-264, an OWS in Building 30142; the other is from ST-72, an OWS in Building 30146. Formerly discharged to a sewage treatment facility west approximately 1000 ft; now discharges north to the Tijeras Arroyo interceptor

Figure 9-1.
Investigative Plan for Sanitary Sewers



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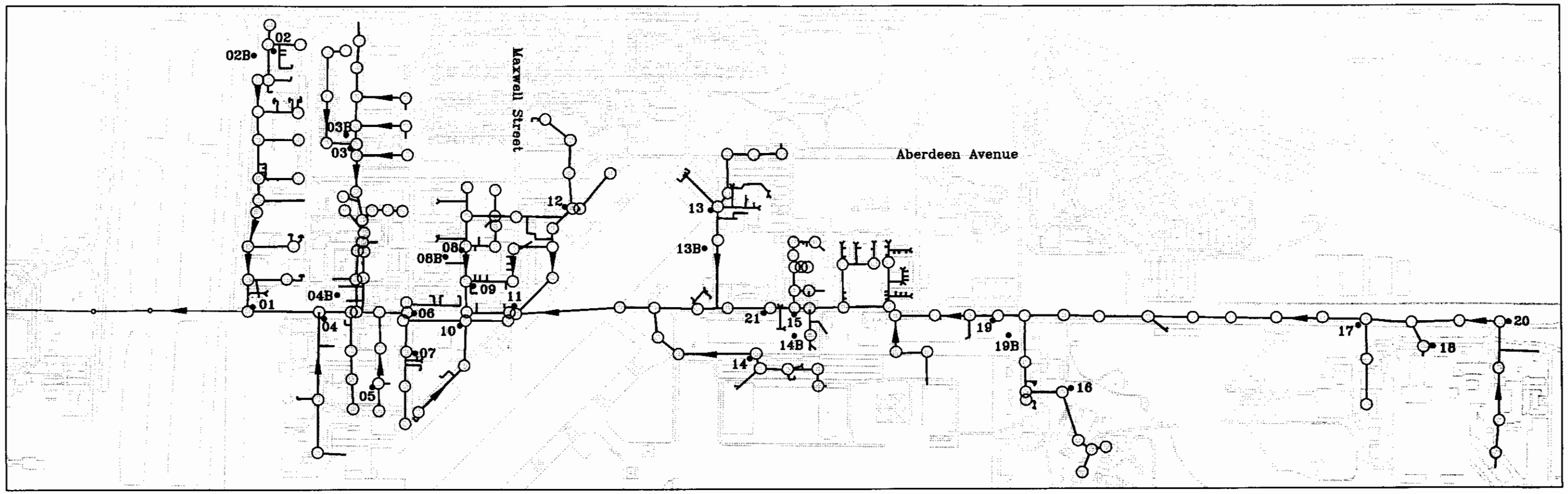

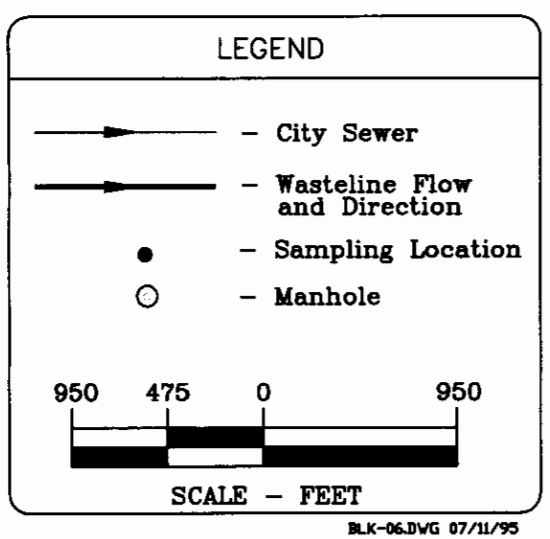

Figure 9-2
Soil Sampling Locations at SWMU 10-1A, Sanitary Sewer A (ST-278)

9.1.2 Study Area Investigation

9.1.2.1 Previous Investigations

No previous investigations have been performed on the subsurface soil surrounding the sanitary sewer system.

9.1.2.2 Data Gaps

Prior to the Appendix III RFI, no data were available to determine the presence or absence of contaminants in the subsurface soil surrounding the sanitary sewer lines.

9.1.2.3 RFI Field Investigation

The objective of the investigation was to determine if contamination exists in soil adjacent to the sanitary sewer lines. Location of sanitary sewer lines and sample borehole designations were completed prior to the startup of the soil sampling effort. Locations for collection of subsurface soil samples were selected based on the vicinity to line tie-ins from buildings known or suspected to have supported industrial activities, location of SWMUs that discharge to the line, lateral tie-ins and elbows, locations where line repairs and/or replacements are known or suspected to have occurred, and distance between sampling locations. Figure 9-2 shows sampling locations. The soil investigation was limited to the shallow subsurface. Subsurface line locations were confirmed using methods described in Section 3.0.

From March 29 to April 10, 1995, 28 boreholes were sampled using a Geoprobe. The sample interval at each borehole location was extended from the depth of the line to 5 ft below the line. From this interval, two samples were collected from each borehole: one at a depth equal to the base of the line, the other from 3 ft below the base of the line. Both samples were field-screened with a FID organic vapor meter and only the sample with the highest FID reading was submitted to the laboratory for analysis. If no elevated FID readings were detected, the sample collected at the depth closest to the base of the line was submitted for analysis. During the investigation along the sanitary sewer lines associated with sanitary sewer A, 22 normal soil samples (including two replicate samples) and nine background samples (including one replicate sample) were collected and submitted for laboratory analysis.

The analytical results from background samples collected during the Stage 2B RFI, and ST-278C-02B, ST-278C-03B, ST-278C-04B, ST-278C-08B, ST-278C-013B, ST-278C-014B, and ST-278C-19B collected during the Appendix III RFI were used as background concentration data for the samples collected at ST-278.

Sampling operations and sample handling procedures are described in Section 3.0. Sample depths, sample locations, and replicate samples collected during the Appendix III RFI are listed in Table 9-3. Soil boring logs for the boreholes drilled and sampled at SWMU 10-1A are in Appendix C.

Table 9-2. Buildings Connected to SWMU 10-1A, Sanitary Sewer A (ST-278)

Building No.	Building Name	Activity	SWMU No. (Kirtland AFB No.)	No. of Sanitary Sewer Line Tie-Ins
201	Youth Center	Child Care	—	1
255	Petrol Operations Building	Tanker Holding Area	8-5 (ST-201 – OWS)	1
276	Research Equipment Storage	Equipment Storage	—	1
277	Research Equipment Storage	Equipment Storage	—	1
322	Science Lab Environmental	Environmental Laboratory	—	1
325	Lab PME	Electronics Laboratory	—	1
333	Aero Club Maintenance Shop (Terminal, Air Freight) Base Operations	Aircraft Repairs and Maintenance	10-7	1
336	AC Jet Engine Shop	Repair and Maintenance	10-7 (ST-206 – OWS) 10-7 (ST-207 – OWS) 10-7 (ST-208 – OWS) 10-7 (ST-209 – Catch Basin) 10-7 (ST-329 - Area Drain)	1
362	Equipment Research Lab	Research Laboratory	—	1
366	No Facility		—	1
367	No Facility		—	1
376	Squadron Operations	Squadron Operations	—	1
381	AGE Shop		10-7 (ST-211 – OWS) 10-7 (ST-212 – OWS) 10-7 (ST-213 – OWS)	1
382	Disaster Prep	Disaster Preparedness, Office & Classroom	—	1
400	Science Lab Laser	Laser Laboratory	—	1
401	Science Lab Physics	Physics Laboratory	—	1
404	Child Care Center	Child Care	—	2
405	Science Lab Laser	Laser Laboratory	—	1
412	HQ Specified	Office	—	2
413	HQ Specified	Office	—	1
416	Science Lab Materials	Materials Laboratory	—	1
418	Science Lab Laser	Laser Laboratory	—	1
419	Library Technical and Professional	Library and Laboratory	—	1
423	HQ Specified	Office	—	3
424	HQ Specified	Office	—	3
425	Dormitory AM	Dormitory and Day Room	—	3
434	HQ Specified	Office	—	1
436	HQ Specified	Classroom	—	1
437	Flight Training Classroom	Classroom	—	2
460	HQ Specified/No. Division	Office Space	—	2
461	No Facility		—	1

Table 9-2. Buildings Connected to SWMU 10-1A, Sanitary Sewer A (ST-278) (Continued)

Building No.	Building Name	Activity	SWMU No. (Kirtland AFB No.)	No. of Sanitary Sewer Line Tie-Ins
471	Former Fueling Station Exchange Mini-Store	Formerly Auto Fueling and Auto Repair	10-7 (ST-215 – OWS) 10-7 (ST-216 – OWS)	1
481	Flight Line Hangar	Routine Aircraft Maintenance	10-7 (ST-217 – OWS)	1
482	Flight Line Hangar	Routine Aircraft Maintenance	10-7 (ST-218 – OWS) 10-7 (ST-219 – OWS between Buildings 482 and 481)	1
498	Research Laboratory, Credit Union & Communications	Laboratory/Office/Phone Duct	—	2
499	DPI/HQ Specified	Office	—	2
585	Gymnasium	Gymnasium	—	1
589	Chapel	Chapel	—	1
915	NCO Professional Education Center	Education Center/Day Room	—	1
916	NCO Professional Education Center	Class Room	—	1
917	Dormitory Airmen	Dormitory/Day Room	—	1
919	Dormitory Airmen	Dormitory/Day Room	—	3
920	Dormitory Airmen	Dormitory/Day Room	—	3
921	Dormitory Airmen	Dormitory/Day Room	—	3
922	NCO Professional Education Center	Class Room	—	1
923	Dining Hall Airmen (DET)	Dining Hall	—	6
924	Dormitory Airmen	Dormitory/Day Room	—	1
925	Dormitory Airmen	Dormitory/Day Room	—	3
926	Exchange Branch	Office/BX Post Office	—	3
927	Dormitory Airmen	Dormitory/Day Room	—	3
928	Dormitory Airmen	Dormitory/Day Room	—	3
951	Swim Pool Water Treatment (Demolished)	Pumphouse	—	1
952	Flight Simulator Training	Simulator Training Bay	—	1
953	Flight Training Classroom	Classroom	—	1
955	Flight Simulator Training	Simulator Training Bay	—	1
956	Flight Simulator Training	Simulator Training Bay	—	1
980	BE Maintenance Shop	Engineering Maintenance Shop	—	1
1000	Flight Line Hangar	Routine Aircraft Maintenance	8-6 (WP-47: area drain)	1
1001	Flight Line Hangar	Routine Aircraft	10-2BC (ST-220 - Area drain)	1
1002	Flight Line Hangar	Routine Aircraft Maintenance	8-13 (ST-221 – OWS between Buildings 1002 and 1001)	1
1005	Weapon Systems Management Facility	ICBM Shop	—	1
1006	Compressor A PCT Building	Air Compressor Building	—	1

Table 9-2. Buildings Connected to SWMU 10-1A, Sanitary Sewer A (ST-278) (Concluded)

Building No.	Building Name	Activity	SWMU No. (Kirtland AFB No.)	No. of Sanitary Sewer Line Tie-Ins
1010	Warehouse Supply and Equipment	Warehouse/Office/Parachute Towers	—	1
1013	Heating Facility	Steam Plant	—	1
1015	Warehouse Supply and Equipment	Warehouse/Office	—	1
1017	Headquarters Wing	Office Space	—	1
1018	Avionics Shop	Avionics Shop	—	1
1019	Operations System	Office Space	—	1
1020	Headquarters Wing	Office Space	—	1
1025	Warehouse Supply and Equipment	Warehouse Storage	—	1
1029	Administration Office	Office Space	—	1
1036	Petroleum Operations Building	Petroleum Support	—	1
1038	Fire Station	Fire Station	—	1
1042	Disaster Prep	Classroom	—	1
1043	Headquarters Maintenance Shop	Routine A.C. Maintenance	—	1
1044	Shop Aircraft General Purpose	Equipment Shop	—	1
1045	Communications Facility	Communications Support	—	1
1046	New Mexico Air National Guard Weapons Shop	Weapons System Shop	10-7 (ST-230 – OWS)	1
1047	Squadron Operations	Office Space	—	1
1050	Shop Aircraft General Purpose	Equipment Shop	—	1
1051	Shop A/SE Storage Facility	Support Equipment Storage	10-7 (ST-235 – OWS)	1
1053	Reserved for OPL Training	Classroom	—	1
1054	Education Center	Education Center Office	—	1
1056	Warehouse Supply and Equipment Storage	Supply Administration Office	—	1
1058	Air National Guard Vehicular Service Shop	Routine Automotive Maintenance	10-7 (ST-238 – OWS) 10-7 (ST-239 – OWS)	1
1059	Security Police Operations	Security Police Operations	10-7 (ST-238 – OWS) 10-7 (ST-239 - OWS)	1
1060	Avionics Shop/Electronic Control Storage	Shop Electronic Control Measurement Storage	10-7 (ST-234 – OWS)	1
1061	Jet Engine Shop	Jet Engine Shop	8-26 (ST-242 – OWS)	1
1063	Aircraft Corrosion Control	Corrosion Control Facility	8-26 (ST-242 – OWS) 8-26 (ST-243 – OWS)	1
1064	BE Maintenance Shop	Engineering Maintenance Shop	10-7 (ST-244 – OWS)	1
2637	Aircraft Pad	Wash Rack Aircraft	10-7 (ST-247 – OWS)	1

Table 9-3. Boreholes and Samples Analyzed from Appendix III SWMU 10-1A, Sanitary Sewer A (ST-278)

Borehole	Borehole Location	Sample Depths (ft)	FID (ppm_v)
01	Adjacent to manhole R1, SW of Building 255	15–17	10
02	Adjacent to manhole R1-10, N of NW corner of Hickman St., and Scott St.	4–6	0
02B	Background sample, 102 ft E of borehole 02	4–6	0
03	Adjacent to manhole R4-8 at SW corner of E Ave. and Project Dr.	6–8	0
03B	Background sample, 100 ft N of borehole 03	6–11[a]	0
04	Adjacent to manhole R-2 at SW corner of Randolph Ave. and Kirtland Dr.	13–15	0
04B	Background sample, 120 ft N of borehole 04	13–18	0
05	Adjacent to manhole R5-2, N of Mather Ave. between Henderson St. and Carlisle Blvd.	3–5	0
06	Adjacent to manhole R-6, SW corner of Randolph Ave. and Carlisle Blvd.	12–14	0
07	Adjacent to manhole R6-1, N of Building 323T parking lot	6–8	0
08	Adjacent to manhole R8-3, N of NE corner of Lowry Ave. and Chanute St.	7–12	0
08B	Background sample, 120 ft SW of borehole 08	7–9	0
09	Adjacent to manhole R8-2 at NE corner of Lowry Ave. and Chanute St.	7–12[a]	0
10	Adjacent to manhole R-8, NE of Building 381	12–14	≤500
11	Adjacent to manhole R-10 at SW corner of Maxwell St. and Bolling St.	8–10	0
12	Adjacent to manhole R10-4 on NE side of Building 481	5–7	0
13	Adjacent to manhole R13-A2, E of Building 956	10–12	7
13B	Background sample, 330 ft S of borehole 13	10–12	0
14	Adjacent to manhole R12-3, NW of Building 1020	6–8	0
14B	Background sample, 450 ft SW of borehole 14	6–8	0
15	Adjacent to manhole R-16, SW of Kirtland NCO Academy	10–12	0
16	Adjacent to manhole R24-3	8–10	0
17	Adjacent to manhole R32 along Randolph Ave. N of NMANG area	8–10	0
18	Adjacent to manhole R33-1, E of Building 1052	10–15[a]	0
19	Adjacent to manhole R-23, SW of SW corner of Randolph Ave. and San Mateo Blvd.	10–12	0
19B	Background sample, 200 ft SE of borehole 19	10–12	0
20	Adjacent to manhole R-35 along Randolph Ave. NE of NMANG area	10–12	0
21B	Background sample, adjacent to intersection of Doris St. and Randolph Ave.	8–10	0

FID readings are values above background and are the high readings of the sample interval.

a. Replicate sample also collected at this interval.

9.1.2.4 Laboratory Analysis

The soil samples were analyzed for VOCs, SVOCs, TPH, metals, mercury (the potential contaminants associated with normal operations in this area), soil pH, and soil moisture. The soil samples in the four brass tubes in each 2-ft sample interval were field-screened for possible contamination using a beta-gamma meter and a FID. With the exception of borehole 13, where the measured FID reading was 7 ppm_v, all field-screening instrument readings remained at background levels throughout Appendix III RFI sampling activities at SWMU 10-1A.

Background samples collected during the Stage 2B RFI and at SWMU 10-1A during the Appendix III RFI were used as background concentration data. Background samples were analyzed for TPH, VOCs, SVOCs, metals, soil pH, and soil moisture.

9.1.3 Site Characteristics

9.1.3.1 Geology

The area serviced by sanitary sewer A is underlain by unconsolidated alluvial sediment that is predominantly fine-grained sand and very fine-grained to fine-grained silty sand. Thirty-one boreholes were drilled with a maximum depth of 17 ft below grade. No boreholes penetrated into the Santa Fe Group sediments that presumably underlie this area. A discussion of the general geology at Kirtland AFB is presented in Section 2.4.

As a result of the installation of the lines associated with sanitary sewer A, it is probable that backfill material is present around each line to a depth equal to each line's total depth. Borehole logs for this area are presented in Appendix C.

9.1.3.2 Hydrogeology

The area beneath the lines associated with sanitary sewer A is found within the Upper Santa Fe sediments and is characterized to be within the HR1 saturated zone (Figure 2-9) (SNL, 1994). Groundwater in this area is generally thought to be unconfined in the upper portion of the aquifer. Hydrogeologic characterization in this portion of Kirtland AFB is complicated by the presence of numerous production wells (Figure 2-11). It is probable that uniform groundwater conditions do not exist in this region. Local cones of depression associated with groundwater withdrawal have altered the groundwater flow direction in the vicinity of the well fields (Figure 2-7).

The gradient is probably northeast at this site. Three production wells are located near sanitary sewer A: KAFB-12, 500 ft (upgradient) northeast; KAFB-13, 200 ft (downgradient) west; and KAFB-14, 50 ft (downgradient) south. Depth to groundwater is estimated to be 350 ft below grade (Figure 2-10); however, shallower perched water zones may occur. Hydraulic conductivity within HR1 is estimated at 2 to 171 ft/day (SNL, 1994). A general discussion of the hydrogeology at Kirtland AFB is presented in Section 2.5.

9.1.4 Nature and Extent of Contamination

The following sections describe the nature and extent of contamination based on analytical results for soil samples submitted for analysis at SWMU 10-1A. Analytical results for sanitary sewer A are presented in Table 9-4, where only the reportable concentrations are listed. Full analytical results are presented in Appendix F. Laboratory validation reports are presented in Appendix K.

Organic Compounds

No VOC analytes were detected in any of the soil samples submitted for analysis from SWMU 10-1A.

Benzyl butyl phthalate, bis(2-ethylhexyl)phthalate, and di-n-butylphthalate were the SVOC analytes detected in soil samples submitted for analysis. Benzyl butyl phthalate (0.620 to 1.6 mg/kg) was detected in six samples including one background. The concentrations of benzyl butyl phthalate detected are below the HHRB action level of 16,000 mg/kg. Bis(2-ethylhexyl)phthalate was detected in one background sample submitted for analysis at a concentration of 0.70 mg/kg, below the HHRB action level of 46 mg/kg. Di-n-butylphthalate (0.72 to 5 mg/kg) was detected in 17 samples including five background. The concentrations of di-n-butylphthalate detected were below the HHRB action level of 8,000 mg/kg (Table 9-4).

Petroleum Hydrocarbons

Diesel range hydrocarbons were detected in two normal samples, six background samples, and one field replicate. Concentrations ranged from 5.5 to 14 mg/kg and do not exceed the NMED action level of 100 mg/kg (Table 9-4).

Metals

Table 9-4 lists all metal concentrations reported at SWMU 10-1A and the respective UTL and HHRB action level concentrations. Arsenic (1.1 to 5.5 mg/kg) was detected in all of the soil samples at concentrations above the HHRB action level of 0.37 mg/kg, but below the 6.5 mg/kg UTL. Beryllium (0.31 to 0.78 mg/kg) was detected in 24 soil samples at concentrations above the 0.15 mg/kg HHRB action level, but below the 0.84 mg/kg UTL. One sample, ST-278C-10, had a detected manganese concentration of 399 mg/kg, exceeding the HHRB action level of 390 mg/kg, but below the 549 mg/kg UTL. These concentrations of arsenic, beryllium, and manganese appear to be naturally occurring at Kirtland AFB as discussed in Section 4.2.2.

Soil pH and Moisture

Soil pH values ranged from 7.4 to 9.3 in these samples. Soil moisture values ranged from 3.3 to 17.3 percent.

Table 9-4. Summary of Reportable Concentrations for Soil Analyses at SWMU 10-1A, Sanitary Sewer A (ST-278)[1]
(Concentrations mg/kg)

Chemical Class	Analyte	HHRB Action Level[2]	PQL UTL	Borehole Number and Sample Depth Interval (ft)					
				ST278C-01	*ST278C-02*	*ST278C-02B*	*ST278C-03*	*ST278C-03B*	
				15–17	4–6	4–6	6–8	6–11 FR	6–11
SVOC	Benzyl butyl phthalate	16,000	N/A	ND	0.62	0.78	0.87	ND	ND
	Bis(2-ethylhexyl)phthalate	46.0	0.70	ND	ND	ND	ND	ND	ND
	Di-n-butylphthalate	7,800	0.70	3.7	5.0	4.0	3.4	3.8	3.7
TPH	Diesel fraction	100	10.0	ND	ND	ND	ND	7.1	6.5
METALS	Aluminum	78,000	N/A	4570	9560	3990	4570	4800	8960
	Antimony	31.0	N/A	ND	0.64	ND	0.65	ND	ND
	Arsenic	0.37	N/A	2.2	2.5	2.2	2.0	2.2	3.7
	Barium	5,500	N/A	22.7	106	382	71.7	183	365
	Beryllium	0.15	N/A	ND	0.45	ND	ND	0.31	0.43
	Cadmium	39.0	N/A	ND	0.68	ND	0.86	ND	ND
	Calcium	N/A	N/A	6,590	41,500	34,900	2,120	20,000	66,400
	Chromium, total	390	N/A	4.9	8.0	3.8	4.6	5.8	7.3
	Cobalt	4,700	N/A	3.3	7.3	1.6	7.3	4.4	5.2
	Copper	2,900	N/A	27.2	38.5	10.8	20.3	47.1	50.3
	Iron	N/A	N/A	5,480	13,200	5,140	13,700	7,820	13,300
	Lead	400	N/A	2.4	4.9	1.8	3.6	4.8	6.2
	Magnesium	N/A	N/A	2,020	4,290	2,840	2,810	3,070	6,010
	Manganese	390	N/A	137	271	76.4	161	131	250
	Nickel	1,600	N/A	3.3	6.3	6.6	5.8	6.6	11.2
	Potassium	N/A	N/A	832	1,730	737	1,150	856	1,630
	Sodium	N/A	N/A	76.6	123	49.6	69.2	164	165
	Thallium	N/A	N/A	0.11	0.17	ND	0.12	ND	0.14
	Vanadium	550	N/A	14.1	33.3	19.1	32.6	21.3	38.0
	Zinc	23,000	N/A	22.5	44.8	15.3	28.6	30.6	43.8
OTHER	Moisture (%)			6.5	11.4	6.4	6.7	4.6	6.2
	pH			8.2	8.0	8.2	7.4	9.1	8.9

Table 9-4. Summary of Reportable Concentrations for Soil Analyses at SWMU 10-1A, Sanitary Sewer A (ST-278)[1] (Concentrations mg/kg) (Continued)

Chemical Class	Analyte	HHRB Action Level[2]	PQL UTL	Borehole Number and Sample Depth Interval (ft)					
				ST278C-04 13–15	*ST278C-04B* 13–18	*ST278C-05* 3–5	*ST278C-06* 12–14	*ST278C-07* 6–8	*ST278C-08* 7–12
SVOC	Benzyl butyl phthalate	16,000	N/A	1.4	ND	1.4	ND	ND	ND
	Bis(2-ethylhexyl)phthalate	46.0	0.70	ND	ND	ND	ND	ND	ND
	Di-n-butylphthalate	7,800	0.70	3.3	3.6	2.3	ND	ND	ND
TPH	Diesel fraction	100	10.0	ND	7.6	ND	ND	ND	14.0
METALS	Aluminum	78,000	N/A	7060	4900	9280	3860	8920	6340
	Antimony	31.0	N/A	ND	ND	ND	ND	ND	ND
	Arsenic	0.37	N/A	3.8	1.6	5.3	1.5	5.2	3.1
	Barium	5,500	N/A	51.8	23.2	694	96.6	762	185
	Beryllium	0.15	N/A	0.44	0.32	0.57	ND	0.48	ND
	Cadmium	39.0	N/A	0.55	ND	0.69	ND	ND	ND
	Calcium	N/A	N/A	17,500	4,600	87,600	5,210	116,000	47,000
	Chromium, total	390	N/A	8.7	5.6	7.5	9.0	9.3	8.5
	Cobalt	4,700	N/A	6.4	3.9	3.9	4.6	3.7	3.4
	Copper	2,900	N/A	46.9	16.8	12.5	89.2	26.9	14.1
	Iron	N/A	N/A	11,300	8,880	8,670	9,060	9,150	8,600
	Lead	400	N/A	5.0	4.4	4.6	3.6	4.5	11.8
	Magnesium	N/A	N/A	3,820	2,730	4,960	2,540	6,150	2,880
	Manganese	390	N/A	215	148	115	218	105	113
	Nickel	1,600	N/A	6.7	5.4	7.1	4.8	7.0	30.5
	Potassium	N/A	N/A	1,880	1,130	1,540	630	1,770	1,350
	Sodium	N/A	N/A	87.1	205	76.1	57.9	88.6	96.3
	Thallium	N/A	N/A	ND	0.12	ND	ND	ND	ND
	Vanadium	550	N/A	30.2	19.9	31.7	19.7	30.6	21.4
	Zinc	23,000	N/A	42.2	26.1	22.7	47.6	26.1	25.2
OTHER	Moisture (%)			8.7	4.8	12.6	4.5	16.1	11.5
	pH			8.3	9.3	8.4	7.8	7.8	8.1

Table 9-4. Summary of Reportable Concentrations for Soil Analyses at SWMU 10-1A, Sanitary Sewer A (ST-278)[1] (Concentrations mg/kg) (Continued)

Chemical Class	Analyte	HHRB Action Level[2]	PQL UTL	Borehole Number and Sample Depth Interval (ft)						
				ST278C-08B	*ST278C-09*			*ST278C-10*	*ST278C-11*	*ST278C-12*
				7–9	7–12 FR	7–12 FR	7–12	12–14	8–10	5–7
SVOC	Benzyl butyl phthalate	16,000	N/A	ND	ND	ND	ND	ND	ND	1.6
	Bis(2-ethylhexyl)phthalate	46.0	0.70	ND	ND	ND	ND	ND	ND	ND
	Di-n-butylphthalate	7,800	0.70	4.8	ND	ND	ND	ND	ND	2.2
TPH	Diesel fraction	100	10.0	7.9	ND	ND	ND	ND	ND	ND
METALS	Aluminum	78,000	N/A	6080	ND	4750	8350	8200	8300	6490
	Antimony	31.0	N/A	ND	ND	ND	ND	ND	ND	ND
	Arsenic	0.37	N/A	4.7	3.4	ND	5.5	5.0	5.1	4.6
	Barium	5,500	N/A	1,610	128	ND	90.0	354	86.3	248
	Beryllium	0.15	N/A	ND	0.33	ND	0.46	0.56	0.46	ND
	Cadmium	39.0	N/A	ND	ND	ND	0.57	0.78	0.68	0.73
	Calcium	N/A	N/A	115,000	29,600	ND	19,700	22,400	110,000	163,000
	Chromium, total	390	N/A	6.2	6.9	ND	8.9	8.7	9.2	6.7
	Cobalt	4,700	N/A	3.4	3.7	ND	5.7	8.7	5.5	2.4
	Copper	2,900	N/A	27.9	19.5	ND	7.1	17.8	45.0	11.2
	Iron	N/A	N/A	9,410	8,500	ND	11,900	16,700	10,800	6,230
	Lead	400	N/A	4.4	4.0	ND	6.6	7.0	6.4	4.2
	Magnesium	N/A	N/A	3,880	3,110	ND	4,260	5,550	5,820	4,890
	Manganese	390	N/A	197	133	ND	201	399	198	89.7
	Nickel	1,600	N/A	4.5	13.3	ND	7.6	10.1	7.6	7.4
	Potassium	N/A	N/A	1,290	1,110	ND	1,580	2,390	1,300	1,050
	Sodium	N/A	N/A	86.5	78.5	ND	88.8	114	133	101
	Thallium	N/A	N/A	ND	0.19	ND	0.11	0.20	0.13	ND
	Vanadium	550	N/A	31.8	25.5	ND	36.4	41.6	34.3	24.8
	Zinc	23,000	N/A	28.5	24.5	ND	26.8	43.8	39.0	18.5
OTHER	Moisture (%)			11.6	9.1	ND	12.7	10.3	12.2	17.3
	pH			8.9	8.1	ND	7.9	8.2	8.1	8.1

Table 9-4. Summary of Reportable Concentrations for Soil Analyses at SWMU 10-1A, Sanitary Sewer A (ST-278)[1] (Concentrations mg/kg) (Continued)

Chemical Class	Analyte	HHRB Action Level[2]	PQL UTL	Borehole Number and Sample Depth Interval (ft)					
				ST278C-13 10–12	*ST278C-13B* 10–12	*ST278C-14* 6–8	*ST278C-14B* 6–8	*ST278C-15* 10–12	*ST278C-16* 8–10
SVOC	Benzyl butyl phthalate	16,000	N/A	ND	ND	ND	ND	ND	ND
	Bis(2-ethylhexyl)phthalate	46.0	0.70	ND	0.70	ND	ND	ND	ND
	Di-n-butylphthalate	7,800	0.70	ND	ND	0.72	ND	0.91	1.4
TPH	Diesel fraction	100	10.0	ND	11.0	ND	11.0	ND	5.5
METALS	Aluminum	78,000	N/A	5650	6280	11500	6180	6730	8380
	Antimony	31.0	N/A	ND	ND	ND	ND	ND	ND
	Arsenic	0.37	N/A	2.4	1.6	3.1	2.3	2.4	3.4
	Barium	5,500	N/A	152	45.1	67.4	186	283	164
	Beryllium	0.15	N/A	0.34	0.42	0.78	0.43	0.44	0.68
	Cadmium	39.0	N/A	ND	ND	0.56	ND	0.77	0.57
	Calcium	N/A	N/A	29,100	32,300	83,600	63,100	16,300	53,900
	Chromium, total	390	N/A	6.7	7.0	8.2	6.0	7.2	8.8
	Cobalt	4,700	N/A	4.8	2.7	5.9	3.1	4.7	4.7
	Copper	2,900	N/A	25.6	74.3	40.8	21.3	44.3	59.1
	Iron	N/A	N/A	8,120	7,500	11,000	8,550	8,940	10,100
	Lead	400	N/A	4.8	5.1	5.6	4.5	4.2	7.2
	Magnesium	N/A	N/A	2,910	3,110	4,580	3,590	2,720	3,870
	Manganese	390	N/A	143	149	158	143	147	150
	Nickel	1,600	N/A	6.6	7.5	5.2	6.6	5.0	3.6
	Potassium	N/A	N/A	986	1,070	2,090	1,040	1,330	1,440
	Sodium	N/A	N/A	93.6	304	131	352	91.1	160
	Thallium	N/A	N/A	ND	ND	0.15	ND	ND	ND
	Vanadium	550	N/A	17.4	24.6	27.0	20.1	19.4	26.7
	Zinc	23,000	N/A	29.9	36.3	37.0	25.8	33.4	39.9
OTHER	Moisture (%)			10.6	5.8	10.7	7.8	9.1	12.0
	pH			8.2	8.3	8.2	8.7	8.4	7.8

Table 9-4. Summary of Reportable Concentrations for Soil Analyses at SWMU 10-1A, Sanitary Sewer A (ST-278)[1] (Concentrations mg/kg) (Concluded)

Chemical Class	Analyte	HHRB Action Level[2]	PQL UTL	Borehole Number and Sample Depth Interval (ft)							
				ST278C-17	*ST278C-18*			*ST278C-19*	*ST278C-19B*	*ST278C-20*	*ST278C-21*
				8–10	10–15 FR	10–15 FR	10–15	10–12	10–12	10–12	8–10
SVOC	Benzyl butyl phthalate	16,000	N/A	ND	ND	ND	ND	ND	ND	ND	ND
	Bis(2-ethylhexyl)phthalate	46.0	0.70	ND	ND	ND	ND	ND	ND	ND	ND
	Di-n-butylphthalate	7,800	0.70	1.9	2.5	ND	2.2	ND	ND	ND	ND
TPH	Diesel fraction	100	10.0	ND	ND	ND	ND	ND	13.0	ND	11.0
METALS	Aluminum	78,000	N/A	11300	ND	7980	10700	11900	11400	4600	5500
	Antimony	31.0	N/A	ND	ND	ND	ND	ND	ND	ND	ND
	Arsenic	0.37	N/A	3.1	2.4	ND	3.1	2.8	3.8	1.1	2.1
	Barium	5,500	N/A	98.5	137	ND	198	66.0	57.1	51.1	109
	Beryllium	0.15	N/A	0.64	0.56	ND	0.78	0.68	0.80	0.41	0.45
	Cadmium	39.0	N/A	0.74	0.67	ND	0.78	1.3	ND	ND	ND
	Calcium	N/A	N/A	34,100	58,400	ND	28,100	99,000	34,500	29,400	75,100
	Chromium, total	390	N/A	9.1	10.3	ND	11.0	11.1	12.2	6.2	5.9
	Cobalt	4,700	N/A	8.0	6.7	ND	6.5	6.3	7.5	7.1	3.4
	Copper	2,900	N/A	28.8	41.7	ND	43.7	31.6	22.7	38.0	24.9
	Iron	N/A	N/A	14,200	12,100	ND	15,100	12,500	16,400	9,830	7,250
	Lead	400	N/A	6.6	5.4	ND	6.5	5.7	10.0	4.6	5.4
	Magnesium	N/A	N/A	5,110	4,670	ND	5,330	5,380	6,960	3,330	3,410
	Manganese	390	N/A	260	191	ND	278	178	383	270	131
	Nickel	1,600	N/A	7.2	6.6	ND	7.3	8.1	14.2	2.7	2.9
	Potassium	N/A	N/A	2,090	1,450	ND	2,230	1,950	1,680	1,150	922
	Sodium	N/A	N/A	92.6	94.2	ND	104	195	700	84.3	80.6
	Thallium	N/A	N/A	0.13	0.16	ND	0.16	0.13	0.15	ND	ND
	Vanadium	550	N/A	31.8	24.1	ND	32.9	26.4	34.4	18.8	18.9
	Zinc	23,000	N/A	39.0	36.4	ND	43.3	37.7	46.8	39.3	24.8
OTHER	Moisture (%)			5.8	10.1	ND	9.9	12.1	12.8	3.3	10.9
	pH			8.2	8.6	ND	8.6	8.6	8.5	8.9	8.6

FOOTNOTES

1	Complete laboratory analytical results and method detection limits are presented in Appendix K.
2	Action level of RCRA Proposed Rule Subpart S (55 FR 30814, 7/27/90).
*	TPH action level is 100 mg/kg adopted from NMED UST regulations (NMED, 1990). SW-8015 analyzes volatile and semivolatile petroleum hydrocarbon fractions separately. The total concentration of the two fractions analyzed under SW-8015 will be used to assess compliance with stipulated action levels for the purpose of this RFI.
#	Denotes TCLP analysis, results in mg/l.
--	No Data.
FR	Field Replicate.
HHRB	Human health risk based.
J	Estimated value.
N/A	Not Applicable.
NA	Not Analyzed.
ND	Not detected above the method detection limit.
pCi/g	picocuries per gram.
PQL	Practical quantitation limits (defines VOC, SVOC, and TPH).
R	Reject NDs due to interference.
RAD	Radionuclides.
RE	Resample.
SVOC	Semivolatile organic compounds.
TPH	Total petroleum hydrocarbons.
U	Accept data (positive results may be influenced by lab contamination).
UJ	Estimated nondetect.
UTL	Upper tolerance limits (defines metals).
VOC	Volatile organic compounds.

9.1.5 Conclusions and Recommendations

Conclusions

- No VOCs were detected. Three SVOCs were detected at concentrations below respective HHRB action levels.
- Diesel range hydrocarbons were detected in nine samples at concentrations below the NMED action level of 100 mg/kg. The TPH concentrations were consistent with those background samples collected throughout the Stage 2B and Appendix III RFIs. Because no other release components (such as VOCs, SVOCs, or metals) were detected at concentrations exceeding action levels, it is probable that a release has not occurred.
- Arsenic, beryllium, and manganese were the only metals detected at concentrations exceeding respective HHRB action levels; these concentrations appear to be naturally occurring throughout Kirtland AFB.
- The analytical results at SWMU 10-1A are not indicative of a release from this site.

Recommendations

- Based on the findings of the RFI, no further action is necessary; therefore, SWMU 10-1A does not require further investigation. A No Further Action proposal should be prepared.

9.2 SWMU 10-1B, Sanitary Sewer B (ST-279)

9.2.1 Site Background and Environmental Setting

Sanitary sewer B (ST-279), designated as SWMU 10-1B in Module IV of the RCRA Part B Permit, is located in the eastern part of the base north of Gibson Boulevard. It is 4 mi of mapped line of varying diameters (10, 8, and 6 in.) consisting of reinforced concrete pipe. Sanitary sewer B was built as an individual system to serve residential dwellings.

Sanitary sewer line B serves residential dwellings only; no buildings supporting industrial activities discharge to sanitary sewer B. Waste carried in sanitary sewer B would typically be restricted to residential, domestic waste. Industrial waste was (and is) not normally carried in sanitary sewer line B.

Sanitary sewer B is located in the urban/industrial zone. The nearest production well ST-279 is KAFB-12, 50 ft from sanitary sewer B lines.

9.2.2 Study Area Investigation

Based on engineering drawings and observed field conditions, the lines associated with sanitary sewer B serve only residential areas; no industrial buildings were or are served by sanitary sewer B. Since the waste carried in sanitary sewer B would typically be restricted to residential, domestic waste, no sampling and analysis were performed.

9.2.3 Conclusions and Recommendations

Conclusions

- Since sanitary sewer B has been restricted to residential use, there is no indication that hazardous compounds were in the sanitary sewer lines or have been released to the subsurface soil surrounding the unit.

Recommendations

- A No Further Action proposal should be prepared for SWMU 10-1B.

9.3 SWMU 10-1C, Sanitary Sewer C (ST-280)

9.3.1 Site Background and Environmental Setting

Sanitary sewer C (ST-280), designated as SWMU 10-1C in Module IV of the RCRA Part B Permit, is located in the eastern part of the base north of Gibson Boulevard. It is 4 mi of mapped line of varying diameters (10, 8, and 6 in.). It is bound by Conner Avenue to the north, portions by Hirsch and Perimeter to the east, and Perimeter to the south and west. Sanitary sewer C was built as an individual system to serve residential dwellings. No industrial buildings are served by sanitary sewer C.

Sanitary sewer C is in the urban/industrial zone. The closest production well to sanitary sewer C is KAFB-1, 340 ft east.

9.3.2 Study Area Investigation

Based on engineering drawings and observed field conditions, the lines associated with sanitary sewer C serve only residential areas. No industrial buildings are served by sanitary sewer C. Since the waste carried in sanitary sewer C would typically be restricted to residential, domestic waste, no sampling and analysis were performed.

9.3.3 Conclusions and Recommendations

Conclusions

- Since sanitary sewer C has been restricted to residential use, there is no indication that hazardous compounds were in the sanitary sewer lines or have been released to the subsurface soil surrounding the unit.

Recommendations

- A No Further Action proposal should be prepared for SWMU 10-1C.

9.4 SWMU 10-1D, Sanitary Sewer D (ST-281)

9.4.1 Site Background and Environmental Setting

Sanitary sewer D (ST-281), designated as SWMU 10-1D in Module IV of the RCRA Part B Permit, is 3 mi of mapped line of varying diameters (12, 10, 8, and 6 in.) and consists of reinforced concrete pipe. Located in the eastern portion of the base, it serves industrial buildings for both Kirtland AFB and the DOE (Sandia National Laboratories), supporting such activities as automotive repair, maintenance, and equipment washdown operation. The general location of the line is shown on Figure 9-3.

Sanitary sewer D is bound to the west by Kirtland Road, to the east by Wyoming Boulevard, to the north by I Street, and to the south by M Street. Numerous SWMUs (OWS and area drains) are in the area served by sanitary sewer D and discharge to it. The majority of the lines of sanitary sewer D serve industrial or administrative buildings. Table 9-5 lists the buildings, associated SWMUs, and number of sanitary sewer tie-in locations that have been mapped.

Sanitary sewer D is located in the urban/industrial zone. The closest production well to sanitary sewer D is KAFB-1, 20 ft south.

9.4.2 Study Area Investigation

9.4.2.1 Previous Investigations

No previous investigations have been performed on the subsurface soil surrounding the sanitary sewer system.

9.4.2.2 Data Gaps

Prior to the Appendix III RFI, no data were available to determine the presence or absence of contaminants in the subsurface soil surrounding the sanitary sewer lines.

9.4.2.3 RFI Field Investigation

The objective of the investigation was to determine if contamination exists in soil adjacent to the sanitary sewer lines. Location of sanitary sewer lines and sample borehole designations were completed prior to the soil sampling effort. Locations for collection of subsurface soil samples were selected based on the vicinity to line tie-ins from buildings known or suspected to have supported industrial activities, location of SWMUs that discharge to the line, lateral tie-ins and elbows, locations where line repairs and/or replacements are known or suspected to have occurred, and distance between sampling locations. Figure 9-3 shows sampling locations. The soil investigation was limited to the shallow subsurface. Subsurface line locations were confirmed using methods described in Section 3.0.

Table 9-5. Buildings Connected to SWMU 10-1D, Sanitary Sewer D (ST-281)

Building No.	Building Name	Activity	SWMU No. (Kirtland AFB No.)	No. of Sanitary Sewer Line Tie-Ins
20338	Transportation Maintenance/Allied Trades Building	Vehicle Maintenance Operations	8-28 (ST-250 – OWS)	1
20339	Thrift Shop	Retail Sales	—	1
20340	Thrift Shop	Retail Sales	—	1
20344	Transportation Maintenance Body Shop	Vehicle Body Repair	8-29 (ST-251 – OWS)	1
20348	Transportation Maintenance Shop	Vehicle Maintenance and Repair	8-31 (ST-252 OWS) 8-31 (ST-253 OWS)	1
20356	Car Wash (Vehicle Operations Administration)	Vehicle and Engine Washing	10-7 (ST-254 – OWS west of Building 20356)	1
20358	Museum Building	Retail Sales / Tours	—	1
20360	FCDNA Headquarters	-	—	4
20361	Radar Transmitter Building	Communications	—	4
20362	Administration Office	Administrative	—	4
20363	Administration Office	Administrative	—	4
20364	Administration Office	Administrative	—	4
20375	Auto Hobby Shop	Auto Repair and Maintenance	10-7 (ST-255 – OWS) 10-7 (ST-256 – OWS) 10-7 (ST-257 – OWS) 10-7 (ST-258 – OWS)	1
20381	DOE	Office	—	3
20382	DOE	Office	—	4
20383	DOE	Office	—	4
20384	DOE	Office	—	4
20389	Administration Office	Administrative	—	1
20402	Warehouse Supply and Equipment	Storage and Equipment BSE	—	1
20405	Comm Sq Maintenance Facility	Maintenance Facility	—	1
20410	SVS Supply / NAF	Warehouse / Supply	—	1
20411	Warehouse and Supply	Warehouse Storage	—	1
20412	Material Service	Storage	—	1
20413	EOD	Administration Office / Storage	—	1
20414	Warehouse Supply and Equipment	Warehouse Storage	—	1
20415	Housing Maintenance	Warehouse Storage	—	1
20420	Comm Sq Maintenance Facility	Maintenance Facility	—	4
20423	Heavy Equipment Maintenance Shop	Equipment and Engine Repair and Maintenance	8-47 (ST-261 – OWS)	2

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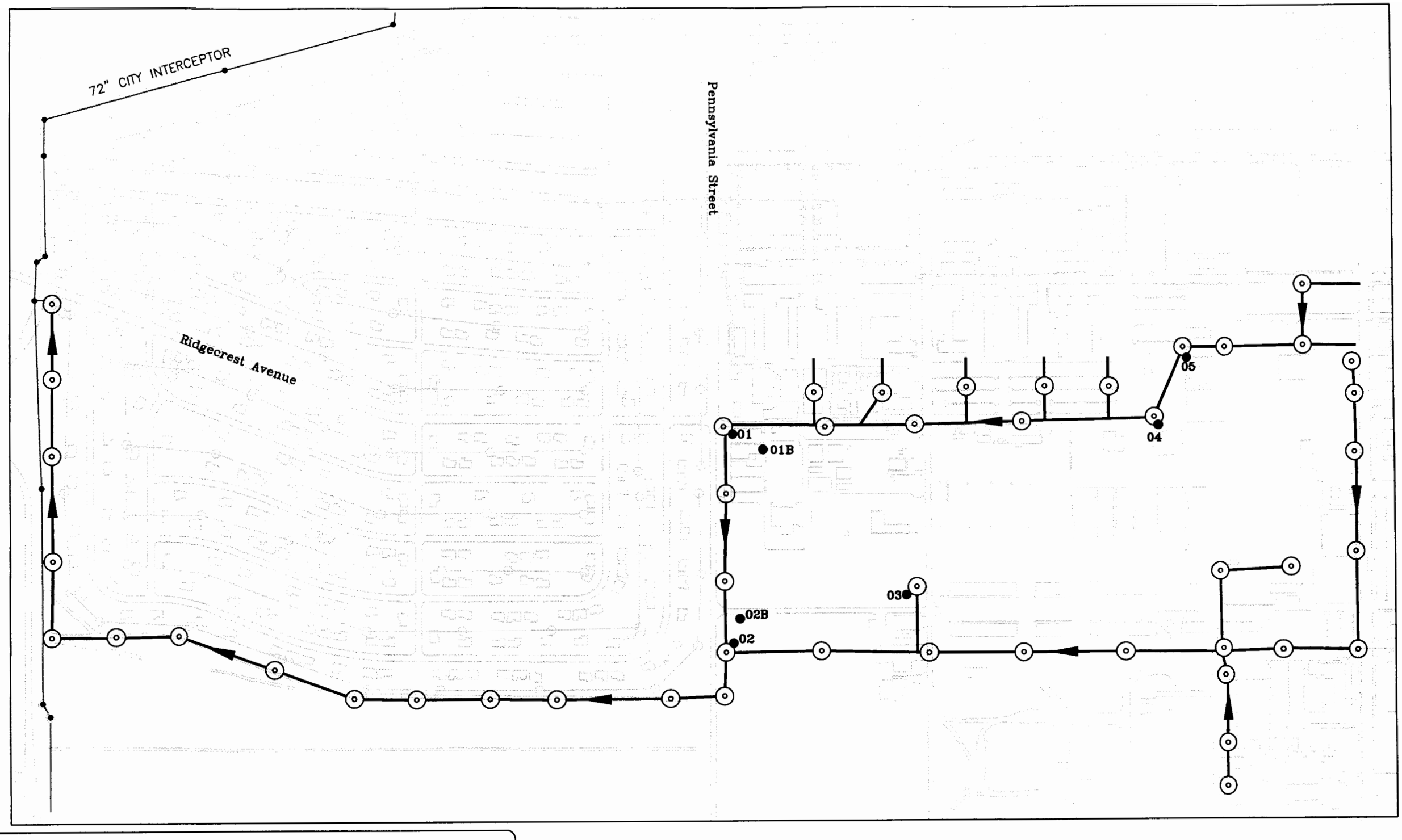


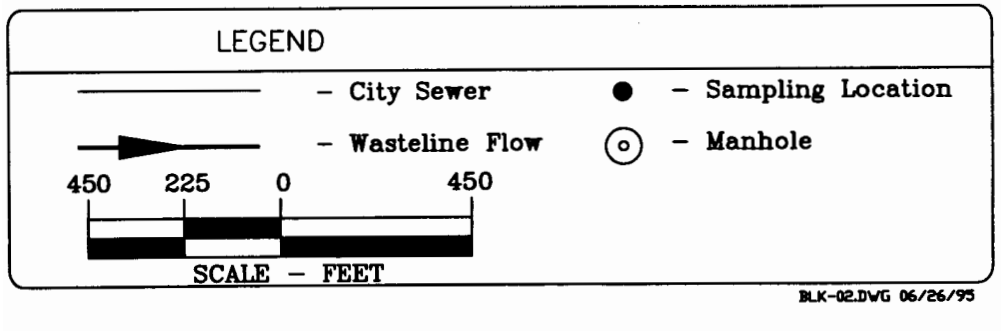


Figure 9-3
Soil Sampling Locations at SWMU 10-1D, Sanitary Sewer D (ST-281)

On April 10 and 11, 1995, seven boreholes were sampled using a Geoprobe. The sample interval at each borehole location was extended from the depth of the line to 5 ft below the line. From this interval, two samples were collected from each borehole: one at a depth equal to the base of the line, the other from 3 ft below the base of the line. Both samples were field-screened with a FID organic vapor meter and only the sample with the highest FID reading was submitted to the laboratory for analysis. If no elevated FID readings were detected, the sample collected at the depth closest to the base of the line was submitted for analysis. During the investigation along the sanitary sewer lines associated with sanitary sewer D, five normal soil samples and two background samples were collected and submitted for laboratory analysis.

The analytical results from background samples collected during the Stage 2B RFI, and ST-281C-01B and ST-281C-02B, collected during the Appendix III RFI, were used as background concentration data for the samples collected at sanitary sewer D.

Sampling operations and sample handling procedures are described in Section 3.0. Sample depths and sample locations are listed in Table 9-6. The corresponding soil boring logs for the boreholes drilled and sampled at sanitary sewer D are in Appendix C.

Table 9-6. Boreholes and Samples Analyzed from SWMU 10-1D, Sanitary Sewer D (ST-281)

Borehole	Borehole Location	Sample Depths (ft)	FID (ppm_v)
01	Adjacent to manhole C20-3 at NE corner of Burgess St. and Pennsylvania St.	13–15	0
01B	Background sample, 150 ft SE of borehole 01	13–15	0
02	Adjacent to manhole C-20 S of SE corner of M Ave. and Pennsylvania St.	12–14	0
02B	Background sample, 100 ft N of borehole 02	12–14	0
03	Adjacent to manhole C-21-1 at NW corner of M Ave. and Texas St.	4–6	0
04	Adjacent to manhole C20-7 N of Building 20344	7–9	8
05	Adjacent to manhole C20-9 E of Building 20339	5–7	0

FID readings are values above background and are the high readings of the sample interval.

9.4.2.4 Laboratory Analysis

The soil samples were analyzed for VOCs, SVOCs, TPH, metals, mercury (the potential contaminants associated with normal operations in this area), soil pH, and soil moisture. The four brass tubes in each 2-ft sample interval were field-screened for possible contamination using a beta-gamma meter and a FID. With the exception of a 8 ppm_v FID measurement at borehole 04, all field-screening instrument readings remained at background levels throughout sampling activities at sanitary sewer D.

Background samples collected during the Stage 2B RFI and at sanitary sewer D during the Appendix III RFI were used as background concentration data. Background samples were analyzed for TPH, VOCs, SVOCs, metals, soil pH, and soil moisture.

9.4.3 Site Characteristics

9.4.3.1 Geology

The area served by sanitary sewer D is underlain by unconsolidated alluvial sediment that is predominantly fine-grained sand and very fine-grained to fine-grained silty sand. Seven boreholes were drilled with a maximum depth of 15 ft below grade. No boreholes penetrated into the Santa Fe Group sediments that presumably underlie this area. A discussion of the general geology at Kirtland AFB is presented in Section 2.4.

As a result of the installation of the lines associated with sanitary sewer D, it is probable that backfill material is present around each line to a depth equal to each line's total depth. Borehole logs for this area are presented in Appendix C.

9.4.3.2 Hydrogeology

Groundwater beneath the lines associated with sanitary sewer D is found within the Upper Santa Fe sediments and is generally thought to be unconfined in the upper portion of the aquifer. This area is within the HR1 saturated zone setting as defined by SNL (Figure 2-9) (SNL, 1994. Hydrogeologic characterization in this portion of Kirtland AFB is complicated by the presence of numerous production wells (Figure 2-11). It is probable that uniform groundwater conditions do not exist in this region. Local cones of depression associated with groundwater withdrawal have altered the groundwater flow direction in the vicinity of the well fields (Figure 2-7).

The gradient is probably north at this site. One production well is located near sanitary sewer D: KAFB-1, 20 ft south. Depth to groundwater is estimated to be 350 ft below grade (Figure 2-10); however, shallower perched water zones may occur. Hydraulic conductivity within HR1 is estimated at 2 to 171 ft/day (SNL, 1994). A general discussion of the hydrogeology at Kirtland AFB is presented in Section 2.5.

9.4.4 Nature and Extent of Contamination

The following sections describe the nature and extent of contamination based on the analytical results. Analytical results for sanitary sewer D are summarized in Table 9-7, where only the reportable concentrations are listed. Full analytical results are presented in Appendix F. Laboratory validation reports are presented in Appendix K.

Organic Compounds

No VOC analytes were detected in any soil samples submitted for analysis.

Bis(2-ethylhexyl)phthalate was detected in one background sample at a concentration of 1.3 mg/kg, below the 46 mg/kg HHRB action level.

Petroleum Hydrocarbons

Gasoline range hydrocarbons were detected in one sample at a concentration of 0.24 mg/kg. Diesel range hydrocarbons were detected in two background samples at concentrations of 11 mg/kg and 10 mg/kg. Detected TPH concentrations do not exceed the NMED action level of 100 mg/kg.

Metals

Table 9-7 lists all reportable metal concentrations detected at sanitary sewer D and the respective UTL and HHRB action level concentrations. Arsenic (1.3 to 8.1 mg/kg) was detected in all of the soil samples at concentrations above the HHRB action level of 0.37 mg/kg. One sample (8.1 mg/kg) was above the 6.5 mg/kg UTL. Beryllium (0.31 to 1.1 mg/kg) was detected in all of the samples at concentrations above the HHRB action level of 0.15 mg/kg. One sample (1.1 mg/kg) was above the 0.84 mg/kg UTL. Manganese (442 mg/kg) was detected in one sample above the 390 mg/kg HHRB action level, but below the 549 mg/kg UTL. These concentrations of arsenic, beryllium, and manganese appear to be naturally occurring at Kirtland AFB as discussed in Section 4.2.2.

Soil pH and Moisture

Soil pH values ranged from 8.2 to 8.8 in these samples. Soil moisture values ranged from 2.8 to 16.6 percent.

9.4.5 Conclusions and Recommendations

Conclusions

- No VOCs were detected in soil samples submitted for analysis at this site.
- One SVOC was detected in a background sample at a concentration below the HHRB action level.

Table 9-7. Summary of Reportable Concentrations for Soil Analyses at SWMU 10-1D, Sanitary Sewer D (ST-281)[1]
(Concentrations mg/kg)

Chemical Class	Analyte	HHRB Action Level[2]	PQL UTL	Borehole Number and Sample Depth Interval (ft)						
				ST281C-01	*ST281C-01B*	*ST281C-02*	*ST281C-02B*	*ST281C-03*	*ST281C-04*	*ST281C-05*
				13–15	13–15	12–14	12–14	4–6	7–9	5–7
SVOC	Bis(2-ethylhexyl)phthalate	46.0	0.70	ND	1.3	ND	ND	ND	ND	ND
TPH	Diesel fraction	100	10.0	ND	11.0	ND	10.0	ND	ND	ND
	Gasoline fraction	100	1.0	ND	0.24	ND	ND	ND	ND	ND
METALS	Aluminum	78,000	14,700	17,900	9,540	4,220	7,630	8,840	13,300	8,740
	Arsenic	0.37	6.5	3.9	1.8	1.3	2.6	4.5	2.9	8.1
	Barium	5,500	735	122	128	55.3	138	276	181	408
	Beryllium	0.15	0.84	1.1	0.45	0.31	0.42	0.54	0.79	0.57
	Cadmium	39.0	N/A	1.7	ND	0.82	ND	0.54	1.9	0.57
	Calcium	N/A	121,000	55,000	18,400	19,300	32,600	29,700	27,600	108,000
	Chromium, total	390	21.6	17.7	9.5	7.2	9.4	10.3	13.3	8.2
	Cobalt	4,700	15.4	11.8	8.3	4.5	5.9	6.9	9.5	6.3
	Copper	2,900	223	30.8	152	92.6	17.5	23.7	25.5	40.8
	Iron	N/A	23,800	20,200	15,900	9,050	12,100	11,500	18,200	10,000
	Lead	400	17.5	12.1	7.4	4.0	6.6	6.1	8.0	3.7
	Magnesium	N/A	10,400	7,980	5,700	2,670	4,930	4,570	6,940	10,200
	Manganese	390	549	442	378	186	238	188	369	120
	Nickel	1,600	188	13.7	10.9	ND	8.3	4.8	7.2	6.3
	Potassium	N/A	3,590	3,290	2,530	870	1,360	2,040	3,490	1,410
	Sodium	N/A	787	147	542	95.8	158	138	187	180
	Thallium	N/A	N/A	0.22	0.15	ND	0.18	0.16	0.15	ND
	Vanadium	550	55.3	37.2	29.2	16.8	25.4	37.7	46.5	56.3
	Zinc	23,000	114	54.4	91.7	45.7	31.9	30.9	52.4	29.8
OTHER	Moisture (%)			16.6	12.0	2.8	4.3	7.1	11.4	11.7
	pH			8.4	9.2	8.8	8.7	8.4	8.2	8.5

FOOTNOTES

1	Complete laboratory analytical results and method detection limits are presented in Appendix K.
2	Action level of RCRA Proposed Rule Subpart S (55 FR 30814, 7/27/90).
*	TPH action level is 100 mg/kg adopted from NMED UST regulations (NMED, 1990). SW-8015 analyzes volatile and semivolatile petroleum hydrocarbon fractions separately. The total concentration of the two fractions analyzed under SW-8015 will be used to assess compliance with stipulated action levels for the purpose of this RFI.
#	Denotes TCLP analysis, results in mg/l.
--	No Data.
FR	Field Replicate.
HHRB	Human health risk based.
J	Estimated value.
N/A	Not Applicable.
NA	Not Analyzed.
ND	Not detected above the method detection limit.
pCi/g	picocuries per gram.
PQL	Practical quantitation limits (defines VOC, SVOC, and TPH).
R	Reject NDs due to interference.
RAD	Radionuclides.
RE	Resample.
SVOC	Semivolatile organic compounds.
TPH	Total petroleum hydrocarbons.
U	Accept data (positive results may be influenced by lab contamination).
UJ	Estimated nondetect.
UTL	Upper tolerance limits (defines metals).
VOC	Volatile organic compounds.

- No gasoline or diesel range hydrocarbons were detected in the normal soil samples submitted for analysis. Gasoline and diesel range hydrocarbons were detected in the background samples.
- Arsenic, beryllium, and manganese were detected at a concentrations exceeding the respective HHRB action levels; these concentrations appear to be naturally occurring throughout Kirtland AFB.
- The analytical results at sanitary sewer D are not indicative of a release from this site.

Recommendations

- Based on the findings of the RFI, no further action is necessary; therefore, sanitary sewer D does not require further investigation. A No Further Action proposal should be prepared.

9.5 SWMU 10-1E, Sanitary Sewer E (ST-282)

9.5.1 Site Background and Environmental Setting

Sanitary sewer E (ST-282), designated as SWMU 10-1E in Module IV of the RCRA Part B Permit, is approximately 2 mi of mapped line of varying diameters (12, 10, 8, and 6 in.); it consists of reinforced concrete pipe. It serves nonindustrial (administrative and operations) buildings, industrial buildings (1 mi), and residential dwellings for Kirtland AFB. The general location of the lines associated with sanitary sewer E is shown on Figure 9-4.

Sanitary sewer E consists of three independent lines that tie-in at Manhole A3. Two of the lines are lateral tie-ins at A3 and serve residential dwellings. The main line serves buildings where nonindustrial activities occur. The lines serving residential dwellings have manholes with designations A3-1, A3-2, etc.; the nonresidential portion of the line has manholes with designations A3, A4, A5, A6, A7, A7-1, A7-2, etc. The industrial portion runs below F Street and extends to 1st Street to the east. The residential portion extends to Pennsylvania Boulevard to the east and has lines extending beyond Ridgecrest Drive to the south. No SWMUs are mapped as discharging to sanitary sewer E. DOE industrial activities occur in Buildings 20219, 20220, 20221, and 20222.

Table 9-8 lists the industrial buildings that have been mapped to discharge to sanitary sewer E. Sanitary sewer E is located in the urban/industrial zone. The closest production well to sanitary sewer E is KAFB-1, which is 200 ft east of the portion that serves residential dwellings and 1,400 ft southwest of the portion that serves industrial buildings.

9.5.2 Study Area Investigation

9.5.2.1 Previous Investigations

No previous investigations have been performed on the subsurface soil surrounding the sanitary sewer system.

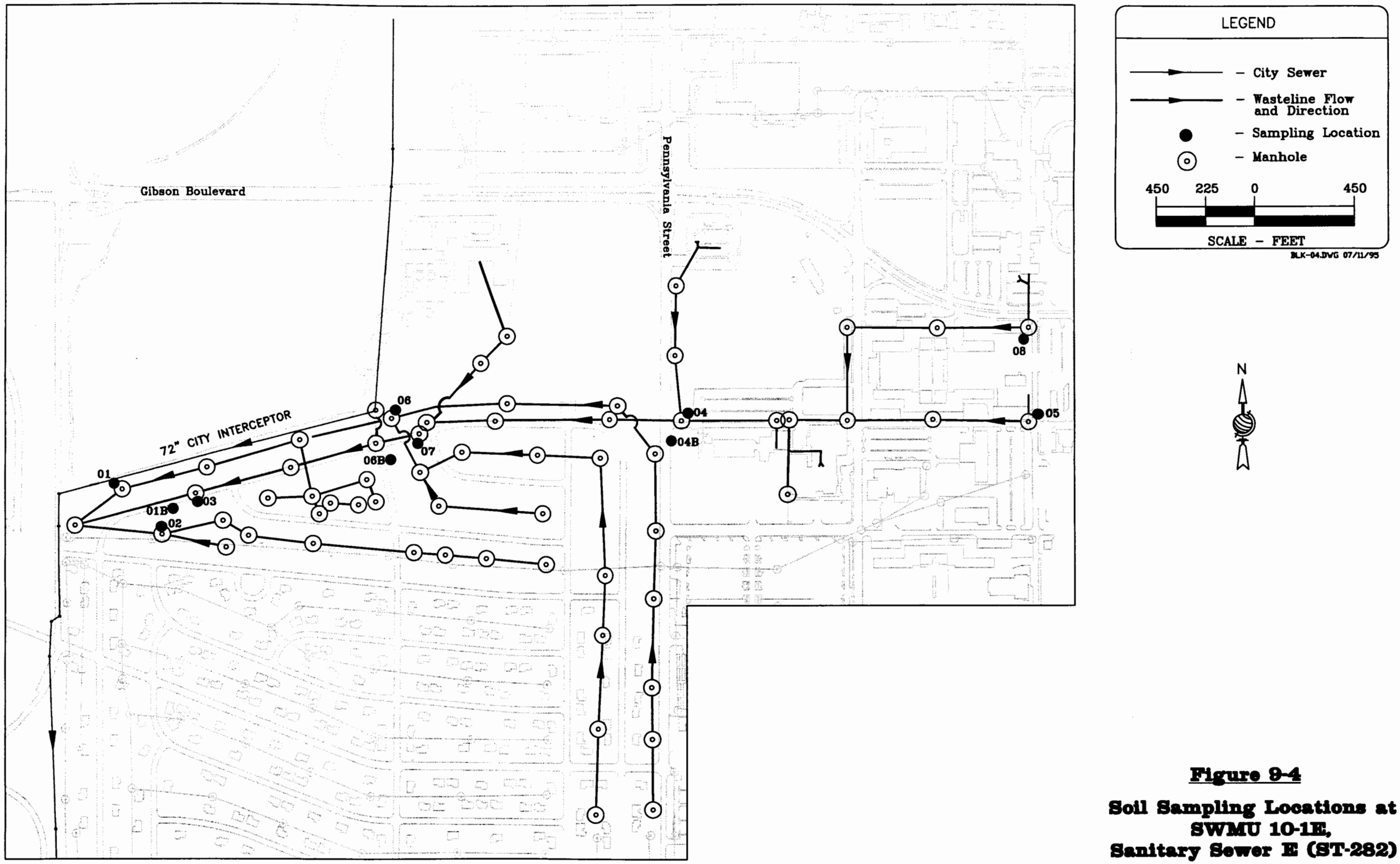


Figure 9-4

Soil Sampling Locations at SWMU 10-1E, Sanitary Sewer E (ST-282)

Table 9-8. Buildings Other Than Base Housing Connected to SWMU 10-1E, Sanitary Sewer E (ST-282)

Building No.	Building Name	Activity	No. of Sanitary Sewer Line Tie-Ins
20219	Security Police Operations	Security Police Operations	1
20220	Dormitory Airmen	Dormitory Supply Storage	2
20221	Dormitory Airmen	Dormitory Supply Storage	7
20222	Dormitory Airmen	Dormitory Supply Storage	7
20228	Gymnasium	Gymnasium/Bowling Center	2
20229	Swimming Pool	Indoor Swimming Pool	2
20241	Exchange Cafe	Cafe Snack Bar	1

9.5.2.2 Data Gaps

Prior to the Appendix III RFI, no data were available to determine the presence or absence of contamination in the subsurface soil surrounding ST-282.

9.5.2.3 RFI Field Investigation

The objective of the ST-282 investigation was to determine if contamination exists in the soil adjacent to the sanitary sewer lines. Location of sanitary sewer lines and sample borehole designations were completed prior to the soil sampling effort. Locations for collection of subsurface soil samples were selected based on the vicinity to line tie-ins from buildings known or suspected to have supported industrial activities, lateral tie-ins and elbows, locations where line repairs and/or replacements are known or suspected to have occurred, and distance between sampling locations. Figure 9-4 shows sampling locations. The soil investigation was limited to the shallow subsurface. Subsurface line locations were confirmed using methods described in Section 3.0.

On April 11 and 12, 1995, seven boreholes were sampled using a Geoprobe. The sample interval at each borehole location was from the depth of the line to 5 ft below the line. From this interval, two samples were collected from each borehole: one at a depth equal to the base of the line, the other from 3 ft below the base of the line. Both samples were field-screened with a FID organic vapor meter and only the sample with the highest FID reading was submitted to the laboratory for analysis. If no FID readings were detected, the sample collected at the depth closest to the base of the line was submitted for analysis. During the investigation along the sanitary sewer lines associated with sanitary sewer E (ST-282), nine normal soil samples, one replicate sample, and three background samples were collected and submitted for laboratory analysis.

The analytical results from background samples collected during the Stage 2B RFI and ST-282C-01B, ST-282C-04B, and ST-282C-06B collected during the Appendix III RFI, were used as background concentration data for the samples collected at sanitary sewer E.

Sampling operations and sample handling procedures are described in Section 3.0. Sample depths, sample locations, and replicate samples collected during the Appendix III RFI are listed in Table 9-9. Soil boring logs for the boreholes drilled and sampled at sanitary sewer E are in Appendix C.

Table 9-9. Boreholes and Samples Analyzed from SWMU 10-1E, Sanitary Sewer E (ST-282)

Borehole	Borehole Location	Sample Depths (ft)	FID (ppm_v)
01	Adjacent to manhole A3-1, N of Building 1847	7-9	9
01B	Background sample, 225 ft SE of borehole 01	10-12	0
02	Adjacent to manhole A3-1A, S of Building 1842	6-8	0
03	Adjacent to manhole A-4, S of Building 1837	14-19	0
04	Adjacent to manhole A7-3 at NE corner of Pennsylvania and parking lot for Building 20223	11-13[a]	0
04B	Background sample, 100 ft SW of borehole 04	9-14	0
05	Adjacent to manhole A7-6 at NW corner of F St. and 1st St.	16-18	0
06	Adjacent to manhole A3-4 N of Building 1809	5-7	0
06B	Background sample, 200 ft SW of borehole 06	5-10[a]	0
07	Adjacent to manhole A-6 S of Building 1807	8-10	0
08	Adjacent to manhole A7-4C at SW corner of Gibson Ave. and 1st St.	12-14	0

FID readings are values above background and are the high readings of the sample interval.

a. Replicate sample also collected at this interval.

9.5.2.4 Laboratory Analysis

The soil samples were analyzed for VOCs, SVOCs, TPH, metals, mercury (the potential contaminants associated with normal operations in this area), soil pH, and soil moisture. The four brass tubes in each 2-ft sample interval were field-screened for possible contamination using a beta-gamma meter and a FID. With the exception of a FID measurement of 9 ppm_v in borehole 01, all field-screening instrument readings remained at background levels throughout sampling activities at ST-282.

Background samples collected during the Stage 2B RFI and at sanitary sewer E during the Appendix III RFI were used as background concentration data. Background samples were analyzed for TPH, VOCs, SVOCs, metals, soil pH, and soil moisture.

9.5.3 Site Characteristics

9.5.3.1 Geology

The area served by sanitary sewer E is underlain by unconsolidated alluvial sediment. The sediment is predominantly fine-grained sand and very fine-grained to fine-grained silty sand. Eleven boreholes were drilled with a maximum depth of 19 ft below grade. No boreholes penetrated into the Santa Fe Group sediments that presumably underlie this area. A discussion of the general geology at Kirtland AFB is presented in Section 2.4.

As a result of the installation of the lines associated with sanitary sewer E, it is probable that backfill material is present around each line to a depth equal to each line's total depth. Borehole logs for this area are presented in Appendix C.

9.5.3.2 Hydrogeology

Groundwater beneath the lines associated with sanitary sewer E is found within the Upper Santa Fe sediment and is generally thought to be unconfined in the upper portion of the aquifer. This area is within the HR1 saturated zone setting as defined by SNL (Figure 2-9) (SNL, 1994). Hydrogeologic characterization in this portion of Kirtland AFB is complicated by the presence of numerous production wells (Figure 2-11). It is probable that uniform groundwater conditions do not exist in this region. Local cones of depression associated with groundwater withdrawal have altered the groundwater flow direction in the vicinity of the well fields (Figure 2-7).

The gradient is probably northeast at this site. One production well is located near sanitary sewer E: KAFB-1 is 200 ft east of the portion that serves residential dwellings and downgradient 1,400 ft southwest of the portion that serves industrial buildings. Depth to groundwater is estimated to be 350 ft below grade (Figure 2-10); however, shallower perched water zones may occur. Hydraulic conductivity within HR1 is estimated at 2 to 171 ft/day (SNL, 1994). A general discussion of the hydrogeology at Kirtland AFB is presented in Section 2.5.

9.5.4 Nature and Extent of Contamination

The following sections describe the nature and extent of contamination based on the analytical results. Analytical results for sanitary sewer E are summarized in Table 9-10, where only the reportable concentrations are listed. Full analytical results are presented in Appendix F. Laboratory validation reports are presented in Appendix K.

Table 9-10. Summary of Reportable Concentrations for Soil Analyses at SWMU 10-1E, Sanitary Sewer E (ST-282)[1]
(Concentrations mg/kg)

Chemical Class	Analyte	HHRB Action Level[2]	PQL UTL	Borehole Number and Sample Depth Interval (ft)							
				ST282C-01	*ST282C-01B*	*ST282C-02*	*ST282C-03*	*ST282C-04*		*ST282C-04B*	*ST282C-05*
				7–9	10–12	6–8	14–19	9–14 FR	9–14	9–14	16–18
SVOC	Di-n-butylphthalate	7,800	0.70	ND	ND	ND	ND	ND	ND	ND	ND
TPH	Diesel fraction	100	10.0	ND	5.9	ND	ND	ND	23.0	ND	6.2
METALS	Aluminum	78,000	14,700	4,970	4,780	6,960	8,560	9,050	5,010	10,500	4,600
	Arsenic	0.37	6.5	1.8	2.0	3.2	2.7	2.5	1.2	2.8	0.59
	Barium	5,500	735	57.2	174	489	160	128	96.1	245	69.9
	Beryllium	0.15	0.84	ND	0.32	ND	0.34	0.46	ND	0.70	ND
	Cadmium	39.0	N/A	ND	ND	ND	ND	ND	ND	ND	0.52
	Calcium	N/A	121,000	11,900	21,500	51,200	26,800	35,500	27,900	38,200	24,500
	Chromium, total	390	21.6	5.5	8.2	5.8	9.1	11.2	8.4	14.1	6.0
	Cobalt	4,700	15.4	3.9	3.8	5.2	8.0	9.4	10.0	8.7	7.2
	Copper	2,900	223	71.7	48.3	15.0	18.5	25.7	62.7	25.8	32.0
	Iron	N/A	23,800	9,830	9,580	10,700	15,700	17,700	19,600	19,400	17,500
	Lead	400	17.5	4.0	5.7	4.6	6.4	7.9	4.3	10.3	3.4
	Magnesium	N/A	10,400	2,940	3,350	4,960	5,220	6,680	3,830	7,180	3,660
	Manganese	390	549	168	177	183	262	358	291	486	262
	Nickel	1,600	188	5.3	161	5.4	7.1	12.9	56.9	14.5	30.2
	Potassium	N/A	3,590	1,130	1,190	1,470	1,600	1,940	1,750	2,060	1,680
	Sodium	N/A	787	78.4	70.4	117	140	167	82.1	387	117
	Thallium	N/A	N/A	0.13	ND	ND	ND	ND	ND	0.21	ND
	Vanadium	550	55.3	17.0	18.5	31.5	27.7	26.0	32.8	30.2	27.3
	Zinc	23,000	114	37.1	38.3	24.6	32.6	43.3	44.1	60.1	37.2
OTHER	Moisture (%)			4.6	5.6	9.5	13.0	12.4	3.0	14.7	3.1
	pH			8.3	8.5	8.3	8.2	8.1	8.1	8.6	8.6

Table 9-10. Summary of Reportable Concentrations for Soil Analyses at SWMU 10-1E, Sanitary Sewer E (ST-282)[1] (Concentrations mg/kg) (Continued)

Chemical Class	Analyte	HHRB Action Level[2]	PQL UTL	Borehole Number and Sample Depth Interval (ft)				
				ST282C-06	*ST282C-06B*		*ST282C-07*	*ST282C-08*
				5–7	5–10 FR	5–10	8–10	12–14
SVOC	Di-n-butylphthalate	7,800	0.70	2.4	ND	ND	ND	ND
TPH	Diesel fraction	100	10.0	ND	9.9	ND	ND	ND
METALS	Aluminum	78,000	3,900	3,900	4,510	7,260	13,700	4,220
	Arsenic	0.37	1.1	1.1	2.8	2.4	2.7	1.2
	Barium	5,500	64.8	64.8	115	172	230	81.1
	Beryllium	0.15	ND	ND	0.34	0.35	0.58	ND
	Cadmium	39.0	ND	ND	ND	ND	0.92	ND
	Calcium	N/A	15,300	15,300	25,600	32,600	47,000	21,500
	Chromium, total	390	4.3	4.3	8.7	7.8	9.5	4.7
	Cobalt	4,700	4.7	4.7	3.1	6.0	9.6	4.8
	Copper	2,900	26.8	26.8	16.7	101	31.1	25.5
	Iron	N/A	8,070	8,070	7,820	14,400	17,800	9,220
	Lead	400	3.0	3.0	6.1	7.4	6.1	4.4
	Magnesium	N/A	2,130	2,130	2,870	5,030	5,990	3,120
	Manganese	390	136	136	168	309	295	201
	Nickel	1,600	4.7	4.7	11.9	7.1	12.7	5.5
	Potassium	N/A	839	839	832	1,590	2,730	1,040
	Sodium	N/A	73.3	73.3	81.3	107	246	59.8
	Thallium	N/A	ND	ND	0.12	0.14	ND	ND
	Vanadium	550	15.4	15.4	14.6	25.2	35.6	14.5
	Zinc	23,000	21.8	21.8	24.1	60.0	46.8	29.4
OTHER	Moisture (%)			8.6	10.8	13.5	13.4	4.8
	pH			8.3	8.6	8.6	8.2	8.1

FOOTNOTES

1	Complete laboratory analytical results and method detection limits are presented in Appendix K.
2	Action level of RCRA Proposed Rule Subpart S (55 FR 30814, 7/27/90).
*	TPH action level is 100 mg/kg adopted from NMED UST regulations (NMED, 1990). SW-8015 analyzes volatile and semivolatile petroleum hydrocarbon fractions separately. The total concentration of the two fractions analyzed under SW-8015 will be used to assess compliance with stipulated action levels for the purpose of this RFI.
#	Denotes TCLP analysis, results in mg/l.
--	No Data.
FR	Field Replicate.
HHRB	Human health risk based.
J	Estimated value.
N/A	Not Applicable.
NA	Not Analyzed.
ND	Not detected above the method detection limit.
pCi/g	picocuries per gram.
PQL	Practical quantitation limits (defines VOC, SVOC, and TPH).
R	Reject NDs due to interference.
RAD	Radionuclides.
RE	Resample.
SVOC	Semivolatile organic compounds.
TPH	Total petroleum hydrocarbons.
U	Accept data (positive results may be influenced by lab contamination).
UJ	Estimated nondetect.
UTL	Upper tolerance limits (defines metals).
VOC	Volatile organic compounds.

Organic Compounds

No VOC analytes were detected in any of the soil samples collected at sanitary sewer E.

Di-n-butylphthalate (2.4 mg/kg) was the only SVOC analyte detected in one soil sample. The concentration detected was below the HHRB action level of 7,800 mg/kg.

Petroleum Hydrocarbons

Diesel range hydrocarbons were detected in two of the normal soil samples submitted for analysis from sanitary sewer E at concentrations of 23 and 6.2 mg/kg. Diesel range hydrocarbons were also detected in two of the background samples submitted for analysis (5.9 and 9.9 mg/kg). The concentrations detected do not exceed the NMED action level of 100 mg/kg.

Metals

Table 9-10 lists all reportable metal concentrations detected at sanitary sewer E and the respective UTL and HHRB action level concentrations. Arsenic (0.59 to 3.2 mg/kg) was detected in the eight soil samples and one field replicate at concentrations above the HHRB action level of 0.37 mg/kg, but below the 6.5 mg/kg UTL. Beryllium (0.34 to 0.58 mg/kg) was detected in two samples and one field replicate at concentrations above the HHRB action level of 0.15 mg/kg, but below the 0.84 mg/kg UTL. Manganese (486 mg/kg) was detected in one background sample at a concentration exceeding the HHRB action level of 390 mg/kg, but below the 549 mg/kg UTL. These concentrations of arsenic, beryllium, and manganese appear to be naturally occurring at Kirtland AFB as discussed in Section 4.2.2.

Soil pH and Moisture

Soil pH values ranged from 8.1 to 8.6 in these samples. Soil moisture values ranged from 3.0 to 13.4 percent.

9.5.5 Conclusions and Recommendations

Conclusions

- No VOCs were detected in the soil samples collected from this site.
- One SVOC was detected in a soil sample collected from this site; the concentration was below the HHRB action level.
- No gasoline or diesel range hydrocarbons were detected at concentrations above the NMED action levels. The TPH concentrations measured in the samples submitted for analysis from this site were similar to those measured in background samples collected during the Stage 2B and Appendix III RFIs. The TPH detections are not conclusive evidence of a release from this unit. Because no other release components (VOCs, SVOCs, or metals) are present, it is probable that a release has not occurred.

- Arsenic, beryllium, and manganese were the only metals detected at concentrations exceeding the HHRB action level; those concentrations appear to be naturally occurring throughout Kirtland AFB.
- The analytical results at sanitary sewer E are not indicative of a release from this site.

Recommendations

- Based on the findings of the RFI, no further action is necessary; therefore, sanitary sewer E does not require further investigation. A No Further Action proposal should be prepared.

9.6 SWMU 10-1F, Sanitary Sewer F (ST-283)

9.6.1 Site Background and Environmental Setting

Sanitary sewer F (ST-283), designated as SWMU 10-1F in Module IV of the RCRA Part B Permit, primarily serves nonindustrial buildings (administrative) for both Kirtland AFB and for the DOE (Sandia National Laboratories); it has limited industrial applications (i.e., power station, steam plant, and fire station). The general location of the lines associated with sanitary sewer F is shown on Figure 9-5.

Sanitary sewer F is approximately 3 mi of mapped line of varying diameters (12, 10, 8, and 6 in.) and consists of reinforced concrete pipe. Sanitary sewer F extends on the west from Louisiana Boulevard to the eastern boundary of Kirtland AFB; the residential portion of sanitary sewer F is down line from manhole B12-11. The majority of the lines of sanitary sewer F serve nonindustrial or administrative buildings; the residential dwellings tie-in at manhole B12-11. Table 9-11 lists the industrial buildings discharging to sanitary sewer F and the number of sanitary sewer tie-in locations that have been mapped. The site is located in the urban/industrial zone. The closest production well is KAFB-1, 80 ft south.

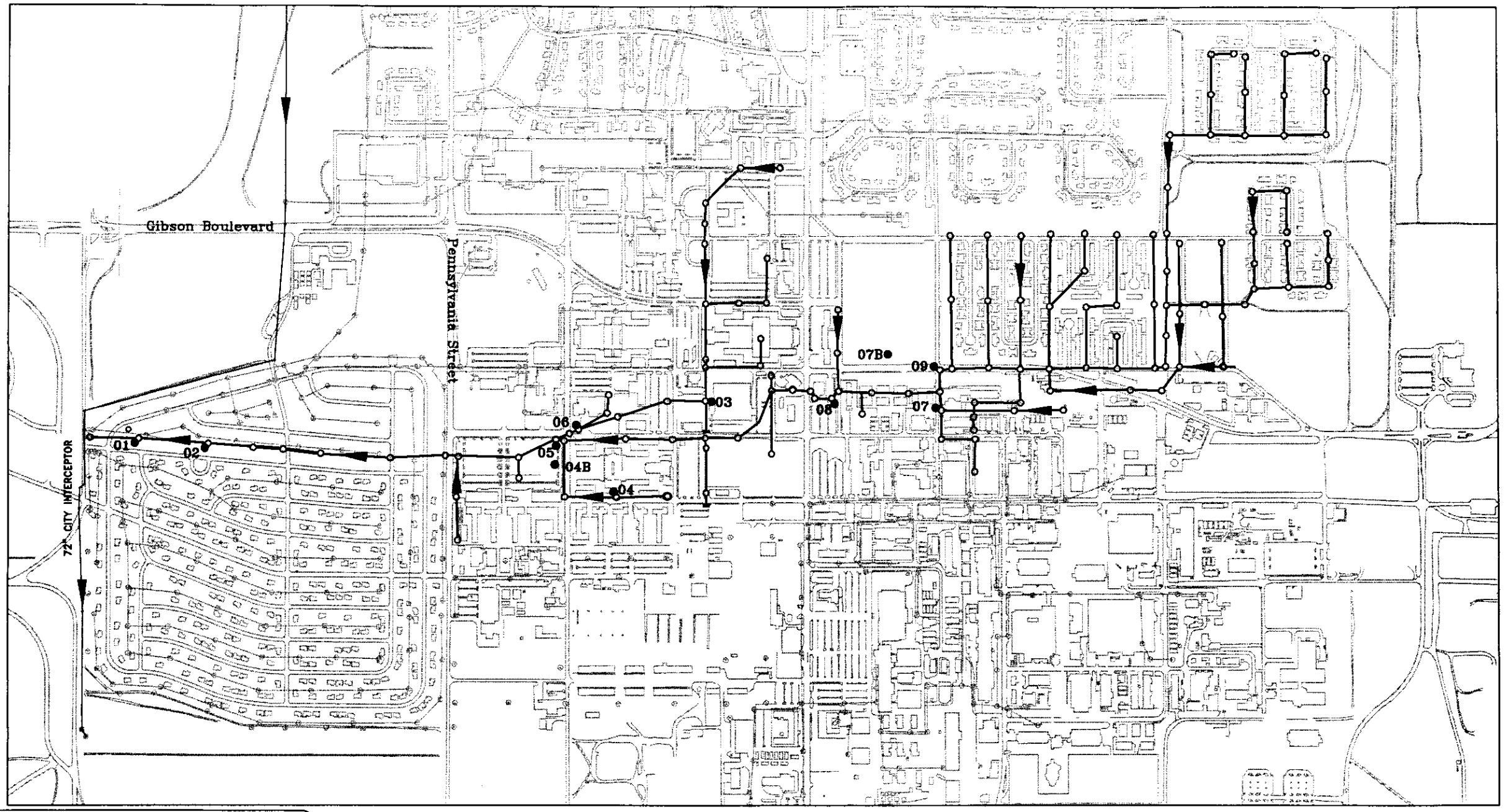
9.6.2 Study Area Investigation

9.6.2.1 Previous Investigations

No previous investigations have been performed on the subsurface soil surrounding the sanitary sewer system.

9.6.2.2 Data Gaps

Prior to the Appendix III RFI, no data were available to determine the presence or absence of contamination in the subsurface soil surrounding sanitary sewer F.



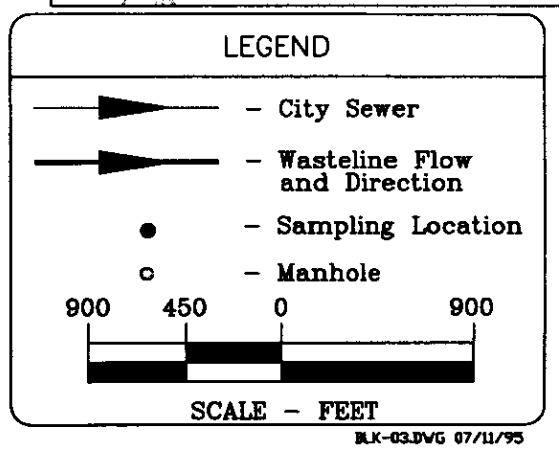


Figure 9-5
Soil Sampling Locations at SWMU 10-1F, Sanitary Sewer F (ST-283)

Table 9-11. Buildings Connected to SWMU 10-1F, Sanitary Sewer F (ST-283)

Building No.	Building Name	Activity	No. of Sanitary Sewer Line Tie-Ins
20101	Visiting Airmen Quarters	Temporary Quarters	1
20102	Technical Training Room	Classroom	1
20107	Chapel Center	Chapel	1
20130	Headquarter Center	Administration	2
20200	Headquarter Center	Administration	3
20201	Base Personnel Office	Personnel Office	1
20202	Headquarter Wing	Administration	4
20203	Base Personnel Office	Warehouse Supplies/ Admin Office	6
20204	Postal and Library	Library and Military Post Office (formerly Youth Center)	1
20206	Arts and Crafts Center	Arts and Crafts	1
20210	Fire Station	Fire Station	1
20211	Heating Facility Building	Old Steam Plant	4
20224	Exchange Service Outlet	Retail Store Base Exchange	1
20225	Theater	Base Theater	1
20226	Open Mess NCO	Dining/NCO Club	1
20245	Administration Office	Administration/Laboratory/Office	2
20350	Dining Hall Administration	Administration/Dining	1
20351	Dormitory	Dormitory/Administration	6
20352	Dormitory	Dormitory/Administration	6
20368	Electrical Power Building	Power Station	1
20385	DOE	Research and Development	2

9.6.2.3 RFI Field Investigation

The objective of the investigation was to determine if contamination exists in the soil adjacent to the sanitary sewer lines. Location of sanitary sewer lines and sample borehole designations were completed prior to the soil sampling effort. Locations for collection of subsurface soil samples were selected based on the vicinity to line tie-ins from buildings known or suspected to have supported industrial activities, location of SWMUs that discharge to the line, lateral tie-ins and elbows, locations where line repairs and/or replacements are known or suspected to have occurred, and distance between sampling locations. Figure 9-5 shows sampling locations. The soil investigation was limited to the shallow subsurface. Subsurface line locations were confirmed using methods described in Section 3.0.

From April 13 to 18, 1995, 11 boreholes were sampled using a Geoprobe. The sample interval at each borehole location was from the depth of the line to 5 ft below the line. From this interval, two samples were collected from each borehole: one at a depth equal to the base of the line, the other from 3 ft below the base of the line. Both samples were field-screened with a FID organic vapor meter and only the

sample with the highest FID reading was submitted to the laboratory for analysis. If no elevated FID readings were detected, the sample collected at the depth closest to the base of the line was submitted for analysis. Nine soil samples, one field replicate sample, and two background samples were collected during the investigation along the sanitary sewer lines associated with sanitary sewer F and submitted for laboratory analysis.

The analytical results from background samples collected during the Stage 2B RFI and ST-283C-04B and ST-283C-07B collected during the Appendix III RFI, were used as background concentration data for the samples collected at sanitary sewer F.

Sampling operations and sample handling procedures are described in Section 3.0. Sample depths, sample locations, and replicate samples collected during the Appendix III RFI are listed in Table 9-12. Soil boring logs for the boreholes drilled and sampled at ST-229 are in Appendix C.

Table 9-12. Boreholes and Samples Analyzed from SWMU 10-1F, Sanitary Sewer F (ST-283)

Borehole	Borehole Location	Sample Depths (ft)	FID (ppm_v)
01	Adjacent to manhole B4, NE of Building 1850	6-8	0
02	Adjacent to manhole B5, N of Building 7281	7-9	0
03	Adjacent to manhole B6, SE of Post Office	12-14	0
04	Adjacent to manhole B12-1B, S of Building 20352	11-13	0
04B	Background sample, 225 ft NW of borehole 04	11-13	0
05	Adjacent to manhole B12, W-SW of SW corner of G Ave. and Texas St.	7-12[a]	0
06	Adjacent to manhole B13-A, E-NE of NE corner of G Ave. and Texas St.	6-11	9
07	Adjacent to manhole B12-10-1, SW of Building 831	7-12	0
07B	Background sample, 250 ft NW of borehole 07	7-9	0
08	Adjacent to manhole B12-7C, SE of Building 20206	10-12	0
09	Adjacent to manhole B12-11, in intersection of Ave. F and 7th St.	8-10	0

FID readings are values above background and are the high readings of the sample interval.

a. Replicate sample also collected at this interval.

9.6.2.4 Laboratory Analysis

The soil samples were analyzed for VOCs, SVOCs, TPH, metals, mercury (the potential contaminants associated with normal operations in the area), soil pH, and soil moisture. The four brass tubes in each 2-ft sample interval were field-screened for possible contamination using a beta-gamma meter and a FID. With the exception of a FID detection of 9 ppm_v in borehole 06, all field-screening instrument readings remained at background levels throughout sampling activities at ST-283.

Background samples collected during the Stage 2B RFI and at sanitary sewer F during the Appendix III RFI were used as background concentration data. Background samples were analyzed for TPH, VOCs, SVOCs, metals, soil pH, and soil moisture.

9.6.3 Site Characteristics

9.6.3.1 Geology

The area serviced by sanitary sewer F is underlain by unconsolidated alluvial sediment that is predominantly fine-grained sand and very fine-grained to fine-grained silty sand. Twelve boreholes were drilled with a maximum depth of 16 ft below grade. No boreholes penetrated into the Santa Fe Group sediments that presumably underlie this area. A discussion of the general geology at Kirtland AFB is presented in Section 2.4.

As a result of the installation of the lines associated with sanitary sewer F, it is probable that backfill material is present around each line to a depth equal to each line's total depth. Borehole logs for this area are presented in Appendix C.

9.6.3.2 Hydrogeology

Groundwater beneath the lines associated with sanitary sewer F is found within the Upper Santa Fe sediments and is generally thought to be unconfined in the upper portion of the aquifer. This area is within the HR1 saturated zone setting as defined by SNL (Figure 2-9) (SNL, 1994). Hydrogeologic characterization in this portion of Kirtland AFB is complicated by the presence of numerous production wells (Figure 2-11). It is probable that uniform groundwater conditions do not exist in this region. Local cones of depression associated with groundwater withdrawal have altered the groundwater flow direction in the vicinity of the well fields (Figure 2-7).

The gradient is probably to the northeast at this site. The production well located near sanitary sewer F is KAFB-1, 80 ft south. Depth to groundwater is estimated to be 350 ft below grade (Figure 2-10); however, shallower perched water zones may occur. Hydraulic conductivity within HR1 is estimated at 2 to 171 ft/day (SNL, 1994). A general discussion of the hydrogeology at Kirtland AFB is presented in Section 2.5.

9.6.4 Nature and Extent of Contamination

The following sections describe the nature and extent of contamination based on the analytical results. Analytical results for sanitary sewer F are summarized in Table 9-13, where only reportable concentrations are listed. Full analytical results are presented in Appendix F. Laboratory validation reports are presented in Appendix K.

Table 9-13. Summary of Reportable Concentrations for Soil Analyses at SWMU 10-1F, Sanitary Sewer F (ST-283)[1]
(Concentrations mg/kg)

Chemical Class	Analyte	HHRB Action Level[2]	PQL UTL	Borehole Number and Sample Depth Interval (ft)				
				ST283C-01 6–8	*ST283C-02* 7–9	*ST283C-03* 12–14	*ST283C-04* 11–13	*ST283C-04B* 11–13
SVOC	Di-n-butylphthalate	7,800	0.70	ND	0.38	0.37	0.53	ND
TPH	Diesel fraction	100	10.0	ND	4.8	ND	ND	9.4
	Gasoline fraction	100	1.0	ND	ND	0.26	ND	ND
METALS	Aluminum	78,000	14,700	6,530	3,700	2,540	4,520	7,710
	Arsenic	0.37	6.5	2.1	1.2	0.97	1.2	2.3
	Barium	5,500	735	98.5	59.7	60.4	81.7	88.8
	Beryllium	0.15	0.84	ND	ND	ND	ND	0.44
	Cadmium	39.0	N/A	ND	ND	ND	ND	ND
	Calcium	N/A	121,000	69,600	34,400	18,600	21,400	24,400
	Chromium, total	390	21.6	8.1	11.1	4.1	6.6	7.7
	Cobalt	4,700	15.4	6.7	6.5	5.1	7.4	7.0
	Copper	2,900	223	18.6	83.1	73.3	124	16.2
	Iron	N/A	23,800	11,300	9,140	7,610	12,900	13,700
	Lead	400	17.5	5.3	4.3	2.5	5.1	7.5
	Magnesium	N/A	10,400	4,270	3,130	2,000	3,600	5,510
	Manganese	390	549	230	206	129	193	315
	Nickel	1,600	188	8.3	4.3	ND	14.8	12.3
	Potassium	N/A	3,590	1,500	1,120	609	1,530	2,020
	Sodium	N/A	787	101	110	57.4	116	424
	Thallium	N/A	N/A	ND	ND	ND	ND	0.17
	Vanadium	550	55.3	23.2	16.3	16.4	27.1	24.0
	Zinc	23,000	114	33.4	41.4	35.4	63.0	40.0
OTHER	Moisture (%)			7.6	1.3	5.1	2.2	9.5
	pH			8.5	8.8	8.8	8.5	9.2

Table 9-13. Summary of Reportable Concentrations for Soil Analyses at SWMU 10-1F, Sanitary Sewer F (ST-283)[1]
(Concentrations mg/kg) (Continued)

Chemical Class	Analyte	HHRB Action Level[2]	PQL UTL	Borehole Number and Sample Depth Interval (ft)							
				ST283C-05			*ST283C-06*	*ST283C-07*	*ST283C-07B*	*ST283C-08*	*ST283C-09*
				7–12 FR	7–12 FR	7–12	6–11	7–12	7–9	10–12	8–10
SVOC	Di-n-butylphthalate	7,800	0.70	2.2	ND	2.7	0.69	ND	ND	ND	ND
TPH	Diesel fraction	100	10.0	5.6	ND	ND	6.7	ND	ND	ND	ND
	Gasoline fraction	100	1.0	ND	ND	ND	ND	ND	ND	ND	ND
METALS	Aluminum	78,000	7,650	11,000	ND	9,020	7,650	14,800	4,680	9,330	7,190
	Arsenic	0.37	3.0	3.3	ND	2.6	3.0	3.4	1.1	2.5	1.5
	Barium	5,500	154	207	ND	178	154	244	93.6	271	124
	Beryllium	0.15	0.33	0.46	ND	0.34	0.33	0.84	ND	0.42	0.41
	Cadmium	39.0	0.67	ND	ND	0.68	0.67	1.2	ND	0.64	1.7
	Calcium	N/A	42,700	28,800	ND	36,300	42,700	26,700	22,600	35,800	31,500
	Chromium, total	390	8.6	10.3	ND	8.6	8.6	11.0	5.0	6.2	5.4
	Cobalt	4,700	7.0	6.8	ND	6.0	7.0	8.6	5.8	8.1	8.4
	Copper	2,900	35.2	18.2	ND	20.9	35.2	113	46.2	25.8	137
	Iron	N/A	10,500	14,100	ND	12,800	10,500	20,300	11,400	18,800	17,900
	Lead	400	10.3	8.1	ND	6.1	10.3	9.0	4.7	6.0	4.7
	Magnesium	N/A	4,330	5,270	ND	5,210	4,330	6,980	3,490	6,000	4,550
	Manganese	390	204	226	ND	234	204	365	253	359	361
	Nickel	1,600	10.5	10.9	ND	7.7	10.5	13.1	4.6	9.2	7.1
	Potassium	N/A	1,700	1,910	ND	1,880	1,700	2,990	1,380	2,420	2,230
	Sodium	N/A	192	196	ND	161	192	283	73.5	172	320
	Thallium	N/A	ND	ND	ND	ND	ND	ND	0.10	0.20	0.13
	Vanadium	550	22.1	25.3	ND	29.7	22.1	36.4	19.4	31.6	31.3
	Zinc	23,000	46.0	ND	39.9	38.6	46.0	70.2	40.4	48.7	75.4
OTHER	Moisture (%)			13.6	100	11.3	10.4	17.0	3.2	5.8	3.1
	pH			8.2	ND	7.8	8.1	8.2	8.2	8.4	8.4

FOOTNOTES

1	Complete laboratory analytical results and method detection limits are presented in Appendix K.
2	Action level of RCRA Proposed Rule Subpart S (55 FR 30814, 7/27/90).
*	TPH action level is 100 mg/kg adopted from NMED UST regulations (NMED, 1990). SW-8015 analyzes volatile and semivolatile petroleum hydrocarbon fractions separately. The total concentration of the two fractions analyzed under SW-8015 will be used to assess compliance with stipulated action levels for the purpose of this RFI.
#	Denotes TCLP analysis, results in mg/l.
--	No Data.
FR	Field Replicate.
HHRB	Human health risk based.
J	Estimated value.
N/A	Not Applicable.
NA	Not Analyzed.
ND	Not detected above the method detection limit.
pCi/g	picocuries per gram.
PQL	Practical quantitation limits (defines VOC, SVOC, and TPH).
R	Reject NDs due to interference.
RAD	Radionuclides.
RE	Resample.
SVOC	Semivolatile organic compounds.
TPH	Total petroleum hydrocarbons.
U	Accept data (positive results may be influenced by lab contamination).
UJ	Estimated nondetect.
UTL	Upper tolerance limits (defines metals).
VOC	Volatile organic compounds.

Organic Compounds

Di-n-butylphthalate (0.370 to 2.7 mg/kg) was the only SVOC analyte detected in six soil samples submitted for analysis at sanitary sewer F. The concentrations detected were below the HHRB action level of 7,800 mg/kg.

Petroleum Hydrocarbons

Gasoline range hydrocarbons were detected in one soil sample collected at sanitary sewer F at a concentration of 0.26 mg/kg, below the NMED action level of 100 mg/kg.

Diesel range hydrocarbons were detected in four soil samples (three normal and one background) submitted for analysis at sanitary sewer F. Concentrations ranged from 4.8 to 9.4 mg/kg and do not exceed the NMED action level of 100 mg/kg.

Metals

Table 9-13 lists all reportable metal concentrations detected at sanitary sewer F and the respective UTL and HHRB action level concentrations. Arsenic (0.97 to 3.4 mg/kg) was detected in all soil samples at concentrations above the HHRB action level of 0.37 mg/kg, but below the 6.5 mg/kg UTL. Beryllium (0.33 to 0.84 mg/kg) was detected in five soil samples and the field replicate at concentrations above the 0.15 mg/kg HHRB action level. All beryllium concentrations were at or below the 0.84 mg/kg UTL. These concentrations of arsenic and beryllium appear to be naturally occurring at Kirtland AFB as discussed in Section 4.2.2.

Soil pH and Moisture

Soil pH values ranged from 8.5 to 9.2 in these samples. Soil moisture values ranged from 1.3 to 9.5 percent.

9.6.5 Conclusions and Recommendations

Conclusions

- No VOCs were detected in the soil samples collected from this site.
- One SVOC was detected in the soil samples collected from this site. All concentrations were below HHRB action levels.
- No gasoline or diesel range hydrocarbons were detected at concentrations above the NMED action levels. TPH concentrations measured in the samples submitted from this site were similar to those measured in background samples collected during the Stage 2B and Appendix III RFIs. The TPH detections alone are not conclusive evidence of a release from this unit. Because no other release components (such as VOCs, SVOCs, or metals) are present, it is probable that a release has not occurred.

- Arsenic and beryllium were the only metals detected at concentrations exceeding the HHRB action level; these concentrations appear to be naturally occurring throughout Kirtland AFB.

- The analytical results at sanitary sewer F are not indicative of a release from this site.

Recommendations

- Based on the findings of the RFI, no further action is necessary; therefore, sanitary sewer F does not require further investigation. A No Further Action proposal should be prepared.

9.7 SWMU 10-1G, Sanitary Sewer G (ST-284)

9.7.1 Site Background and Environmental Setting

Sanitary sewer G (ST-284), designated as SWMU 10-1G in Module IV of the RCRA Part B Permit, primarily serves residential dwellings; it also receives waste from the commissary, a retail exchange center, the child care center, and the former base hospital. The former base hospital is now occupied by various organizations including the audio-visual/photography laboratory, Red Cross, and the refill pharmacy. These buildings are the only nonresidential sources served by sanitary sewer G. The general location of the lines associated with sanitary sewer G is shown on Figure 9-6.

Sanitary sewer G is approximately 9 mi of mapped line of varying diameters (10, 8, and 6 in.) consisting of reinforced concrete pipe. It is bound by the Kirtland AFB boundary lines to the west, north, and east, and by Gibson Boulevard to the south.

Sanitary sewer G is located in the urban/industrial zone. The closest production well is KAFB-3, 800 ft northwest.

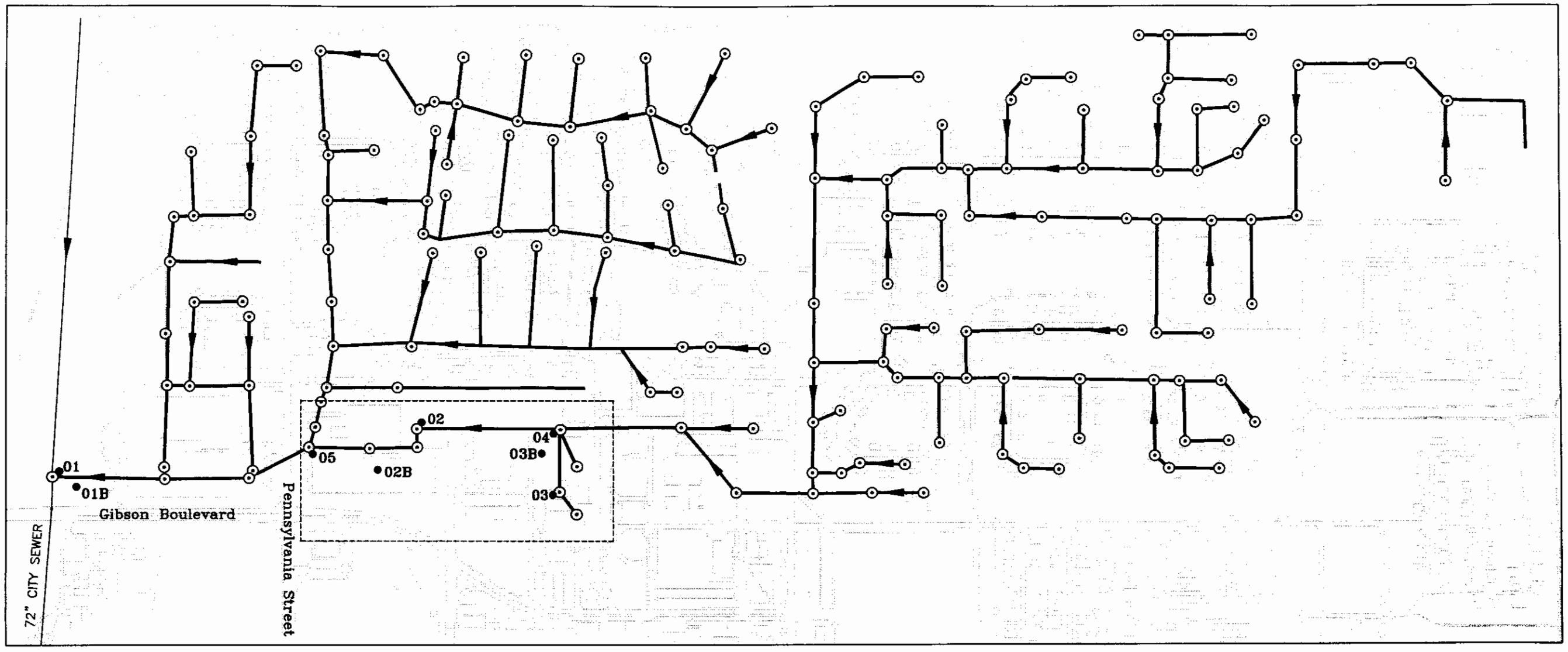
9.7.2 Study Area Investigation

9.7.2.1 Previous Investigations

No previous investigations have been performed on the subsurface soil surrounding the sanitary sewer system.

9.7.2.2 Data Gaps

Prior to the Appendix III RFI, no data were available to determine the presence or absence of contamination in the subsurface soil surrounding sanitary sewer G.



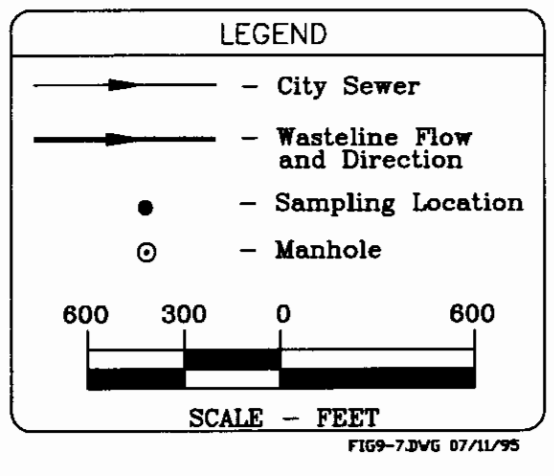


Figure 9-6

Soil Sampling Locations at SWMU 10-1G, Sanitary Sewer G (ST-284)

9.7.2.3 RFI Field Investigation

The objective of the sanitary sewer G investigation was to determine if contamination exists in the soils adjacent to the sanitary sewer lines. Location of sanitary sewer lines and sample borehole designations were completed prior to the soil sampling effort. Locations for collection of subsurface soil samples were selected based on the vicinity to line tie-ins from buildings known or suspected to have supported industrial activities, location of SWMUs that discharge to the line, lateral tie-ins and elbows, locations where line repairs and/or replacements are known or suspected to have occurred, and distance between sampling locations. Figure 9-6 shows sampling locations. The soil investigation was limited to the shallow subsurface. Subsurface line locations were confirmed using methods described in Section 3.0.

On April 19 and 20, 1995, eight boreholes were sampled using a Geoprobe. The sample interval at each borehole location was driven from the depth of the line to 5 ft below the line. From this interval, two samples were collected from each borehole: one at a depth equal to the base of the line, the other from 3 ft below the base of the line. Both samples were field-screened with a FID organic vapor meter and only the sample with the highest FID reading was submitted to the laboratory for analysis. If no elevated FID readings were detected, the sample collected at the depth closest to the base of the line was submitted for analysis. During the investigation along the sanitary sewer lines associated with sanitary sewer G (ST-284), five normal soil samples and two background soil samples were collected and submitted for laboratory analysis during the ST-284 investigation.

The analytical results from background samples collected during the Stage 2B RFI, and ST-284C-01B and ST-284C-03B collected during the Appendix III RFI were used as background concentration data for the samples collected at sanitary sewer G.

Sampling operations and sample handling procedures are described in Section 3.0. Sample depths and sample locations are listed in Table 9-14. Soil boring logs for the boreholes drilled and sampled at sanitary sewer G are in Appendix C.

9.7.2.4 Laboratory Analysis

The soil samples were analyzed for VOCs, SVOCs, TPH, metals, mercury (the potential contaminants associated with normal operations in this area), soil pH, and soil moisture. The four brass tubes in each 2-ft sample interval were field-screened for possible contamination using a beta-gamma meter and a FID. All field-screening instrument readings remained at background levels throughout sampling activities at sanitary sewer G.

Background samples collected during the Stage 2B RFI and at sanitary sewer G during the Appendix III RFI were used as background concentration data. Background samples were analyzed for TPH, VOCs, SVOCs, metals, soil pH, and soil moisture.

Table 9-14. Boreholes and Samples Analyzed from SWMU 10-1G, Sanitary Sewer G (ST-284)

Borehole	Borehole Location	Sample Depths (ft)
01	Adjacent to manhole at city interceptor, W of SW corner of commissary	12-14
01B	Background sample, 100 ft NW of borehole 01	12-14
02	Adjacent to manhole A11-1, E of base department store	4-6
02B	Background sample, 325 ft NE of borehole 02	4-6
03	Adjacent to manhole A11-4A1 in west courtyard area of old base hospital	8-10
03B	Background sample, 200 ft SE of borehole 03	8-10
04	Adjacent to manhole A11-4, NW of old base hospital	11-13
05	Adjacent to manhole A1D-A in parking lot SW of garden center	15-17

FID readings are values above background and are the high readings of the sample interval.

9.7.3 Site Characteristics

9.7.3.1 Geology

The area served by sanitary sewer G is underlain by unconsolidated alluvial sediment that is predominantly fine-grained sand and very fine-grained to fine-grained silty sand. Seven boreholes were drilled with a maximum depth of 20 ft below grade. No boreholes penetrated into the Santa Fe Group sediments that presumably underlie this area. A discussion of the general geology at Kirtland AFB is presented in Section 2.4.6.

As a result of the installation of the lines associated with sanitary sewer G, it is probable that backfill material is present around each line to a depth equal to each line's total depth. Borehole logs for this area are presented in Appendix C.

9.7.3.2 Hydrogeology

Groundwater beneath the lines associated with sanitary sewer G is found within the Upper Santa Fe sediment and is generally thought to be unconfined in the upper portion of the aquifer. This area is within the HR1 saturated zone setting as defined by SNL (Figure 2-9) (SNL, 1994). Hydrogeologic characterization in this portion of Kirtland AFB is complicated by the presence of numerous production wells (Figure 2-11). It is probable that uniform groundwater conditions do not exist in this region. Local

cones of depression associated with groundwater withdrawal have altered the groundwater flow direction in the vicinity of the well fields (Figure 2-7).

The gradient is probably north at this site. The production well located near sanitary sewer G is KAFB-1, 800 ft northwest. Depth to groundwater is estimated to be 350 ft below grade (Figure 2-10); however, shallower perched water zones may occur. Hydraulic conductivity within HR1 is estimated at 2 to 171 ft/day (SNL, 1994). A general discussion of the hydrogeology at Kirtland AFB is presented in Section 2.5.

9.7.4 Nature and Extent of Contamination

The following sections describe the nature and extent of contamination based on the analytical results. Analytical results for sanitary sewer G are summarized in Table 9-15, where only the reportable concentrations are listed. Full analytical results are presented in Appendix F. Laboratory validation reports are presented in Appendix K.

Organic Compounds

No VOC analytes were detected in any of the soil samples collected at sanitary sewer G.

Bis(2-ethylhexyl)phthalate was the only SVOC analyte detected in one of the five soil samples collected. The concentration detected of 0.46 mg/kg is below the HHRB action level of 46 mg/kg.

Petroleum Hydrocarbons

Diesel range hydrocarbons were detected in one soil sample at a concentration of 12 mg/kg. This concentration does not exceed the NMED action level of 100 mg/kg.

Metals

Table 9-15 lists all reportable metal concentrations detected at sanitary sewer G and the respective UTL and HHRB action level concentrations. Arsenic (0.78 to 4.4 mg/kg) was detected in all soil samples at concentrations above the HHRB action level of 0.37 mg/kg, but below the 6.5 mg/kg UTL. Beryllium (0.31 to 0.89 mg/kg) was detected in three of the five normal soil samples and one background soil sample at concentrations above the 0.15 mg/kg HHRB action level. With the exception of the concentration detected in ST-284C-02 of 0.89 mg/kg, all beryllium concentrations were below the 0.84 mg/kg UTL. Manganese was detected in one normal sample (454 mg/kg) and one background sample (485 mg/kg) at concentrations above the HHRB action level of 390 mg/kg, but below the 549 mg/kg UTL. These concentrations of arsenic, beryllium, and manganese appear to be naturally occurring at Kirtland AFB as discussed in Section 4.2.2.

Soil pH and Moisture

Soil pH values ranged from 8.2 to 9.2 in these samples. Soil moisture values ranged from 3.5 to 10.6 percent.

Table 9-15. Summary of Reportable Concentrations for Soil Analyses at SWMU 10-1G, Sanitary Sewer G (ST-284)[1]
(Concentrations mg/kg)

Chemical Class	Analyte	HHRB Action Level[2]	PQL UTL	Borehole Number and Sample Depth Interval (ft)							
				ST284C-01	*ST284C-01B*	*ST284C-02*	*ST284C-02B*	*ST284C-03*	*ST284C-03B*	*ST284C-04*	*ST284C-05*
				12–14	12–14	4–6	4–6	8–10	8–10	11–13	15–17
SVOC	Bis(2-ethylhexyl)phthalate	46.0	0.70	ND	ND	ND	ND	ND	ND	0.46	ND
TPH	Diesel fraction	100	10.0	ND	ND	ND	ND	12.0	ND	ND	ND
METALS	Aluminum	78,000	14,700	6,960	4,780	19,000	4,210	6,240	11,700	4,840	4,550
	Arsenic	0.37	6.5	2.2	1.2	4.4	0.78	1.9	2.4	1.5	1.2
	Barium	5,500	735	172	105	325	48.3	119	227	74.8	83.9
	Beryllium	0.15	0.84	0.41	ND	0.89	ND	0.31	0.56	ND	ND
	Cadmium	39.0	N/A	0.93	0.51	ND	ND	0.93	0.56	0.84	0.52
	Calcium	N/A	121,000	23,000	47,800	39,500	10,900	28,300	27,800	56,800	32,700
	Chromium, total	390	21.6	7.0	5.0	14.1	6.7	8.9	12.9	5.1	5.1
	Cobalt	4,700	15.4	8.1	6.9	10.0	6.1	5.8	9.4	6.9	8.8
	Copper	2,900	223	40.1	56.0	46.8	42.8	44.8	16.6	92.1	66.6
	Iron	N/A	23,800	16,100	12,400	21,600	12,300	12,200	17,800	13,300	11,900
	Lead	400	17.5	5.3	4.9	10.3	3.6	19.9	8.6	3.6	3.4
	Magnesium	N/A	10,400	4,670	4,310	8,460	3,200	3,330	6,930	3,420	2,970
	Manganese	390	549	293	307	454	204	186	485	260	236
	Nickel	1,600	188	7.3	7.1	15.1	5.7	334	12.7	5.7	5.2
	Potassium	N/A	3,590	1,920	1,750	3,720	1,600	1,500	2,450	1,390	1,290
	Sodium	N/A	787	663	180	1,770	83.7	180	163	118	111
	Thallium	N/A	N/A	0.10	ND	0.22	0.12	ND	0.16	ND	0.10
	Vanadium	550	55.3	27.5	20.3	45.5	22.1	26.6	29.5	25.3	22.4
	Zinc	23,000	114	43.6	51.0	60.9	39.4	31.5	48.8	53.5	40.8
OTHER	Moisture (%)			3.5	2.8	10.6	2.2	3.5	10.2	5.3	4.5
	pH			9.1	9.2	8.8	9.2	8.7	8.8	8.2	8.6

FOOTNOTES

1	Complete laboratory analytical results and method detection limits are presented in Appendix K.
2	Action level of RCRA Proposed Rule Subpart S (55 FR 30814, 7/27/90).
*	TPH action level is 100 mg/kg adopted from NMED UST regulations (NMED, 1990). SW-8015 analyzes volatile and semivolatile petroleum hydrocarbon fractions separately. The total concentration of the two fractions analyzed under SW-8015 will be used to assess compliance with stipulated action levels for the purpose of this RFI.
#	Denotes TCLP analysis, results in mg/l.
--	No Data.
FR	Field Replicate.
HHRB	Human health risk based.
J	Estimated value.
N/A	Not Applicable.
NA	Not Analyzed.
ND	Not detected above the method detection limit.
pCi/g	picocuries per gram.
PQL	Practical quantitation limits (defines VOC, SVOC, and TPH).
R	Reject NDs due to interference.
RAD	Radionuclides.
RE	Resample.
SVOC	Semivolatile organic compounds.
TPH	Total petroleum hydrocarbons.
U	Accept data (positive results may be influenced by lab contamination).
UJ	Estimated nondetect.
UTL	Upper tolerance limits (defines metals).
VOC	Volatile organic compounds.

9.7.5 Conclusions and Recommendations

Conclusions

- No VOCs and one SVOC were detected in the soil samples collected from this site. All concentrations were below HHRB action levels.
- No gasoline or diesel range hydrocarbons were detected at concentrations above the NMED action levels. The TPH concentration measured in one sample at this site was similar to those measured in background samples collected during the Appendix III RFI. The TPH detections alone are not conclusive of a release from this unit. Because no other release components (such as VOCs, SVOCs, or metals) are present, it is probable that a release has not occurred.
- Arsenic, beryllium, and manganese were the only metals detected at concentrations exceeding the HHRB action level; these concentrations appear to be naturally occurring throughout Kirtland AFB.
- The analytical results from sanitary sewer G are not indicative of a release from this site.

Recommendations

- Based on the findings of the RFI, no further action is necessary; therefore, sanitary sewer G does not require further investigation. A No Further Action proposal should be prepared.

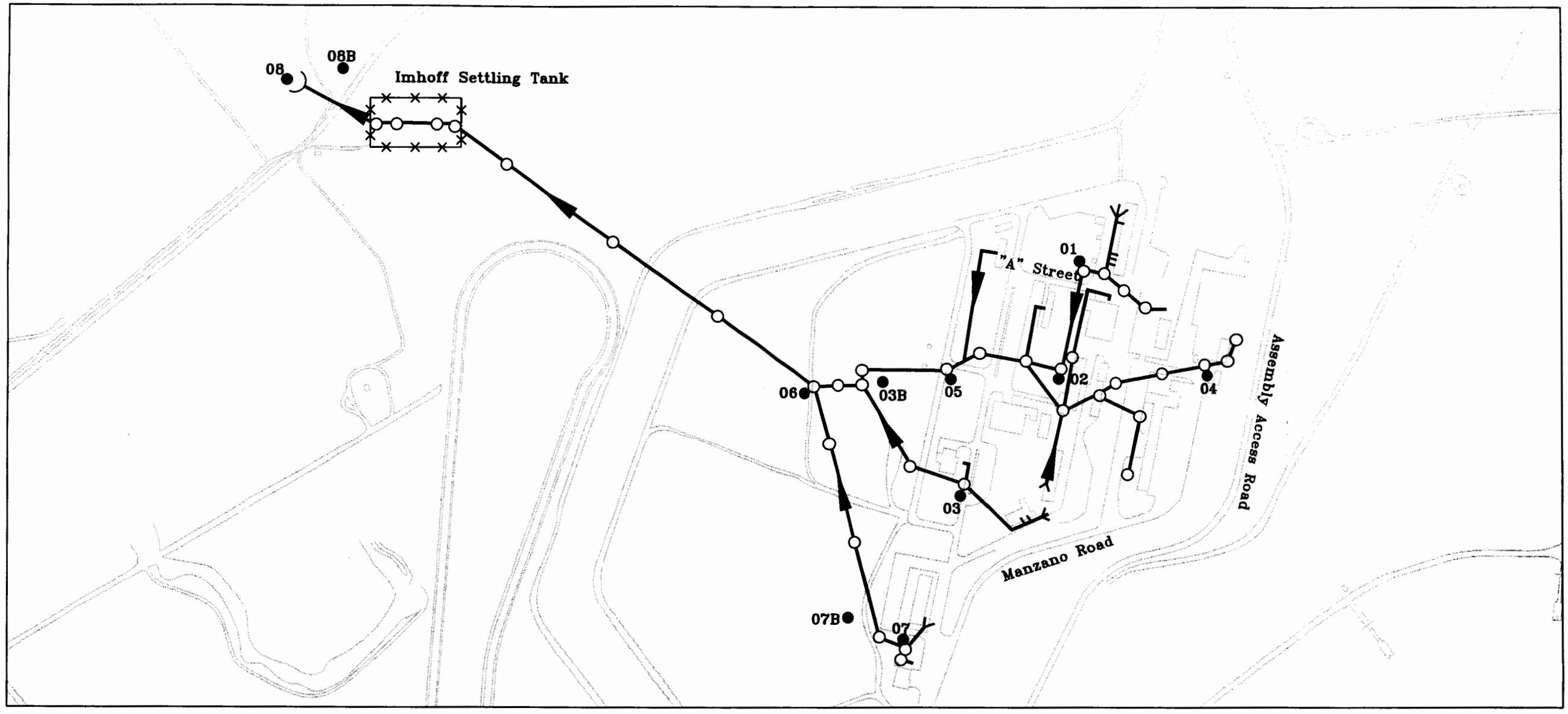
9.8 SWMU 10-1H, Manzano Sanitary Sewer (ST-327)

9.8.1 Site Background and Environmental Setting

Manzano sanitary sewer (ST-327), designated as SWMU 10-1H, in Module IV of the RCRA Part B Permit, the sanitary sewer for the southwest portion of the Manzano area of Kirtland AFB, was also investigated as part of the Appendix III RFI. The general location of the lines associated with the Manzano sanitary sewer and the borehole locations are shown on Figure 9-7. The IRP designation for SWMU 10-1H is ST-327. During the RFI field activities, its IRP designation was ST-MBSS. The borehole designations correlate with this former IRP designation.

The Manzano sanitary sewer serves two other SWMUs: one is an OWS in Building 30142 (SWMU 10-7, ST-264), the Manzano vehicle maintenance shop, and the other is an OWS in Building 30146 (SWMU 10-7, ST-265), the Manzano security police garage. The nearest production well to the Manzano sanitary sewer is KAFB-11, 2.5 mi north.

The MWSA was formerly an Atomic Energy Commission (AEC) installation occupied by SNL from the late 1940s to the early 1960s. During the early 1960s, the installation was turned over to the USAF. During the AEC period, the sanitary sewer received waste primarily from nonindustrial and/or administrative buildings. Industrial activities that are on record as having discharged to the Manzano sanitary sewer were limited to vehicle maintenance operations.



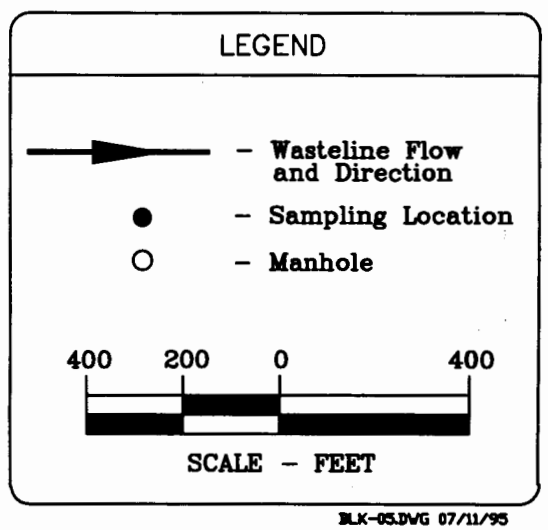


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Figure 9-7

Soil Sampling Locations at SWMU 10-1H, Manzano Sanitary Sewer (ST-327)

The sanitary sewer at the Manzano portion of Kirtland AFB is approximately 1.7 mi of mapped line of varying diameters (10, 8, and 6 in.). The Manzano sanitary sewer line consists both of reinforced concrete pipe and clay pipe. Table 9-16 lists the buildings, associated SWMUs, and number of sanitary sewer tie-in locations that have been mapped.

9.8.2 Study Area Investigation

9.8.2.1 Previous Investigations

No previous investigations have been performed on the subsurface soil surrounding the sanitary sewer system.

9.8.2.2 Data Gaps

Prior to the Appendix III RFI, no data were available to determine the presence or absence of contamination in the subsurface soil surrounding the sanitary sewer at Manzano.

9.8.2.3 RFI Field Investigation

The objective of the Manzano sanitary sewer investigation was to determine if contamination exists in the soils adjacent to the sanitary sewer lines. Location of sanitary sewer lines and sample borehole designations were completed prior to the startup of the soil sampling effort. Locations for collection of subsurface soil samples were selected based on the vicinity to line tie-ins from buildings known or suspected to have supported industrial activities; location of SWMUs that discharge to the line; lateral tie-ins and elbows; locations where line repairs and/or replacements are known or suspected to have occurred; and distance between sampling locations. Figure 9-7 shows sampling locations. The soil investigation was limited to the shallow subsurface. Subsurface line locations were confirmed using methods described in Section 3.0.

From April 20 to 24, 1995, 11 boreholes were sampled using a Geoprobe. The sample interval at each borehole location was driven from the depth of the line to 5 ft below the line. From this interval, two samples were collected from each borehole: one at a depth equal to the base of the line, the other from 3 ft below the base of the line. Both samples were field-screened with a FID organic vapor meter and only the sample with the highest FID reading was submitted to the laboratory for analysis. If no elevated FID readings were detected, the sample collected at the depth closest to the base of the line was submitted for analysis. Eight normal soil samples, one field replicate, and three background samples were collected during investigation along the sanitary sewer lines associated with the Manzano sanitary sewer and submitted for laboratory analysis.

The analytical results from background samples collected during the Stage 2B RFI and ST-MBSS-07B collected during the Appendix III RFI, were used as background concentration data for the samples collected at the Manzano sanitary sewer.

Table 9-16. Buildings Connected to SWMU 10-1H, Manzano Sanitary Sewer (ST-327)

Building No.	Building Name	Activity	SWMU No. (Kirtland AFB No.)	No. of Sanitary Sewer Line Tie-Ins
30108	Sanitary Latrine	Septic/Domestic Waste Conveyor	-	1
30113	Swimmers Bathhouse (Demolished)	Septic/Domestic Waste Conveyor	-	1
30116	Fire Station	Fire Response Equipment Maintenance and Storage	-	1
30117	MWSA Headquarters	Administrative	-	3
30120	Technical Training Laboratory/Shop	Training/Laboratory Operations	-	1
30124	Paving & Grounds Facility	Paving and Grounds Equipment Maintenance and Storage	-	1
30126	Kennel	Canine Boarding	-	1
30129	Technical Training Classroom	Training and Instruction	-	1
30130	Technical Training Classroom	Training and Instruction	-	1
30131	Technical Training Classroom	Training and Instruction	-	1
30132	Technical Training Classroom	Training and Instruction	-	1
30133	Electrical Research Laboratory	Research Operations	-	5
30134	Research Equipment Storage	Storage Operations	-	3
30136	Training Aids Shop	Storage and Distribution	-	1
30142	Vehicle Maintenance Shop	Vehicle Maintenance	10-7 (ST-264 - OWS)	1
30143	Technical Training Classroom	Training and Instruction	-	2
31046	Security Police Central Controls	Police Personnel Headquarters: Police Equipment Maintenance and Storage	10-7 (ST-265 - OWS)	1

Sampling operations and sample handling procedures are described in Section 3.0. Sample depths, sample locations, and replicate samples collected during the Appendix III RFI are listed in Table 9-17. Soil boring logs for the boreholes drilled and sampled along the Manzano sanitary sewer are in Appendix C.

Table 9-17. Boreholes and Samples Analyzed from SWMU 10-1H, Manzano Sanitary Sewer (ST-327)

Borehole	Borehole Location	Sample Depths (ft)
01	Adjacent to manhole 22, W of Space Power Laboratory	5-10
02	Adjacent to manhole 21, N of Building 30131	8-13[a]
03	Adjacent to manhole 40, NW of NW corner of D St. and Barrack Rd.	6-8
03B	Background sample, 425 ft NW of borehole 03	6-8
04	Adjacent to manhole 34, W of Building 30145	6-8
05	Adjacent to manhole 18 in intersection of Vandenberg Rd. and C St.	10-12
06	Adjacent to manhole 9, SW of softball field	5-7
07	Adjacent to manhole 13, NW of Fire Station	14-16
07B	Background sample, 200 ft NW of borehole 07	14-16
08	Below effluent pipe at SE corner of retention pond	0-2
08B	Background sample, 200 ft NE of borehole 08	0-2

a. Replicate sample also collected at this interval.

9.8.2.4 Laboratory Analysis

The soil samples were analyzed for VOCs, SVOCs, TPH, metals, mercury (the potential contaminants associated with normal operations in this area), soil pH, and soil moisture. The four brass tubes in each 2-ft sample interval were field-screened for possible contamination using a beta-gamma meter and a FID. All field-screening instrument readings remained at background levels throughout sampling activities for the Manzano sanitary sewer.

Background samples collected during the Stage 2B RFI and at the Manzano sanitary sewer during the Appendix III RFI were used as background concentration data. Background samples were analyzed for TPH, VOCs, SVOCs, metals, soil pH, and soil moisture.

9.8.3 Site Characteristics

9.8.3.1 Geology

The MWSA is a facilities area isolated from the main urban/industrial part of Kirtland AFB. It is located at the foot of a mountain on the east boundary of the Albuquerque-Belen Basin. The Santa Fe Group at the location of the sanitary sewer is thin or absent. Auger holes drilled by the USGS about 1,200 ft west of Manzano sanitary sewer (toward the Albuquerque-Belen Basin) penetrated weathered granite at about 100 ft; granite may be shallower in this area. The alluvium contains coarse-grained granite wash, but near the mountain front, it may be poorly sorted. Thus, permeability may be low regardless of the coarse-grained material. Surface soil is gravelly.

9.8.3.2 Hydrogeology

The holes drilled to the west during previous investigations ended in granite before penetrating a distinct water table. If a water table is present in this area, the direction of flow is probably west because of the geology of the area. However, with little or no inflow from the east, the flux of water may be very small. Groundwater percolating through this area probably would eventually discharge by way of production wells under current conditions of groundwater development. The nearest production well to the Manzano sanitary sewer is KAFB-11, 2.5 mi north. Groundwater quality is unknown, but is assumed to be potable on the basis of groundwater quality in the basin to the west.

Surface Water: The land surface slopes west at about 2 percent. Drainage is well controlled in the vicinity of the sanitary sewer and discharges west to the Arroyo del Coyote and the Tijeras Arroyo. Surface water flows result only from intense storms. The chemical quality of streamflow is unknown. Surface water has no economic use before it joins the Rio Grande about 9 mi west. Erosion of surface soil is moderated by the coarseness of the soil. Because of the distance to a perennial stream, surface-water-borne contaminants would disperse to soil and might eventually migrate to groundwater by way of surface flows that infiltrate the normally dry channel bottoms.

9.8.4 Nature and Extent of Contamination

The following sections describe the nature and extent of contamination based on the analytical results. Analytical results for the Manzano sanitary sewer are summarized in Table 9-18, where only the reportable concentrations are listed. Full analytical results are presented in Appendix F. Laboratory validation reports are presented in Appendix K.

Organic Compounds

No VOC analytes were detected in the soil samples collected and submitted for analysis from the Manzano sanitary sewer.

Bis(2-ethylhexyl)phthalate was detected in one background soil sample at a concentration of 0.39 mg/kg, below the HHRB action level of 46 mg/kg.

Petroleum Hydrocarbons

No gasoline range hydrocarbons were detected in the soil samples collected and submitted for analysis along the Manzano sanitary sewer.

Diesel range hydrocarbons (5.9 to 8.8 mg/kg) were detected in three soil samples collected and submitted for analysis along the Manzano sanitary sewer. The detections do not exceed the NMED action level of 100 mg/kg.

Metals

Table 9-18 lists all reportable metal concentrations detected along the Manzano sanitary sewer and the respective UTL and HHRB action level concentrations. Arsenic (0.86 to 3.1 mg/kg) was detected in all soil samples at concentrations above the HHRB action level of 0.37 mg/kg, but below the 6.5 mg/kg UTL. Beryllium (0.30 to 0.66 mg/kg) was detected in all soil samples at concentrations above the 0.15 mg/kg HHRB action level, but below the 0.84 mg/kg UTL. Manganese was detected in five samples above the 390 mg/kg HHRB action level, but below the 549 mg/kg UTL. These concentrations of arsenic, beryllium, and manganese appear to be naturally occurring at Kirtland AFB as discussed in Section 4.2.2.

Soil pH and Moisture

Soil pH values ranged from 7.8 to 8.8 in these samples. Soil moisture values ranged from 2.2 to 17.0 percent.

9.8.5 Conclusions and Recommendations

Conclusions

- No VOCs and one SVOC were detected in the soil samples collected from this site; all concentrations were below HHRB action levels.
- No gasoline range hydrocarbons were detected in the soil samples submitted for analysis along the Manzano sanitary sewer. Diesel range hydrocarbons were detected at concentrations below the 100 mg/kg NMED action level. The TPH concentrations measured at this site were similar to those measured in background samples collected during the Appendix III RFI. The TPH detections alone are not conclusive of a release from this unit. Because no other release components (such as VOCs, SVOCs, or metals) are present, it is probable that a release has not occurred.

Table 9-18. Summary of Reportable Concentrations for Soil Analyses at SWMU 10-1H, Manzano Sanitary Sewer (ST-327)[1]
(Concentrations mg/kg)

Chemical Class	Analyte	HHRB Action Level[2]	UTL	Borehole Number and Sample Depth Interval (ft)						
				STMBSS-01	*STMBSS-02*		*STMBSS-03*	*STMBSS-03B*	*STMBSS-04*	*STMBSS-05*
				5–10	8–13 FR	8–13	6–8	6–8	6–8	10–12
SVOC	Bis(2-ethylhexyl)phthalate	46.0	0.70	ND	ND	ND	ND	ND	ND	ND
TPH	Diesel fraction	100	10.0	ND	ND	ND	ND	8.8	ND	ND
METALS	Aluminum	78,000	14,700	11,300	10,300	10,700	8,260	8,730	7,830	5,600
	Arsenic	0.37	6.5	1.7	2.9	1.4	1.1	1.8	0.95	1.4
	Barium	5,500	735	102	97.1	147	76.4	94.9	106	50.0
	Beryllium	0.15	0.84	0.52	0.43	0.32	0.42	0.33	0.30	0.32
	Cadmium	39.0	N/A	1.0	0.86	1.1	ND	ND	0.51	ND
	Calcium	N/A	121,000	15,600	27,700	30,900	4,510	44,600	23,600	6,150
	Chromium, total	390	21.6	9.8	9.0	35.6	7.9	18.2	18.3	7.7
	Cobalt	4,700	15.4	15.8	12.0	13.9	14.1	9.9	11.0	6.8
	Copper	2,900	223	98.1	41.3	153	28.1	28.7	116	37.0
	Iron	N/A	23,800	28,000	21,000	19,400	23,100	14,800	15,500	12,000
	Lead	400	17.5	7.5	5.5	3.4	4.9	5.5	3.8	4.3
	Magnesium	N/A	10,400	7,360	8,080	8,030	6,360	5,920	6,120	3,600
	Manganese	390	549	475	323	303	401	301	318	235
	Nickel	1,600	188	20.0	14.6	147	8.9	16.3	10.3	5.5
	Potassium	N/A	3,590	3,270	2,610	2,890	3,270	2,200	2,500	1,740
	Sodium	N/A	787	169	190	223	95.8	97.7	90.9	82.1
	Thallium	N/A	N/A	0.28	0.23	ND	0.20	ND	0.19	0.16
	Vanadium	550	55.3	53.4	44.2	47.9	45.0	29.3	31.0	21.8
	Zinc	23,000	114	82.8	51.0	71.5	52.8	42.5	74.1	69.9
OTHER	Moisture (%)			3.8	7.0	6.4	4.1	8.0	1.6	5.4
	pH			8.0	8.4	8.3	8.2	8.8	8.4	8.2

Table 9-18. Summary of Reportable Concentrations for Soil Analyses at SWMU 10-1H, Manzano Sanitary Sewer (ST-327)[1]
(Concentrations mg/kg) (Continued)

Chemical Class	Analyte	HHRB Action Level[2]	UTL	Borehole Number and Sample Depth Interval (ft)				
				STMBSS-06 5–7	*STMBSS-07* 14–16	*STMBSS-07B* 14–16	*STMBSS-08* 0–2	*STMBSS-08B* 0–2
SVOC	Bis(2-ethylhexyl)phthalate	46.0	0.70	ND	ND	0.39	ND	ND
TPH	Diesel fraction	100	10.0	ND	ND	5.9	ND	7.9
METALS	Aluminum	78,000	10,600	9,640	7,850	10,600	7,250	15,600
	Arsenic	0.37	3.1	2.2	2.3	3.1	0.86	2.4
	Barium	5,500	165	142	152	165	97.7	206
	Beryllium	0.15	0.41	0.54	0.32	0.41	0.44	0.66
	Cadmium	39.0	0.72	ND	0.64	0.72	ND	0.55
	Calcium	N/A	49,400	3,380	25,700	49,400	10,600	22,100
	Chromium, total	390	29.9	13.1	10.2	29.9	8.0	15.8
	Cobalt	4,700	13.8	9.6	9.4	13.8	7.0	11.5
	Copper	2,900	134	49.4	103	134	34.0	23.5
	Iron	N/A	18,500	16,500	15,400	18,500	12,900	20,500
	Lead	400	6.3	6.3	4.3	6.3	4.7	9.7
	Magnesium	N/A	9,940	5,500	6,750	9,940	4,220	7,030
	Manganese	390	396	392	287	396	193	517
	Nickel	1,600	26.9	13.4	10.0	26.9	6.4	12.4
	Potassium	N/A	2,690	2,110	2,210	2,690	1,940	3,110
	Sodium	N/A	288	368	485	288	72.1	411
	Thallium	N/A	0.15	0.18	0.13	0.15	0.13	0.21
	Vanadium	550	47.7	30.0	32.0	47.7	22.6	37.6
	Zinc	23,000	82.0	51.4	81.5	82.0	43.1	57.0
OTHER	Moisture (%)			6.6	6.0	3.0	9.9	9.4
	pH			8.5	8.4	8.9	8.4	9.3

FOOTNOTES

1	Complete laboratory analytical results and method detection limits are presented in Appendix K.
2	Action level of RCRA Proposed Rule Subpart S (55 FR 30814, 7/27/90).
*	TPH action level is 100 mg/kg adopted from NMED UST regulations (NMED, 1990). SW-8015 analyzes volatile and semivolatile petroleum hydrocarbon fractions separately. The total concentration of the two fractions analyzed under SW-8015 will be used to assess compliance with stipulated action levels for the purpose of this RFI.
#	Denotes TCLP analysis, results in mg/l.
–	No Data.
FR	Field Replicate.
HHRB	Human health risk based.
J	Estimated value.
N/A	Not Applicable.
NA	Not Analyzed.
ND	Not detected above the method detection limit.
pCi/g	picocuries per gram.
PQL	Practical quantitation limits (defines VOC, SVOC, and TPH).
R	Reject NDs due to interference.
RAD	Radionuclides.
RE	Resample.
SVOC	Semivolatile organic compounds.
TPH	Total petroleum hydrocarbons.
U	Accept data (positive results may be influenced by lab contamination).
UJ	Estimated nondetect.
UTL	Upper tolerance limits (defines metals).
VOC	Volatile organic compounds.

- Arsenic, beryllium, and manganese were the only metals detected at concentrations exceeding the HHRB action level; these concentrations appear to be naturally occurring throughout Kirtland AFB.

- The analytical results along the Manzano sanitary sewer are not indicative of a release from this site.

Recommendations

- Based on the findings of the RFI, no further action is necessary; therefore, the Manzano sanitary sewer does not require further investigation. A No Further Action proposal should be prepared.

10.0 Miscellaneous Wasteline Sites

Four miscellaneous sites associated with SWMU 10-7 and one site classified as an AOC were investigated as part of the Appendix III RFI. Figure 10-1 presents the investigative plan for these units on Kirtland AFB. These miscellaneous sites include the lines associated with three sewage ejector units, one catch basin, and one sump. Two of the sewage ejector units and the catch basin serve other SWMUs; the remaining sewage ejector unit and sump have not been identified to be associated with other SWMUs.

The soil samples collected for the miscellaneous units during Stage 2B RFI activities were used to characterize the soil adjacent to line lengths within 50 ft from the unit(s) or in the case of the sump the underlying soil. The specific miscellaneous units (and associated lines) investigated during the Appendix III RFI are discussed in Sections 10.1 through 10.5.

10.1 SWMU 10-7, Building 336, Catch Basin Lines (ST-209)

10.1.1 Site Background and Environmental Setting

ST-209 is near the north side of Building 336, the AC jet engine shop. OWS ST-207 at Building 336 received drainage from ST-209.

ST-209 is a large, rectangular receptacle located below grade in the jet engine shop. Covered by a metal grate, the basin is 12 ft x 14 ft (outside dimensions) and more than 6 ft deep. The catch basin drains into ST-207, 50 ft northeast. In addition, records indicate that ST-209 receives drainage from a wash area, but no registry exists to document the items being washed.

ST-209 is in the urban/industrial zone. Two production wells are located near ST-209: KAFB-13 is 2,900 ft west-northwest and KAFB-14 is 2,800 ft east-northeast.

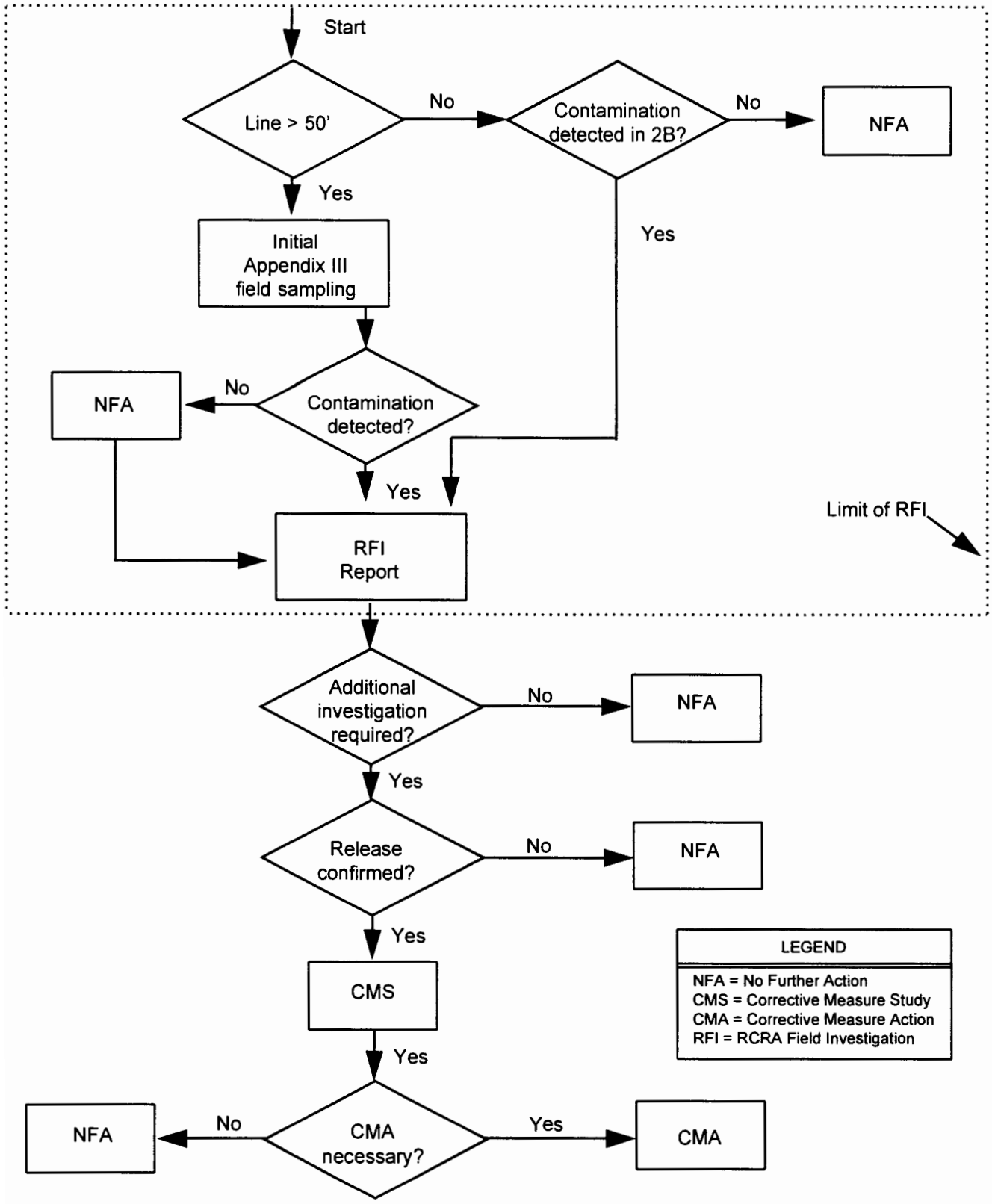
10.1.2 Study Area Investigation

Since ST-209 has line lengths less than 50 ft, the area of investigation for the lines associated with this unit used data obtained during the Stage 2B RFI. Results of the Stage 2B RFI that pertain to ST-209 are described in the following section.

10.1.2.1 Previous Investigations

During the Stage 2B RFI, subsurface soil samples were collected from the perimeter of catch basin ST-209. Analytical results do not indicate that contaminants had been released at the site.

Figure 10-1.
Investigative Plan for Miscellaneous Lines



10.1.2.2 Data Gaps

No information related to the past use of ST-209 was available. No data were available to determine the presence or absence of contaminants in the subsurface soil surrounding the lines serving this unit.

10.1.2.3 RFI Field Investigation

Based on engineering drawings, there are no inflow lines to ST-209 and the outflow line from ST-209 to OWS ST-207 is less than 50 ft. The samples collected for the catch basin unit during the Stage 2B RFI were used to characterize the soil adjacent to line lengths within 50 ft from the unit(s). In this instance, samples collected during the Stage 2B RFI should adequately characterize soil conditions surrounding the outflow line. Line location activities were performed as described in Section 3.0.

10.1.3 Conclusions and Recommendations

Conclusions

- The analytical results from the Stage 2B RFI are not indicative of a release from this unit.

Recommendations

- Based on the findings of the RFI, no further action is necessary; therefore, ST-209 does not require further investigation. A No Further Action proposal should be prepared.

10.2 SWMU 10-7, Building 1031, Sewage Ejector Unit Lines (ST-223)

10.2.1 Site Description and Environmental Setting

ST-223 is located between Building 1031 and an adjacent jet engine test cell. Building 1031 and the jet engine test cell are used for testing and maintaining jet engines. The general location of the unit and the associated lines are shown on Figure 10-2. ST-223 is linked with OWS ST-222 and the wastewater holding tank. The inflow source to this unit is the discharge from OWS ST-222, 8 ft north (Section 5.18). The discharge from ST-223 runs to a wastewater holding tank at the southeast corner of Building 1031.

This unit is in the urban/industrial zone. Three production wells are located near ST-223: KAFB-2 is 2,400 ft southeast, KAFB-7 is 2,400 ft southwest, and KAFB-1 is 4,800 ft east-northeast.

10.2.2 Study Area Investigation

The investigation was limited to the subsurface soil surrounding the outflow lines from ST-223. Possible source materials in the sewage ejector unit were not investigated in this study.

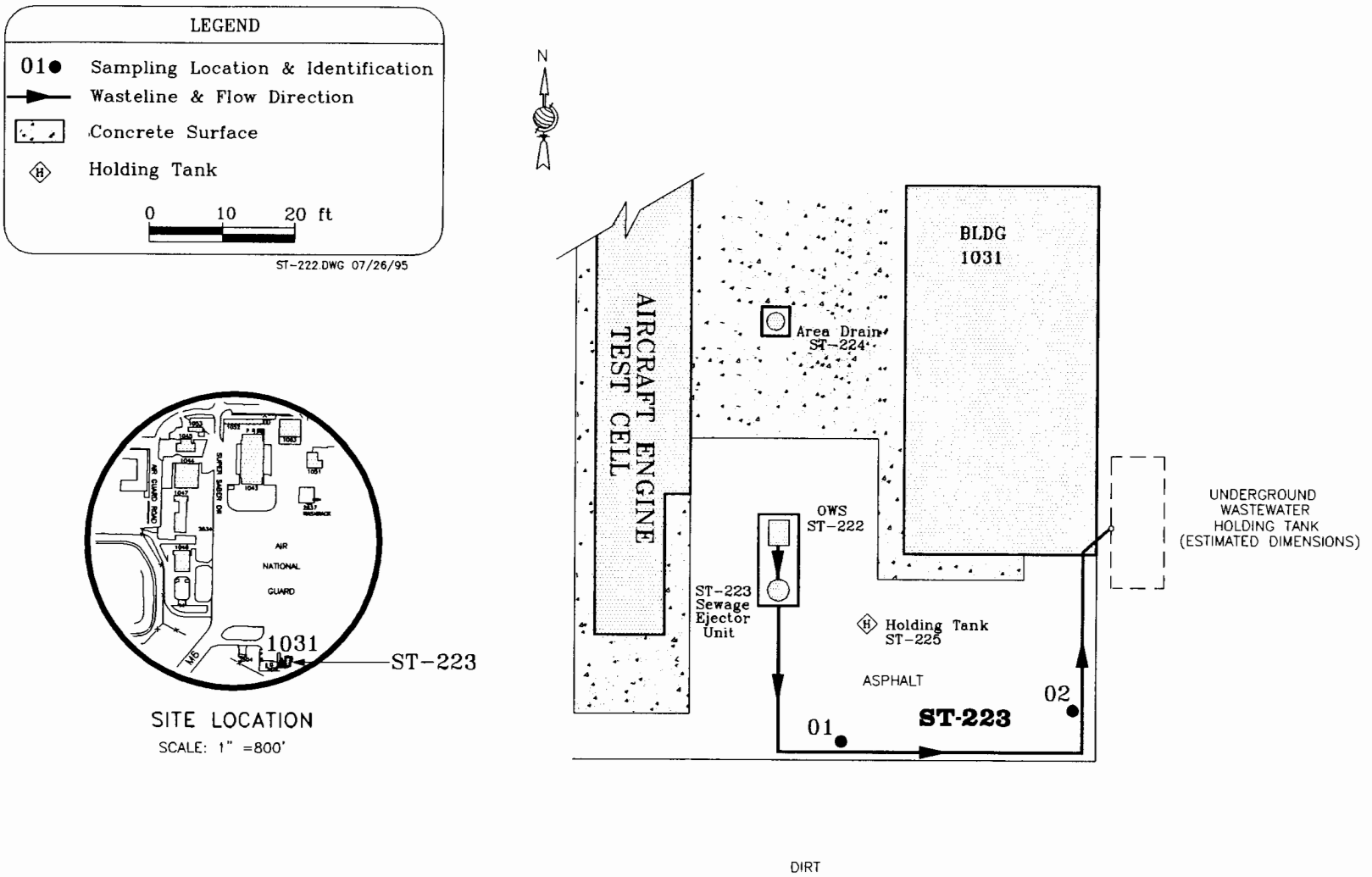


Figure 10-2. Soil Sampling Locations at SWMU 10-7, Building 1031, Sewage Ejector Unit Lines (ST-223)

10.2.2.1 Previous Investigations

During the Stage 2B RFI, subsurface soil samples were collected from the perimeter of OWS ST-223. Analytical results did not indicate that contaminants had been released at the site.

10.2.2.2 Data Gaps

No information related to the past use of ST-223 was available. No data were available to determine the presence or absence of contaminants in the subsurface soil surrounding the lines serving this unit.

10.2.2.3 RFI Field Investigation

The objective of the investigation was to determine if contamination exists in the adjacent soil. Location of wastelines and sample borehole designation were completed prior to the startup of the soil sampling effort. The soil investigation was limited to the near surface vadose zone.

Analytical results from samples collected during the Stage 2B RFI were used to characterize the soil adjacent to the inflow and outflow lines within a 50-ft radius of ST-223. Based on engineering drawings, the inflow line to ST-223 is the discharge from OWS ST-222 approximately 8 ft north (Section 5.18). The outflow from ST-223 runs 20 ft south then turns to run approximately 40 ft east, before finally turning and running about 28 ft north to enter a buried wastewater holding tank at the southeast corner of Building 1031. Subsurface line locations were confirmed using methods described in Section 3.0.

On February 2, 1995, two boreholes were drilled and sampled using a Geoprobe. The sample interval at each borehole location extended from the depth of the line to 5 ft below the line. From this interval, two samples were collected from each borehole: one at a depth equal to the base of the line, the other from 3 ft below the base of the line. Both samples were field-screened with a FID organic vapor meter and only the sample with the highest FID reading was submitted to the laboratory for analysis. If there were no elevated FID readings, the sample collected at the depth closest to the base of the line was submitted for analysis. Along the lines serving ST-223, two soil samples were collected and submitted for laboratory analysis during the Appendix III RFI.

Because of the proximity of ST-222, ST-223, ST-224, and ST-225, the analytical results from background sample ST-222-01, collected during the Stage 2B RFI, were used as background concentration data for samples collected at these units.

Sampling operations and sample handling procedures are described in Section 3.0. Sample depths and locations are listed in Table 10-1. Soil boring logs for the boreholes drilled and sampled at ST-223 are in Appendix C.

Table 10-1. Boreholes and Samples Analyzed from SWMU 10-7, Building 1031, Sewage Ejector Unit Lines (ST-223)

Borehole	Borehole Location	Sample Depths (ft)
01	8.5 ft W and 26.5 ft S of the SW corner of Building 1031	2-4
02	29 ft E and 22 ft S of the SW corner of Building 1031	3-8

10.2.2.4 Laboratory Analysis

The soil samples were analyzed for VOCs, SVOCs, TPH, metals, mercury (the potential contaminants associated with normal operations at this site), soil pH, and soil moisture. The four brass tubes in each 2-ft sample interval were field-screened for possible contamination using a beta-gamma meter (per worker health and safety procedures) and a FID. All field-screening instrument readings remained at background levels throughout the Appendix III RFI sampling activities at ST-223.

ST-222-01, collected during the Stage 2B RFI, was used as a background sample during the investigation of the inflow and outflow lines at ST-223. The soil sampling and analysis at the background hole included analyses for TPH, VOCs, SVOCs, metals, soil pH, and soil moisture.

10.2.3 Site Characteristics

10.2.3.1 Geology

The Building 1031 area is underlain by unconsolidated alluvial sediment that is predominantly very fine-grained to fine-grained sand to silty sand and sandy silt. Two boreholes were drilled at Building 1031 to a maximum depth of 9 ft. No borehole penetrated into the Santa Fe Group sediments that presumably underlie this area. A discussion of the general geology at Kirtland AFB is presented in Section 2.5.

As a result of line installation, it is probable that backfill material is present adjacent to each line to a depth equal to the total depth of each line. Borehole logs for this area are presented in Appendix C.

10.2.3.2 Hydrogeology

Groundwater beneath ST-223 is found within the Upper Santa Fe sediments and is generally thought to be unconfined in the upper portion of the aquifer. This area is within the HR1 saturated zone setting as defined by SNL (Figure 2-9) (SNL, 1994). Hydrogeologic characterization in this portion of Kirtland AFB is complicated by the presence of numerous production wells (Figure 2-11). It is probable that uniform groundwater conditions do not exist in this region. Local cones of depression associated with groundwater withdrawal have altered the groundwater flow direction in the vicinity of the well fields (Figure 2-7).

The gradient is probably north at this site. Three production wells are located near ST-223: KAFB-2 is 2,400 ft west-northwest, KAFB-1 is 4,800 ft east-northeast, and KAFB-7 is 2,400 ft southwest. All three wells are most likely upgradient (Figures 2-7 and 2-11). Depth to groundwater is estimated to be 350 ft below grade (Figure 2-10); however, shallower perched water zones may occur. Hydraulic conductivity within HR1 is estimated at 2 to 171 ft/day (SNL, 1994). A general discussion of the hydrogeology at Kirtland AFB is presented in Section 2.5.

10.2.4 Nature and Extent of Contamination

The following sections describe the nature and extent of contamination based on the analytical results. Analytical results for ST-223 are presented in Table 10-2, where only the reportable concentrations are listed. Full analytical results are presented in Appendix F. Laboratory validation reports are presented in Appendix K.

Organic Compounds

No VOC or SVOC analytes were detected in either of the two soil samples collected and submitted for analysis from ST-223.

Petroleum Hydrocarbons

Diesel range hydrocarbons were detected in both of the samples at ST-223 (7.0 and 8.9 mg/kg); these concentrations do not exceed the NMED action level of 100 mg/kg (Table 10-2).

Metals

Table 10-2 lists all metal concentrations reported at ST-223 and the respective UTL and HHRB action level concentrations. Arsenic (2.8 and 2.7 mg/kg) was detected in both of the soil samples at concentrations above the HHRB action level of 0.37 mg/kg, but below the 6.5 mg/kg UTL.

Soil pH and Moisture

Soil pH values were 9.0 and 9.2 in these samples. Soil moisture values were 8.2 and 4.4 percent (Table 10-2).

10.2.5 Conclusions and Recommendations

Conclusions

- No VOCs or SVOCs were detected in the soil samples collected and submitted for analysis from this site.

Table 10-2. Summary of Reportable Concentrations for Soil Analyses at SWMU 10-7, Building 1031, Sewage Ejector Unit Lines (ST-223)[1] (Concentration mg/kg)

Chemical Class	Analyte	HHRB Action Level[2]	PQL UTL	Borehole Number and Sample Depth Interval (ft)	
				ST223C-01	*ST223C-02*
				2–4	3–8
TPH	Diesel fraction	100	10.0	7.0	8.9
METALS	Aluminum	78,000	14,700	5,740	4,450
	Arsenic	0.37	6.5	2.8	2.7
	Barium	5,500	735	241	216
	Calcium	N/A	121,000	65,400	44,900
	Chromium, total	390	21.6	5.3	4.2
	Cobalt	4,700	15.4	3.4	4.3
	Copper	2,900	223	17.5	27.2
	Iron	N/A	23,800	7,480	6,900
	Lead	400	17.5	3.4	2.7
	Magnesium	N/A	10,400	4,650	2,770
	Manganese	390	549	93.5	81.4
	Nickel	1,600	188	6.5	3.8
	Potassium	N/A	3,590	845	636
	Sodium	N/A	787	198	153
	Vanadium	550	55.3	24.7	26.9
	Zinc	23,000	114	18.2	18.7
OTHER	pH			9.0	9.2
	Moisture (%)			8.2	4.4

FOOTNOTES

1	Complete laboratory analytical results and method detection limits are presented in Appendix K.
2	Action level of RCRA Proposed Rule Subpart S (55 FR 30814, 7/27/90).
*	TPH action level is 100 mg/kg adopted from NMED UST regulations (NMED, 1990). SW-8015 analyzes volatile and semivolatile petroleum hydrocarbon fractions separately. The total concentration of the two fractions analyzed under SW-8015 will be used to assess compliance with stipulated action levels for the purpose of this RFI.
#	Denotes TCLP analysis, results in mg/l.
--	No Data.
FR	Field Replicate.
HHRB	Human health risk based.
J	Estimated value.
N/A	Not Applicable.
NA	Not Analyzed.
ND	Not detected above the method detection limit.
pCi/g	picocuries per gram.
PQL	Practical quantitation limits (defines VOC, SVOC, and TPH).
R	Reject NDs due to interference.
RAD	Radionuclides.
RE	Resample.
SVOC	Semivolatile organic compounds.
TPH	Total petroleum hydrocarbons.
U	Accept data (positive results may be influenced by lab contamination).
UJ	Estimated nondetect.
UTL	Upper tolerance limits (defines metals).
VOC	Volatile organic compounds.

- No gasoline range hydrocarbons were detected in the soil samples collected and submitted for analysis from this site. Diesel range hydrocarbons were detected in each of the two soil samples submitted for analysis but both were at concentrations below the NMED action levels. The diesel range hydrocarbon concentrations, similar to those measured in background samples analyzed during the Appendix III RFI, are not conclusive evidence that a release occurred. Because no other release components (VOCs, SVOCs, or metals) are present, it is probable that the diesel range hydrocarbon concentrations are not attributable to a release from the unit.

- Arsenic was the only metal detected at concentrations exceeding the HHRB action level; these concentrations appear to be naturally occurring throughout Kirtland AFB.

- The analytical results at ST-223 are not indicative of a contaminant release from this site.

Recommendations

- Based on the findings of the RFI, no further action is necessary; therefore, ST-223 does not require further investigation. A No Further Action proposal should be prepared.

10.3 SWMU 10-2, Building 1043, Sewage Ejector Unit Lines (ST-229)

10.3.1 Site Background and Environmental Setting

ST-229 is near the northwest corner of Building 1043, an aircraft hangar in the NMANG complex in the western portion of Kirtland AFB. The general location of the unit and the associated lines are shown on Figure 10-3. According to engineering drawings, ST-229 receives runoff from trench drains along the perimeter of Building 1043 and does not receive sanitary sewage discharge from the building. At present, ST-229 serves only as an area drain effluent collection unit and water lift that discharges through a 2-in. galvanized steel pipe into a leach pit 12 ft southwest.

ST-229 is in the urban/industrial zone. Three production wells are located near ST-229: KAFB-7 is 3,350 ft south-southeast, KAFB-2 is 3,700 ft southwest, and KAFB-1 is 4,800 ft cross-gradient east.

10.3.2 Study Area Investigation

The area of investigation was limited to the subsurface soil surrounding the lines serving ST-229. Possible source materials inside the sewage ejector unit were not investigated in this study.

10.3.2.1 Previous Investigations

During the Stage 2B RFI, subsurface soil samples were collected from the perimeter of sewage ejector unit ST-229. Analytical results did not indicate that contaminants had been released at the site.

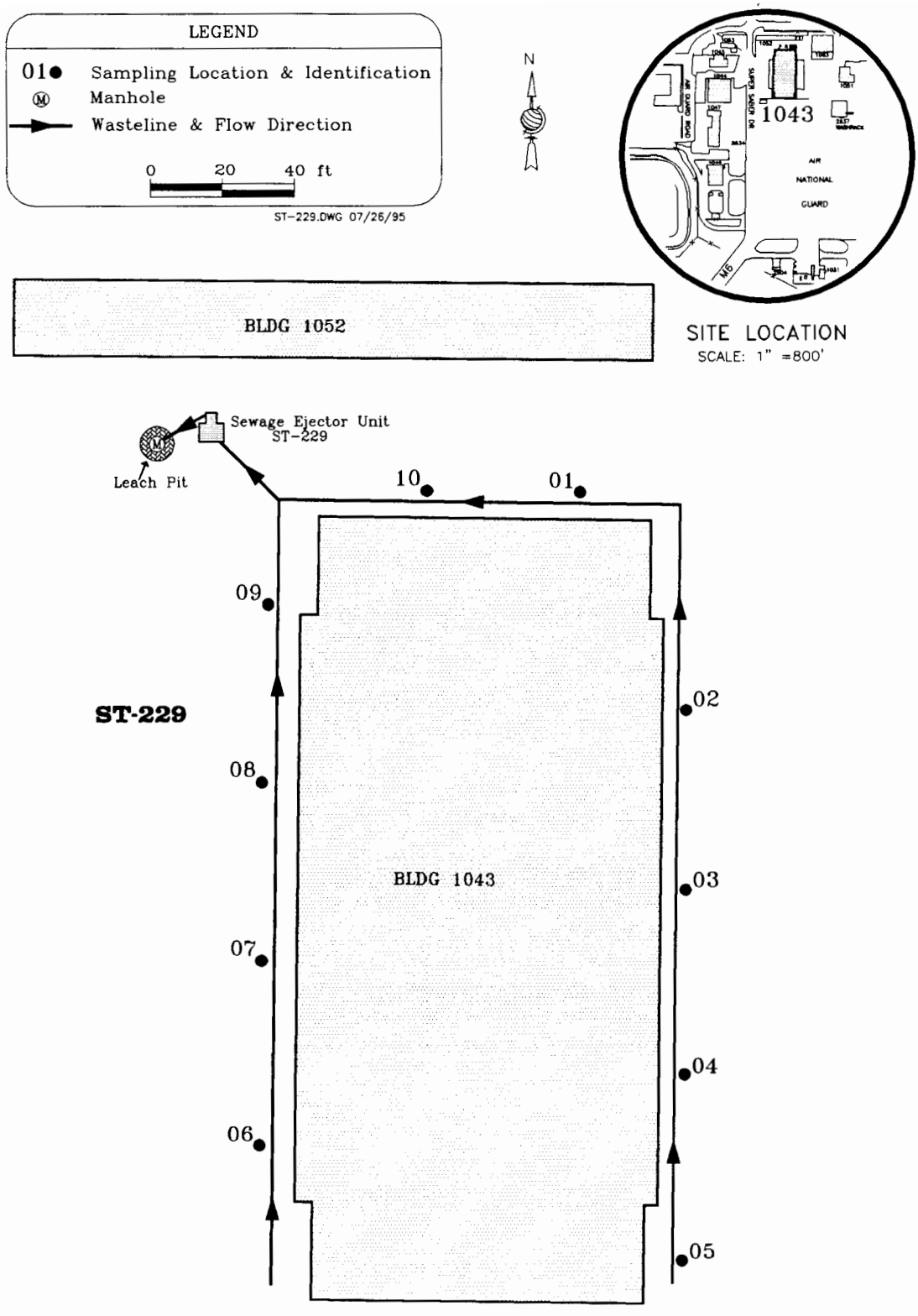


Figure 10-3. Soil Sampling Locations at SWMU 10-2, Building 1043, Sewage Ejector Unit Lines (ST-229)

10.3.2.2 Data Gaps

No information related to the past use of the sewage ejector unit was available. No data were available to determine the presence or absence of contaminants in the subsurface soil surrounding the lines for this unit.

10.3.2.3 RFI Field Investigation

The objective of the investigation was to determine if contamination exists in the adjacent soil. Location of wastelines and sample borehole designation were completed prior to the startup of the soil sampling effort. The soil investigation was limited to the near-surface vadose zone.

Analytical results from samples collected during the Stage 2B RFI were used to characterize the soil adjacent to the inflow and outflow lines within a 50-ft radius of ST-229. Based on engineering drawings, the inflow line to ST-229 is from the trench drains along the perimeter of Building 1043 that collect any surface flow from within the hangar. Discharge is to a leach pit located 12 ft to the southwest. Subsurface line locations were confirmed using methods described in Section 3.0.

On February 7 and 8, 1995, 10 boreholes were sampled using a Geoprobe. The sample interval at each borehole location extended from the depth of the line to 5 ft below the line. From this interval, two samples were collected from each borehole: one at a depth equal to the base of the line, the other from 3 ft below the base of the line. Both samples were field-screened with a FID organic vapor meter and only the sample with the highest FID reading was submitted to the laboratory for analysis. If there were no elevated FID readings, the sample collected at the depth closest to the base of the line was submitted for analysis. Eleven soil samples, including one replicate sample, were collected along the lines serving ST-229 and were submitted for laboratory analysis during the Appendix III RFI.

Due to the proximity of the inflow lines of ST-229 to ST-243, ST-243-01 analytical results collected during the Stage 2B RFI were used as background concentration data for the samples collected along the ST-229 lines during Appendix III RFI.

Sampling operations and sample handling procedures are described in Section 3.0. Sample depths, sample locations, and replicate samples collected during the Appendix III RFI are listed in Table 10-3. Soil boring logs for the boreholes drilled and sampled at ST-229 are in Appendix C.

Table 10-3. Boreholes and Samples Analyzed from SWMU 10-2, Building 1043, Sewage Ejector Unit Lines (ST-229)

Borehole	Borehole Location	Sample Depths (ft)
01	19 ft W and 2.5 ft N of the NE corner of Building 1043	5-10[a]
02	2 ft W and 52.5 ft S of the NE corner of Building 1043	4-6
03	2 ft W and 102.5 ft S of the NE corner of Building 1043	3-5
04	2 ft W and 153.5 ft S of the NE corner of Building 1043	2-4
05	2 ft W and 203.5 ft S of the NE corner of Building 1043	1-3
06	2 ft E and 173.5 ft S of the NW corner of Building 1043	3-5
07	2 ft E and 123.5 ft S of the NW corner of Building 1043	4-6
08	2 ft E and 73.5 ft S of the NW corner of Building 1043	5-7
09	2 ft E and 23.5 ft S of the NW corner of Building 1043	6-8
10	31.5 ft E and 4 ft N of the NW corner of Building 1043	6-8

a. Replicate sample also collected at this interval.

10.3.2.4 Laboratory Analysis

The soil samples were analyzed for VOCs, SVOCs, TPH, metals, mercury, soil pH, and soil moisture. The four brass tubes in each 2-ft sample interval were field-screened for possible contamination using a beta-gamma meter and a FID. All field-screening instrument readings remained at background levels throughout the Appendix III RFI sampling activities at ST-229.

Background sample ST-243-01, collected during the Stage 2B RFI, was used as a background sample during the investigation of the inflow and outflow lines at ST-229. The soil sampling and analysis at the background hole included analyses for TPH, VOCs, SVOCs, metals, soil pH, and soil moisture.

10.3.3 Site Characteristics

10.3.3.1 Geology

The area surrounding ST-229 is underlain by unconsolidated alluvial sediment. The sediment is predominantly fine-grained sand and very fine-grained to fine-grained silty sand. Ten boreholes were drilled with a maximum depth of 11 ft below grade. No boreholes penetrated into the Santa Fe Group sediments that presumably underlie this area. A discussion of the general geology at Kirtland AFB is presented in Section 2.2.

As a result of the line installation, it is probable that backfill material is present around each line to a depth equal to each line's total depth. Borehole logs for this area are presented in Appendix C.

10.3.3.2 Hydrogeology

Groundwater beneath ST-229 is found within the Upper Santa Fe sediments and is generally thought to be unconfined in the upper portion of the aquifer. This area is within the HR1 saturated zone setting as defined by SNL (Figure 2-9) (SNL, 1994). Hydrogeologic characterization in this portion of Kirtland AFB is complicated by the presence of numerous production wells (Figure 2-11). It is probable that uniform groundwater conditions do not exist in this region. Local cones of depression associated with groundwater withdrawal have altered the groundwater flow direction in the vicinity of the well fields (Figure 2-7).

The gradient is probably north at this site. Three production wells are located near ST-229: KAFB-7 is 3,350 ft upgradient south-southeast, KAFB-2 is 3,700 ft upgradient southwest, and KAFB-1 is 4,800 ft cross-gradient east (Figures 2-7 and 2-11). Depth to groundwater is estimated to be 350 ft below grade (Figure 2-10); however, shallower perched water zones may occur. Hydraulic conductivity within HR1 is estimated at 2 to 171 ft/day (SNL, 1994). A general discussion of the hydrogeology at Kirtland AFB is presented in Section 2.5.

10.3.4 Nature and Extent of Contamination

The following sections describe the nature and extent of contamination based on the analytical results. Analytical results for ST-229 are presented in Table 10-4, where only the reportable concentrations are listed. Full analytical results are presented in Appendix F. Laboratory validation reports are presented in Appendix K.

Organic Compounds

No VOC analytes were detected in any of the soil samples collected and submitted for analysis from ST-229.

Di-n-butylphthalate (0.39 to 4.2 mg/kg) was the only SVOC analyte detected in five of the 11 samples. These concentrations were below the HHRB action level of 7,800 mg/kg (Table 10-4).

Table 10-4. Summary of Reportable Concentrations for Soil Analyses at SWMU 10-2, Building 1043, Sewage Ejector Unit Lines (ST-229)[1]
(Concentrations mg/kg)

Chemical Class	Analyte	HHRB Action Level[2]	PQL UTL	Borehole Number and Sample Depth Interval (ft)						
				ST229C-01		*ST229C-02*	*ST229C-03*	*ST229C-04*	*ST229C-05*	*ST229C-06*
				5–10 FR	5–10	4–6	3–5	2–4	1–3	3–5
SVOC	Di-n-butylphthalate	7,800	0.70	4.2	ND	1.1	1.9	0.97	0.39	ND
TPH	Diesel fraction	100	10.0	ND	ND	ND	ND	ND	15.0	ND
METALS	Aluminum	78,000	14,700	5,700	5,070	3,190	5,770	2,950	4,260	4,020
	Antimony	31.0	N/A	ND	ND	ND	ND	ND	ND	ND
	Arsenic	0.37	6.5	4.9	1.7	2.8	4.5	2.6	3.3	2.4
	Barium	5,500	735	171	147	186	361	151	223	224
	Beryllium	0.15	0.84	0.35	0.31	ND	ND	ND	ND	ND
	Cadmium	39.0	N/A	0.69	ND	ND	ND	ND	ND	ND
	Calcium	N/A	121,000	111,000	9,740	52,900	104,000	84,000	54,200	99,900
	Chromium, total	390	21.6	7.3	4.9	4.4	6.7	2.9	4.5	4.3
	Cobalt	4,700	15.4	5.2	5.8	3.0	5.9	3.3	4.0	3.8
	Copper	2,900	223	37.7	16.8	12.9	21.1	5.8	16.5	22.1
	Iron	N/A	23,800	8,370	9,790	4,670	7,880	3,880	5,410	5,310
	Lead	400	17.5	5.1	3.2	3.5	4.3	2.0	2.3	2.4
	Magnesium	N/A	10,400	6,260	3,840	2,580	5,490	2,750	2,660	2,850
	Manganese	390	549	149	179	59.4	108	39.7	57.0	69.7
	Nickel	1,600	188	5.8	5.0	5.1	4.6	3.3	3.0	3.1
	Potassium	N/A	3,590	687	1,100	383	712	367	636	654
	Silver	390	N/A	ND	ND	ND	ND	ND	ND	ND
	Sodium	N/A	787	127	75.0	58.5	115	58.9	155	169
	Thallium	N/A	N/A	ND	0.13	ND	0.13	ND	ND	ND
	Vanadium	550	55.3	29.6	25.7	13.7	28.7	12.3	17.3	14.9
	Zinc	23,000	114	29.4	25.5	11.1	19.3	7.6	13.4	14.1
OTHER	pH			8.7	8.8	8.8	8.7	8.8	9.0	8.9
	Moisture (%)			13.5	3.6	11.9	13.6	9.8	10.2	10.0

Table 10-4. Summary of Reportable Concentrations for Soil Analyses at SWMU 10-2, Building 1043, Sewage Ejector Unit Lines (ST-229)[1] (Concentrations mg/kg) (Continued)

Chemical Class	Analyte	HHRB Action Level[2]	PQL UTL	Borehole Number and Sample Depth Interval (ft)			
				ST229C-07	*ST229C-08*	*ST229C-09*	*ST229C-10*
				4–6	5–7	6–8	6–8
SVOC	Di-n-butylphthalate	7,800	0.70	ND	ND	ND	ND
TPH	Diesel fraction	100	10.0	ND	ND	ND	ND
METALS	Aluminum	78,000	14,700	6,230	5,010	8,720	5,540
	Antimony	31.0	N/A	ND	2.2	ND	ND
	Arsenic	0.37	6.5	6.2	3.3	4.4	3.3
	Barium	5,500	735	439	135	173	196
	Beryllium	0.15	0.84	0.33	0.33	0.46	0.31
	Cadmium	39.0	N/A	0.54	ND	0.58	ND
	Calcium	N/A	121,000	74,700	54,500	51,500	50,100
	Chromium, total	390	21.6	6.9	7.3	9.8	7.6
	Cobalt	4,700	15.4	7.2	4.8	7.6	4.8
	Copper	2,900	223	23.3	21.1	18.3	17.9
	Iron	N/A	23,800	10,800	6,920	12,900	9,220
	Lead	400	17.5	4.3	902	7.4	5.0
	Magnesium	N/A	10,400	5,420	3,070	6,430	4,020
	Manganese	390	549	192	96.5	269	146
	Nickel	1,600	188	6.8	4.9	7.8	7.1
	Potassium	N/A	3,590	679	889	1,320	871
	Silver	390	N/A	ND	2.7	ND	ND
	Sodium	N/A	787	290	158	95.7	148
	Thallium	N/A	N/A	ND	ND	0.13	0.14
	Vanadium	550	55.3	36.8	16.8	35.3	24.0
	Zinc	23,000	114	26.3	17.6	33.0	22.1
OTHER	pH			8.9	8.5	8.6	8.5
	Moisture (%)			7.7	9.6	13.3	4.5

FOOTNOTES

1	Complete laboratory analytical results and method detection limits are presented in Appendix K.
2	Action level of RCRA Proposed Rule Subpart S (55 FR 30814, 7/27/90).
*	TPH action level is 100 mg/kg adopted from NMED UST regulations (NMED, 1990). SW-8015 analyzes volatile and semivolatile petroleum hydrocarbon fractions separately. The total concentration of the two fractions analyzed under SW-8015 will be used to assess compliance with stipulated action levels for the purpose of this RFI.
#	Denotes TCLP analysis, results in mg/l.
--	No Data.
FR	Field Replicate.
HHRB	Human health risk based.
J	Estimated value.
N/A	Not Applicable.
NA	Not Analyzed.
ND	Not detected above the method detection limit.
pCi/g	picocuries per gram.
PQL	Practical quantitation limits (defines VOC, SVOC, and TPH).
R	Reject NDs due to interference.
RAD	Radionuclides.
RE	Resample.
SVOC	Semivolatile organic compounds.
TPH	Total petroleum hydrocarbons.
U	Accept data (positive results may be influenced by lab contamination).
UJ	Estimated nondetect.
UTL	Upper tolerance limits (defines metals).
VOC	Volatile organic compounds.

Petroleum Hydrocarbons

Diesel range hydrocarbons were detected in one of the samples at ST-229 at a concentration of 15 mg/kg. This concentration is below the NMED action level of 100 mg/kg (Table 10-4).

Metals

Table 10-4 lists all reportable metal concentrations detected at ST-229 and the respective UTL and HHRB action level concentrations. Arsenic (1.7 to 6.2 mg/kg) was detected in all of the soil samples at concentrations above the HHRB action level of 0.37 mg/kg but below the UTL of 6.5 mg/kg. Beryllium (0.31 to 0.46 mg/kg) was detected in six of the 11 samples above the HHRB action level of 0.15 mg/kg, but below the UTL of 0.84 mg/kg. These concentrations appear to be naturally occurring at Kirtland AFB as discussed in Section 4.2.2. Lead (902 mg/kg) was detected in soil sample ST-229C-08; the concentration exceeds the HHRB action level of 400 mg/kg.

Soil pH and Moisture

Soil pH values ranged from 8.5 to 9.0 in these samples. Soil moisture values ranged from 3.6 to 13.6 percent (Table 10-4).

10.3.5 Conclusions and Recommendations

Conclusions

- No VOCs and one SVOC were detected in the soil samples collected from this site; all concentrations were below HHRB action levels.

- No gasoline range hydrocarbons were detected in the soil samples submitted for analysis from this site. Diesel range hydrocarbons were detected in one of the soil samples submitted for analysis but the concentration was below the NMED action level. The diesel range hydrocarbon concentration was similar to those measured in background samples analyzed during the Appendix III RFI, and is not conclusive evidence that a release has occurred. Without the presence of other release compounds (VOCs, SVOCs, and metals), it is probable that the diesel range hydrocarbon concentrations are not attributable to a release from the unit.

- Arsenic, beryllium, and lead were the only metals detected at concentrations exceeding the HHRB action levels. The arsenic and beryllium concentrations appear to be naturally occurring throughout Kirtland AFB. A lead concentration exceeding the HHRB action level of 400 mg/kg was detected in one soil sample, ST-229C-08, at a concentration of 902 mg/kg.

- Aside from the anomalous concentration of lead at ST-229C-08, no other contaminants were present to indicate a release at this site. It is unlikely that the lead concentration is attributable to a release at this site since no other release indicators (VOCs, SVOCs, and TPH) were detected in the same sample.

Recommendations

- Though the analytical results at ST-229 are not indicative of a release, the high concentration of lead detected in sample ST-229C-08 warrants further investigation. An additional sample adjacent to the ST-229C-08 borehole should be collected and analyzed to confirm concentrations detected in ST-229C-08.

10.4 SWMU 10-2, Building 1046, Sewage Ejector Unit Lines (ST-232)

10.4.1 Site Background and Environmental Setting

ST-232 is outside the west side of Building 1046, the NMANG weapons shop. According to engineering drawings, ST-232 receives the water-phase discharge from OWS ST-230, 26 ft southeast, which in turn receives flow from floor drains inside the building (Section 5.22). The discharge line from ST-232 is to the west approximately 15 ft where it joins a north-south oriented sanitary sewer lateral west of the building.

ST-232 is in the urban/industrial zone. Two production wells are located near ST-232: KAFB-7 is 2,800 ft south-southeast and KAFB-2 is 3,000 ft south-southwest.

10.4.2 Study Area Investigation

Since ST-232 has line lengths less than 50 ft, the area of investigation for the lines associated with this unit used data obtained during the Stage 2B RFI. Results of the Stage 2B RFI that pertain to ST-209 are described in the following section.

10.4.2.1 Previous Investigations

During the Stage 2B RFI, subsurface soil samples were collected from the perimeter of sewage ejector ST-232. Analytical results do not indicate that contaminants had been released at the site.

10.4.2.2 Data Gaps

No information related to the past use of the ST-232 was available. No data were available to determine the presence or absence of contaminants in the subsurface soil surrounding the lines serving this unit.

10.4.2.3 RFI Field Investigation

Based on engineering drawings, the inflow and outflow lines associated with ST-232 are less than 50 ft in length. The samples collected and analyzed for the sewage ejector unit during the Stage 2B RFI were used to characterize the soil adjacent to lines within 50 ft of the unit. In this instance, samples collected during the Stage 2B RFI should adequately characterize soil conditions surrounding the outflow line.

10.4.3 Conclusions and Recommendations

Conclusions

- The analytical results from the Stage 2B RFI are not indicative of a release from this unit.

Recommendations

- Based on the findings of the RFI, no further action is necessary; therefore, ST-232 does not require further investigation. A No Further Action proposal should be prepared.

10.5 AOC-20405, Building 20405, Undocumented Sump (AOC-20405)

10.5.1 Site Background and Environmental Setting

AOC-20405 is near the south side of Building 20405, currently used for AFMC acid control activities. The sump was identified in late 1994 during a Kirtland AFB Compliance Branch records search. The Restoration Branch proposed including this sump in the Appendix III RFI, rather than completing a separate SWMU Assessment Report; the EPA approved this action. The general location of the unit and associated lines are shown on Figure 10-4. Based on engineering drawings, AOC-20405 was designed to receive drainage from Building 20405 via a valve box. The valve box diverted drainage flow to either the undocumented sump or to the sanitary sewer. AOC-20405 was taken out-of-service and removed prior to the Appendix III RFI soil sampling effort of the RFI.

AOC-20405 is in the urban/industrial zone. Two production wells are located near AOC-20405: KAFB-1 is 1,600 ft west and Sandia-6 is 3,500 ft east-southeast.

10.5.2 Study Area Investigation

The area of investigation was limited to the subsurface soil within and beneath AOC-20405.

10.5.2.1 Previous Investigations

No previous investigations have been performed at this site.

10.5.2.2 Data Gaps

No information related to the past use of AOC-20405 was available. No data were available to determine the presence or absence of subsurface contaminants in the soil around and beneath the sump.

10.5.2.3 RFI Field Investigation

The objective of the investigation was to determine if contamination exists in the underlying soil. The soil investigation was limited to the near surface vadose zone.

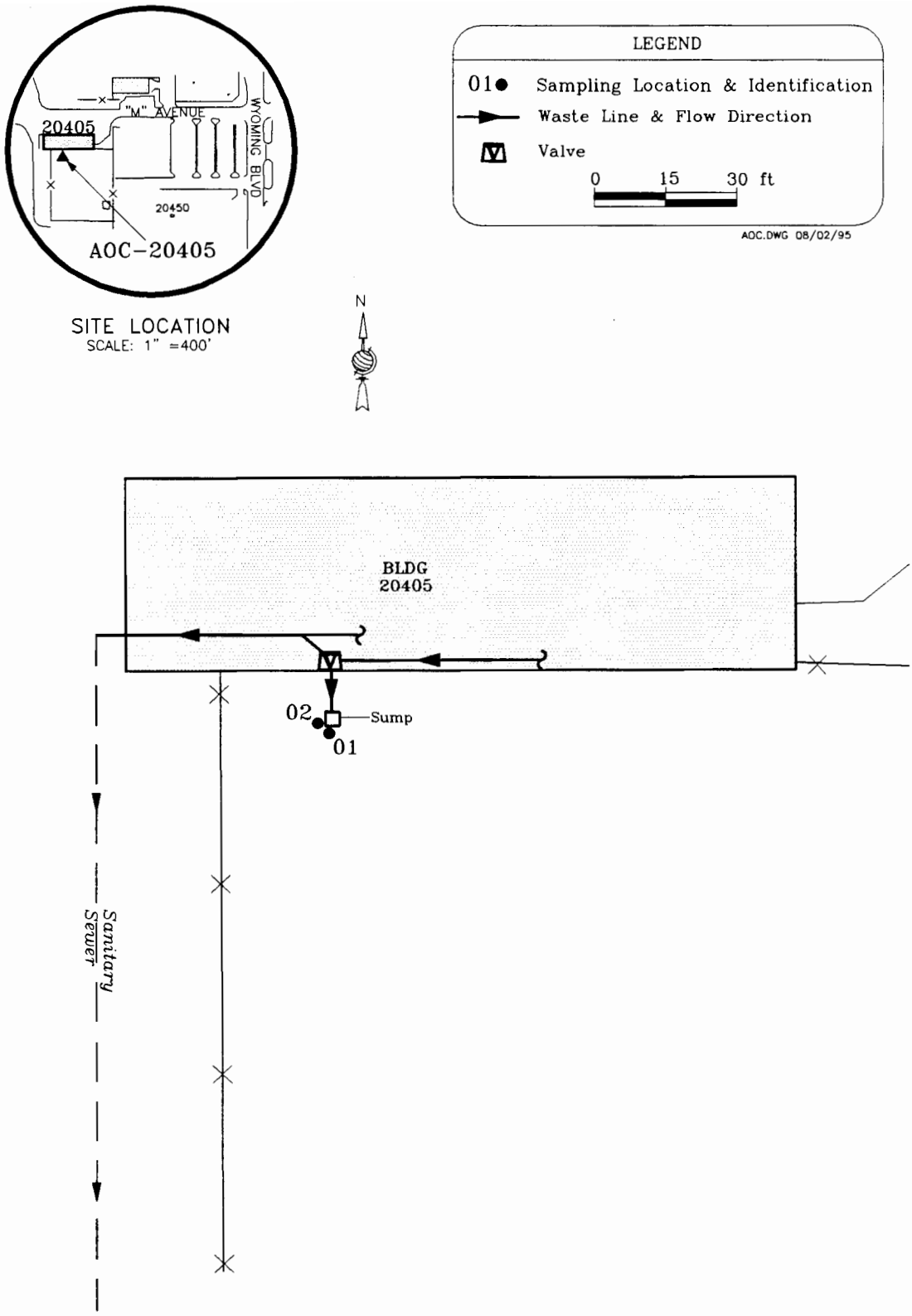


Figure 10-4. Soil Sampling Locations at AOC-20405, Building 20405, Undocumented Sump (AOC-20405)

On July 6, 1995, two boreholes were drilled and sampled using a Geoprobe. The sample interval at each borehole location extended from the depth of the unit to 5 ft below the unit. From this interval, two samples were collected from each borehole: one at a depth equal to the base of the unit, the other from 3 ft below the base of the unit. Both samples were field-screened with a FID organic vapor meter, and only the sample with the highest FID reading was submitted to the laboratory for analysis. If there were no elevated FID readings, the sample collected at the depth closest to the base of the line was submitted for analysis. Two soil samples, which were collected from the subsurface soil within and underlying the unit, were submitted for laboratory analysis.

Sampling operations and sample handling procedures are described in Section 3.0. Sample depths and locations are listed in Table 10-5. Soil boring logs for the boreholes drilled and sampled at AOC-20405 are in Appendix C.

Table 10-5. Boreholes and Samples Analyzed from AOC-20405, Building 20405, Undocumented Sump (AOC-20405)

Borehole	Borehole Location	Sample Depths (ft)	FID (ppm_v)
01	93 ft W and 13.5 ft S of SE corner of Building 20405	5-10	40
02	95 ft W and 12.5 ft S of SE corner of Building 20405	5-10	0

FID readings are values above background and are the high readings of the sample interval.

10.5.2.4 Laboratory Analysis

The soil samples were analyzed for VOCs, SVOCs, TPH, metals, mercury (the potential contaminants associated with normal operations at this site), soil pH, and soil moisture. The four brass tubes in each 2-ft sample interval were field-screened for possible contamination using a beta-gamma meter and a FID. Field-screening instruments detected elevated levels of VOCs from samples collected from borehole AOC-20405-01.

Background sample ST-259-01, collected during the Stage 2B RFI, was used as a background sample during the investigation of the inflow and outflow lines at AOC-20405. The soil sampling and analysis at the background hole included analyses for TPH, VOCs, SVOCs, metals, soil pH, and soil moisture.

10.5.3 Site Characteristics

10.5.3.1 Geology

The area surrounding AOC-20405 is underlain by unconsolidated alluvial sediment. The sediment is predominantly fine-grained sand and very fine-grained to fine-grained silty sand. Ten boreholes were drilled with a maximum depth of 10 ft below grade. No boreholes penetrated into the Santa Fe Group

sediments that presumably underlie this area. A discussion of the general geology at Kirtland AFB is presented in Section 2.2.

10.5.3.2 Hydrogeology

Groundwater beneath AOC-20405 is found within the Upper Santa Fe sediments and is generally thought to be unconfined in the upper portion of the aquifer. This area is within the HR1 saturated zone setting as defined by SNL (Figure 2-9) (SNL, 1994). Hydrogeologic characterization in this portion of Kirtland AFB is complicated by the presence of numerous production wells (Figure 2-11). It is probable that uniform groundwater conditions do not exist in this region. Local cones of depression associated with groundwater withdrawal have altered the groundwater flow direction in the vicinity of the well fields (Figure 2-7).

The gradient is probably north at this site. Two production wells are located near AOC-20405: KAFB-1 is 1,600 ft down-gradient west and Sandia-6 is 3,500 ft upgradient east-southeast (Figures 2-7 and 2-11). Depth to groundwater is estimated to be 350 ft below grade (Figure 2-10); however, shallower perched water zones may occur. Hydraulic conductivity within HR1 is estimated at 2 to 171 ft/day (SNL, 1994). A general discussion of the hydrogeology at Kirtland AFB is presented in Section 2.5.

10.5.4 Nature and Extent of Contamination

The following sections describe the nature and extent of contamination based on the analytical results. Analytical results for AOC-20405 are presented in Table 10-6, where only the reportable concentrations are listed. Full analytical results are presented in Appendix F. Laboratory validation reports are presented in Appendix K.

Organic Compounds

No VOC or SVOC analytes were detected in any of the soil samples collected and submitted for analysis from AOC-20405.

Petroleum Hydrocarbons

No gasoline range hydrocarbons or diesel range hydrocarbons were detected in either of the two samples collected and submitted for analysis from AOC-20405 (Table 10-6).

Metals

Table 10-6 lists all reportable metal concentrations detected at AOC-20405 and the respective UTL and HHRB action level concentrations. Arsenic (3.9 to 5.0 mg/kg) was detected in both of the soil samples at concentrations above the HHRB action level of 0.37 mg/kg, but below the UTL of 6.5 mg/kg. Beryllium (0.44 and 0.45 mg/kg) was detected in the samples collected at concentrations above the 0.15 mg/kg HHRB, but below the 0.84 mg/kg UTL; these concentrations appear to be naturally occurring at Kirtland AFB as discussed in Section 4.2.2.

Table 10-6. Summary of Reportable Concentrations for Soil Analyses at AOC-20405, Building 20405, Undocumented Sump (AOC-20405)[1] (Concentrations mg/kg)

Chemical Class	Analyte	HHRB Action Level[2]	UTL	Borehole Number and Sample Depth Interval (ft)	
				AOC-20405-01	*AOC-20405-02*
				5–10	5–10
METALS	Aluminum	78,000	14,700	8,020	5,720
	Arsenic	0.37	6.5	3.9	5.0
	Barium	5,500	735	108	107
	Beryllium	0.15	0.84	0.45	0.44
	Calcium	N/A	121,000	37,900	51,600
	Chromium, total	390	21.6	6.5	5.8
	Cobalt	4,700	15.4	6.9	7.3
	Copper	2,900	223	73.1	58.4
	Iron	N/A	23,800	12,400	13,500
	Lead	400	17.5	6.8	5.9
	Magnesium	N/A	10,400	5,580	6,410
	Manganese	390	549	229	279
	Nickel	1,600	188	6.3	7.9
	Potassium	N/A	3,590	1,620	1,730
	Sodium	N/A	787	559	417
	Thallium	N/A	N/A	0.13	0.11
	Vanadium	550	55.3	36.5	43.0
	Zinc	23,000	114	50.9	52.8
OTHER	Moisture (%)			89.0	90.1
	pH			8.0	7.9

FOOTNOTES

1	Complete laboratory analytical results and method detection limits are presented in Appendix K.
2	Action level of RCRA Proposed Rule Subpart S (55 FR 30814, 7/27/90).
*	TPH action level is 100 mg/kg adopted from NMED UST regulations (NMED, 1990). SW-8015 analyzes volatile and semivolatile petroleum hydrocarbon fractions separately. The total concentration of the two fractions analyzed under SW-8015 will be used to assess compliance with stipulated action levels for the purpose of this RFI.
#	Denotes TCLP analysis, results in mg/l.
--	No Data.
FR	Field Replicate.
HHRB	Human health risk based.
J	Estimated value.
N/A	Not Applicable.
NA	Not Analyzed.
ND	Not detected above the method detection limit.
pCi/g	picocuries per gram.
PQL	Practical quantitation limits (defines VOC, SVOC, and TPH).
R	Reject NDs due to interference.
RAD	Radionuclides.
RE	Resample.
SVOC	Semivolatile organic compounds.
TPH	Total petroleum hydrocarbons.
U	Accept data (positive results may be influenced by lab contamination).
UJ	Estimated nondetect.
UTL	Upper tolerance limits (defines metals).
VOC	Volatile organic compounds.

Soil pH and Moisture

Soil pH values ranged from 7.9 to 8.0 in these samples. Soil moisture values ranged from 9.9 to 11 percent (Table 10-6).

10.5.5 Conclusions and Recommendations

Conclusions

- No VOCs or SVOCs were detected in the soil samples submitted for analysis from this site.
- No gasoline range or diesel range hydrocarbons were detected in the soil samples submitted for analysis from this site.
- Arsenic and beryllium were the only metals detected at concentrations exceeding HHRB action levels; these concentrations appear to be naturally occurring throughout Kirtland AFB.
- The analytical results at AOC-20405 are not indicative of a contaminant release from this site.

Recommendations

- Based on the findings of the RFI, no further action is necessary; therefore, AOC-20405 does not require further investigation. A No Further Action proposal should be prepared.

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