ENTERED

DEPARTMENT OF THE AIR FORCE
27TH SPECIAL OPERATIONS CIVIL ENGINEER SQUADRON (AFSOC)
CANNON AIR FORCE BASE NEW MEXICO

SEP 30 2014

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RECEIVED

OCT 1 2014

NMED
Hazardous Waste Bureau

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

Dear Mr. Kieling

Cannon Air Force Base has received your Approval with Modifications Final Work Plan Addendum for Landfills and Institutional Control Inspection Sites, dated 5 September 2014. Attached you will find errata pages based on the comments included in the aforementioned letter. If you have any questions regarding this submittal, please contact Mr. Ron Lancaster, Chief, Installation Management Flight at (575) 784-1146.

Sincerely

JOEL A. SLOAN, Lt Col, USAF

Attachment:
Errata Pages for: Final Work Plan Addendum for Landfills and Institutional Control Inspection Sites

cc:
Mr. Daniel Comeau NMED
Mr. David Cobrain NMED

This section provides a description of the field sampling plan including revisions to the existing Facility-Wide Long Term Groundwater Monitoring Plan (AECOM 2011).

4.1 GROUNDWATER MONITORING SAMPLING PLAN

Based on a review of the historical groundwater monitoring data, the groundwater has not been impacted by the historical activities at landfills LF003, LF004, LF005, LF025, or sewage lagoon SI101. Therefore, an optimization of the groundwater monitoring plan is included in this WPA. The rationale supporting the optimization of the groundwater monitoring plan is as follows:

- There is no evidence to indicate that LF003, LF004, LF005, LF025, or SI101 are adversely affecting human health or the environment. The investigation activities completed at LF003, LF004, LF005, LF025, and SI101 indicate that the landfill wastes have not contributed to unacceptable impacts to site media, including regional groundwater, and landfill cover/caps are in place. In addition, the climate is sufficiently arid to prevent potential leachate impact to groundwater.
- The potential for leachate production and subsurface contamination and/or migration at LF003, LF004, LF005, LF025, and SI101 is limited by the soil cover/caps and the arid climate. As such, there are no known or anticipated release mechanisms at this site.
- Administrative land use controls include restrictions requiring the future use of the site as vacant industrial land as administered by Cannon AFB.

Groundwater samples will be collected from all 18 monitoring wells in 2014. Subsequent to the completion of the 2014 sampling event, groundwater sampling will be reduced from the current 18 monitoring wells to the following 11 monitoring wells: MW-C, MW-F, MW-G, MW-Na, MW-Oa, MW-Pa, MW-Rb, MW-S, MW-T, MW-U, and MW-X (**Figure 4-1**). The schedule of the sampling events, monitoring well locations, and rationale for optimization of the monitoring well sampling are included in **Table 4-1**. Those wells not included in the revised monitoring well program will be abandoned in accordance with NMED regulations.

All groundwater samples collected will be analyzed for VOCs, TAL metals (including mercury), chromium VI, perchlorate, chloride, nitrate/nitrite, sulfate, ammonia, total organic carbon (TOC), and field water quality parameters (pH, dissolved oxygen [DO], specific conductance, turbidity, and temperature). Groundwater analytical methods as well as information regarding sample containers, preservation, and hold times are included in **Table 4-2**.

4.2 WATER LEVEL MEASUREMENT

Water level measurements will be collected on an annual basis concurrent with landfill and IC inspections. Prior to groundwater sampling activities, a full round of water levels will be collected from all monitoring wells associated with this LTM investigation using an electronic water level indicator.

TABLE 4-1
FUTURE MONITORING WELL SAMPLING EVENTS

Monitoring Well Number	Monitoring Well Location	Future Biennial Sampling Events		Rationale
		2014	2016, 2018, 2020, 2022	
MW-A	1,000 feet North-Northwest of LF005	X		This well is located 1,000 feet upgradient from LF005. Due to the distance of the well from the landfills and the estimated groundwater flow direction, this well is not representative of background conditions nor would it be useful for indicating migration of contaminants.
MW-B	Eastern Boundary of LF005	X		Two existing monitoring wells (MW-T and MW-U) are located along the eastern border of LF005. No contaminants have historically been identified in MW-B. MW-B and MW-T are located in close proximity to one another. MW-T has a 40-foot screen while MW-B has a 15-foot screen. Therefore, MW-T monitors more of the groundwater formation than MW-B.
MW-C	Southern Boundary of LF005	X	X	None
MW-D	Southern Boundary of LF005	X		Two existing monitoring wells (MW-C and MW-S) are located along the southern border of LF005. No contaminants have historically been identified in MW-D. Based on historical information, Cell 3 is the portion of the landfill that represents the greatest concern. Cell 3 is located in the eastern portion of LF005. Based on the estimated groundwater flow direction and the location of MW-D, this well is not in the optimal location to monitor potential migrating contaminants from LF005.
MW-E	1,100 feet North-Northwest of SI101 and 1,000 feet West of LF025	X		MW-E is located 1,000 feet upgradient from SI101 and LF025. Due to the distance of the well from the landfills and the estimated groundwater flow direction, this well is not representative of background conditions nor would it be useful for indicating migration of contaminants.
MW-F	Western Boundary of LF025	X	X	None
MW-G	Eastern Boundary of SI101	X	X	None

TABLE 4-1
FUTURE MONITORING WELL SAMPLING EVENTS

Monitoring Well Number	Monitoring Well Location	Future Biennial Sampling Events		Rationale
		2014	2016, 2018, 2020, 2022	
MW-H	Southern Boundary of SI101	X		Based on the estimated groundwater flow direction, MW-H is located crossgradient from SI101 and is not optimal for indicating migration of potential contaminants from SI101. Based on historical screening levels and human health risk assessment evaluations, groundwater is not being impacted by seepage from SI101.
MW-Na	200 feet east of LF004	X	X	None
MW-Oa	Southern Boundary of LF003	X	X	None
MW-Pa	100 feet East of SI101	X	X	None
MW-Rb	Eastern Boundary of LF025	X	X	None
MW-S	Southeastern Boundary of LF005	X	X	None
MW-T	Eastern Boundary of LF005	X	X	None
MW-U	Eastern Boundary of LF005	X	X	None
MW-V	Northwestern Boundary of Cannon AFB	X		No contaminants have historically been identified in MW-V. MW-V is utilized as a background well. However, groundwater measured at this location is migrating onto the base from the adjoining properties to the west. Therefore, this well is not representative of background conditions nor would it be useful for indicating migration of contaminants.
MW-W	500 Feet South of LF002	X		MW-W is located approximately 500 feet south of LF002 which does not require any further inspection (beyond IC inspections) or groundwater monitoring. No contaminants have historically been identified in MW-W. MW-W is located approximately 1,600 feet northeast of SI101 and 2,300 feet northwest of LF004. MW-W is not located upgradient from either SI101 or LF004. Due to the distance of the well from the landfills and the estimated groundwater flow direction, this well is not representative of background conditions nor would it be useful for indicating migration of contaminants.

TABLE 4-1
FUTURE MONITORING WELL SAMPLING EVENTS

Monitoring Well Number	Monitoring Well Location	Future Biennial Sampling Events		Rationale
		2014	2016, 2018, 2020, 2022	
MW-X	Southwestern Boundary of Cannon AFB	X	X	None

Note: the estimated groundwater flow direction at Cannon AFB is to the southeast.

Cover System Inspection Report
SITE HERE
Cannon AFB, New Mexico

Inspectors Name and Title: _____ Date: _____

Days since last rain fall: _____ Amount of rainfall: _____

1. Fences and Gates?	Yes	No
• Structural Integrity?		
• Gates locks in place?		
• Signage in place?		
• Tumbleweeds and silt built up?		
Problems observed with the fences/gates/signage:		
Maintenance or repairs required:		
Maintenance to be performed by (Subcontractor name and date):		
2. Cover:	Yes	No
• Overall structural integrity maintained?		
• Surface erosion present?		
• Gullies/washouts present?		
• Exposed buried waste?		
• As-constructed contours (topographic highs) intact?		
• As-constructed contours (depressions) intake?		
• Storm water runoff contained within boundaries of site?		
• Evidence of drainage pathways/diverted runoff?		
• Tumbleweeds or silt built up?		
Problems observed with the cover:		
Maintenance or repairs required:		
Maintenance to be performed by (Subcontractor name and date):		

Cover System Inspection Report
SITE HERE
Cannon AFB, New Mexico

3. Berms (Indicate NA if not present)?	Yes	No
• Is any erosion present?		
• Is any ponding present?		
• Storm water runoff contained onsite?		
Describe location and condition:		
Problems observed with berms:		
Maintenance or repairs required:		
Maintenance to be performed by (Subcontractor name and date):		
4. Drainage Ditches/Channels (Indicate NA if not present):	Yes	No
• Is any erosion present?		
• Is buildup of sediment/silt debris present?		
• Is displaced crushed concrete present?		
• Is storm water runoff contained onsite?		
• Excess accumulation of tumbleweeds present?		
Describe location and condition:		
Problems observed with drainage ditches/channels:		
Maintenance or repairs required:		
Maintenance to be performed by (Subcontractor name and date):		

Cover System Inspection Report
SITE HERE
Cannon AFB, New Mexico

5. Vegetation	Yes	No
• Vegetation native perennial?		
• Vegetation in good condition?		
• Bare/sparse areas?		
Describe overall condition:		
Estimate extent and type of vegetative cover:		
Maintenance or repairs required:		
Maintenance to be performed by (Subcontractor name and date):		
6. Monitoring Wells	Yes	No
• Evidence of tampering?		
• Damage?		
Problems observed with the wells:		
Changes required to the Monitoring and Maintenance Plan?		

_____
Inspector's Signature

_____
Inspector's Name

_____
Date

FINAL

WORK PLAN ADDENDUM FOR LANDFILLS AND INSTITUTIONAL CONTROL INSPECTION SITES

CANNON AIR FORCE BASE
NEW MEXICO
RCRA PERMIT No. NM7572124454

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

Prepared for

AIR FORCE CIVIL ENGINEER CENTER
2261 Hughes Ave., Suite 155
JBSA – Lackland AFB, Texas 78236-9853

June 16, 2014

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Acronyms and Abbreviations

µg/L	micrograms per liter
µg/kg	micrograms per kilogram
AFB	Air Force Base
AFCEC	Air Force Civil Engineer Center
bgs	below ground surface
BRA	Baseline Risk Assessment
CAC	Corrective Action Complete
CFR	Code of Federal Regulations
CMS	Corrective Measures Study
CoC	chain of custody
COC	chemical of concern
COPCs	chemicals of potential concern
COPECs	chemicals of potential environmental concern
DAF	dilution attenuation factor
DDD	dichlorodiphenyldichloroethane
DDE	dichlorodiphenyldichloroethylene
DDT	dichlorodiphenyltrichloroethane
DO	dissolved oxygen
DRO	diesel range organics
EP	extraction procedure
ERPIMS	Environmental Resources Program Information Management System
ERPTools	Environmental Resources Program Tools
FPM	FPM Remediations, Inc.
FT006	Fire Training Area 1 (SWMU 78)
GRO	gasoline range organics
HGL	HydroGeologic, Inc.
HHRA	Human Health Risk Assessment
IC	Institutional Control
IDW	Investigation-Derived Waste
IRP	Installation Restoration Program
LF002	Landfill 2 (SWMU 82)
LF003	Landfill 3 (SWMU 105)
LF004	Landfill 4 (SWMU 104)

LF005	Landfill 5 (Cell 3) (SWMU 113)
LF025	Landfill 25 (SWMU 97)
LTM	long-term monitoring
MCL	Maximum Contaminant Level
mg/kg	milligrams per kilogram
mg/L	milligrams per liter
NMAC	New Mexico Administrative Code
NMED	New Mexico Environmental Department
NMGWQS	New Mexico Groundwater Quality Standard
No.	number
OSWER	Solid Waste and Emergency Response
OWS	oil/water separator
PAH	polynuclear aromatic hydrocarbon
PCB	polychlorinated biphenyl
PBR	performance based remediation
PID	photoionization detector
POL	Petroleum, Oil, and Lubricants
PPE	personal protective equipment
RAGS	Risk Assessment Guidance for Superfund
RCRA	Resource Conservation and Recovery Act
RFA	RCRA Facility Assessment
RFI	RCRA Facility Investigation
RI	Remedial Investigation
SCEM	site conceptual exposure model
SD012	Storm Water Collection Point (South-Playa) (SWMU 85)
SD015	AGE Drainage Ditch (SWMU 34)
SD017	Entomology Rinse Area (SWMU 96)
SD020	Northeast Storm Water Drainage Area (SWMU 95)
SI101	Wastewater Lagoons 1 & 2 (SWMU 101)
SSL	soil screening level
SVOCs	semivolatile organic compounds
SWMU	Solid Waste Management Unit
SW002	Recovered Diesel Tank No. 108 (SWMU 2)
SW004	Recovered Diesel Tank No. 109 (SWMU 4)

SW006	POL Tank No. 129 (SWMU 6)
TAL	Target Analyte List
TCLP	Toxicity Characteristic Leaching Procedure
TOC	total organic carbon
TPH	total petroleum hydrocarbons
TS835	Former Skeet Range
TRPH	total recoverable petroleum hydrocarbons
U.S.	United States
USACE	United States Army Corps of Engineers
USEPA	United States Environmental Protection Agency
URS	URS Group, Inc.
UST	underground storage tank
VOC	volatile organic compound
W-C	Woodward-Clyde Consultants, Inc.
WL102	Wastewater Treatment Effluent Discharge
WPA	Work Plan Addendum
WQCC	Water Quality Control Commission
XRF	x-ray fluorescence

This document presents the Work Plan Addendum (WPA) to the Facility-Wide Long Term Groundwater Monitoring Plan (AECOM 2011) for 15 sites at Cannon Air Force Base (AFB) near Clovis, New Mexico (**Figure 1-1**). This addendum includes planned inspection and groundwater sampling activities for long term monitoring sites and inspection activities for sites with institutional controls (ICs).

Long Term Monitoring Sites

The WPA addresses long term monitoring (LTM) activities at the following sites (**Figure 1-2**):

- Landfill 2 (LF002) (Solid Waste Management Unit [SWMU] 82)
- Landfill 3 (LF003) (SWMU 105)
- Landfill 4 (LF004) (SWMU 104)
- Landfill 5 (Cell 3) (LF005) (SWMU 113)
- Landfill 25 (LF025) (SWMU 97)
- Wastewater Lagoons 1 & 2 (SI101) (SWMU 101)

LTM consists of landfill inspection, maintenance, and repair activities as well as groundwater monitoring. Landfill inspections, maintenance, and repair activities are completed annually. Groundwater monitoring is currently completed on a biennial basis. The results of the landfill inspections and groundwater monitoring are presented to Cannon AFB and the New Mexico Environmental Department (NMED) in a biennial report.

Institutional Control Inspection Sites

This WPA addresses IC inspections at the following sites (**Figure 1-2**):

- Fire Training Area 1 (FT006) (SWMU 78)
- Storm Water Collection Point (South-Playa) (SD012) (SWMU 85)
- AGE Drainage Ditch (SD015) (SWMU 34)
- Entomology Rinse Area (SD017) (SWMU 96)
- Northeast Storm Water Drainage Area (SD020) (SWMU 95)
- Recovered Diesel Tank Number (No.) 108 (SW002) (SWMU 2)
- Recovered Diesel Tank No. 109 (SW004) (SWMU 4)
- Petroleum, Oil and Lubricants (POL) Tank No. 129 (SW006) (SWMU 6)
- Wastewater Treatment Effluent Discharge (WL102) (SWMU102)

IC inspections consist of a visual inspection of current conditions, a review of current and future plans for activities at the site, and a review of ICs for the site. The results of the IC inspections are presented to Cannon AFB and NMED in an IC report on an annual basis.

1.1 AUTHORITY

URS Group, Inc. (URS), as a subcontractor to FPM Remediations, Inc. (FPM), has been contracted by the Air Force Civil Engineer Center (AFCEC) under Contract No. FA8903-13-C-0008, to complete a WPA for these 16 sites at Cannon AFB. This WPA is being completed under the Environmental Restoration Program as part of the Performance Based Remediation (PBR) at Cannon AFB. The period of performance for this PBR is from September 20, 2013 to September 20, 2023. The sites identified in this WPA are subject to corrective action requirements under Cannon AFB Hazardous Waste Facility Permit No. NM7572124454.

1.2 PURPOSE AND SCOPE

This WPA is a supplement to the Facility-Wide Long Term Groundwater Monitoring Plan (AECOM 2011). This WPA provides the scope of the inspections, field sampling activities, and reporting requirements for annual landfill inspection with periodic groundwater monitoring and IC inspections. Previous reports and plans have provided detailed summaries of site history, previous investigations, and the overall technical approach implemented at each site.

1.3 PLAN ORGANIZATION

The plan is organized as follows:

Section 1 describes the authority, purpose and scope, and plan organization.

Section 2 summarizes the backgrounds and conditions, previous investigations, groundwater monitoring, and landfill inspections for the LTM sites.

Section 3 summarizes the site background and conditions and previous investigations for the IC inspection sites.

Section 4 provides a description of the field sampling plan including revisions to the existing Facility-Wide Long Term Groundwater Monitoring Plan.

Section 5 presents the field documentation required for the groundwater sampling.

Section 6 describes landfill inspection, maintenance, and repair activities to be completed at LF002, LF003, LF004, LF005, LF025, and SI101.

Section 7 describes the required components of the groundwater monitoring and landfill inspection report.

Section 8 provides a description of the IC inspections to be completed at Cannon AFB sites FT006, SD012, SD015, SD017, SD020, SW002, SW004, SW006, and WL102.

Section 9 provides the references used to complete this WPA.

Appendix A includes the forms for completing the IC inspections.

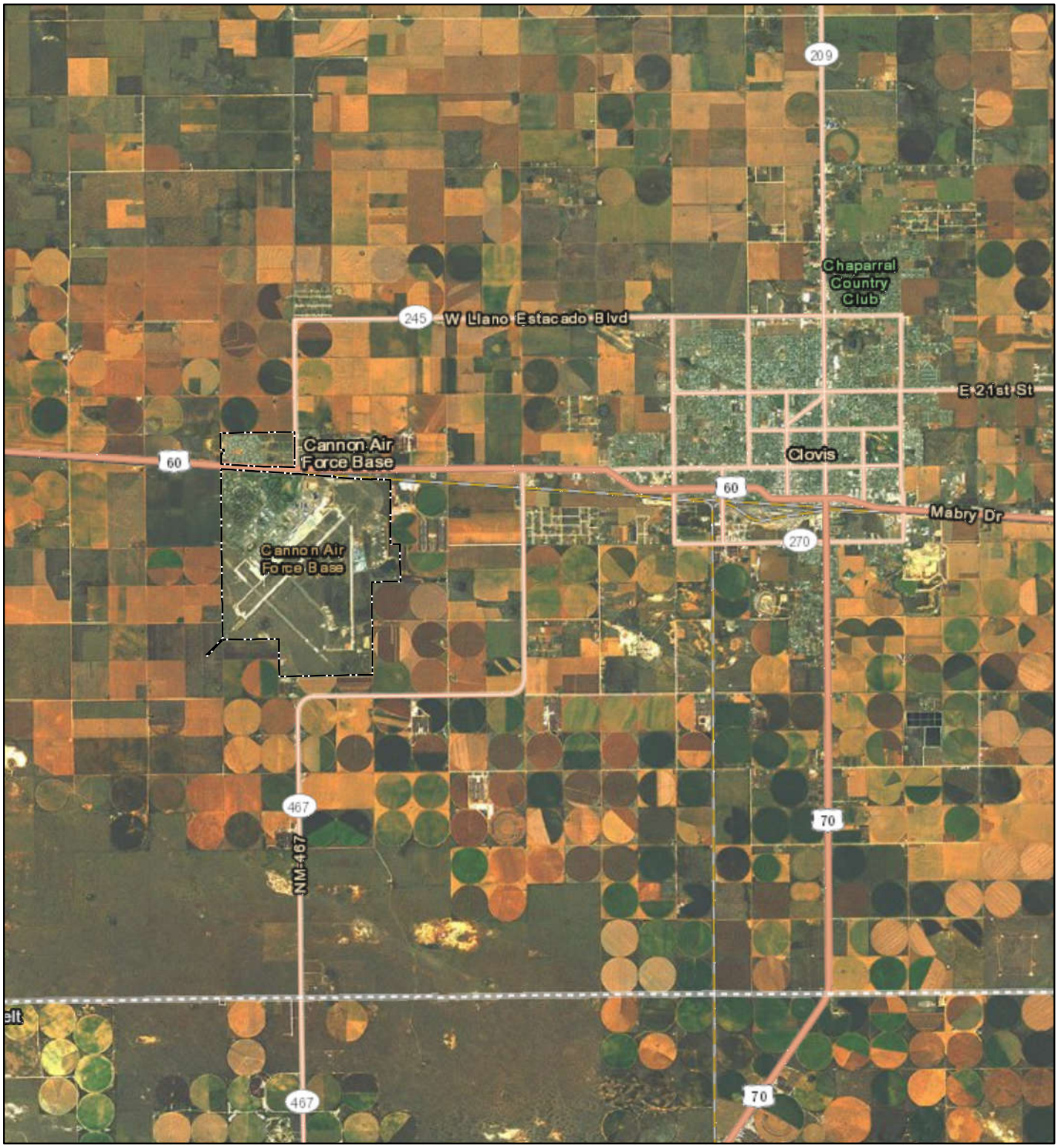
Appendix B includes the forms for completing the groundwater monitoring.

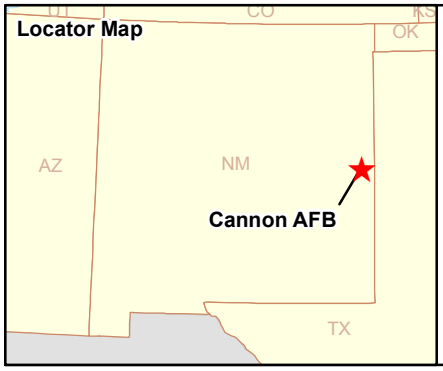
Appendix C includes the forms for completing the landfill cap inspections.

1.4 FACILITY DESCRIPTION AND BACKGROUND

Cannon AFB is in Curry County, New Mexico, approximately 7 miles west of the City of Clovis. Cannon AFB occupies 4,320 acres, consisting primarily of the airfield and associated operations, maintenance, and support facilities that are located northwest of the airfield. Housing facilities are located in the northwestern portion of the base, west of New Mexico (NM) Highway 311 and north of U.S. Highway 60. Additional Cannon AFB support facilities, such as the munitions storage area and current fire department training area, are located south and east of the airfield.

Historically, Cannon AFB dates from 1929 when Portair Field was established on the site as a civilian passenger terminal for early commercial transcontinental flights. In 1942, the Army Air Corps took control of the civilian airfield, and it became known as the Clovis Army Air Base. In early 1945, the Base was renamed Clovis Army Air Field. Flying, bombing, and gunnery classes continued through the end of World War II. The installation was deactivated in May 1947, but was formally reactivated in November 1951 as Clovis Air Force Base and renamed Cannon AFB in 1957. Recently, the Base has transitioned from an Air Combat Command base and is now an Air Force Special Operations Command base (AECOM 2011).





Legend

Base Boundary

N

10,000 5,000 0 10,000 Feet

Map projection: NAD83 State Plane Feet New Mexico East (FIPS 3001)

Installation Location Map
Cannon Air Force Base, New Mexico

Drawn By:	Date:	Project No.	
DPG	3/7/2014	23446539	Figure 1-1
Checked By: MS	Revision: 0		

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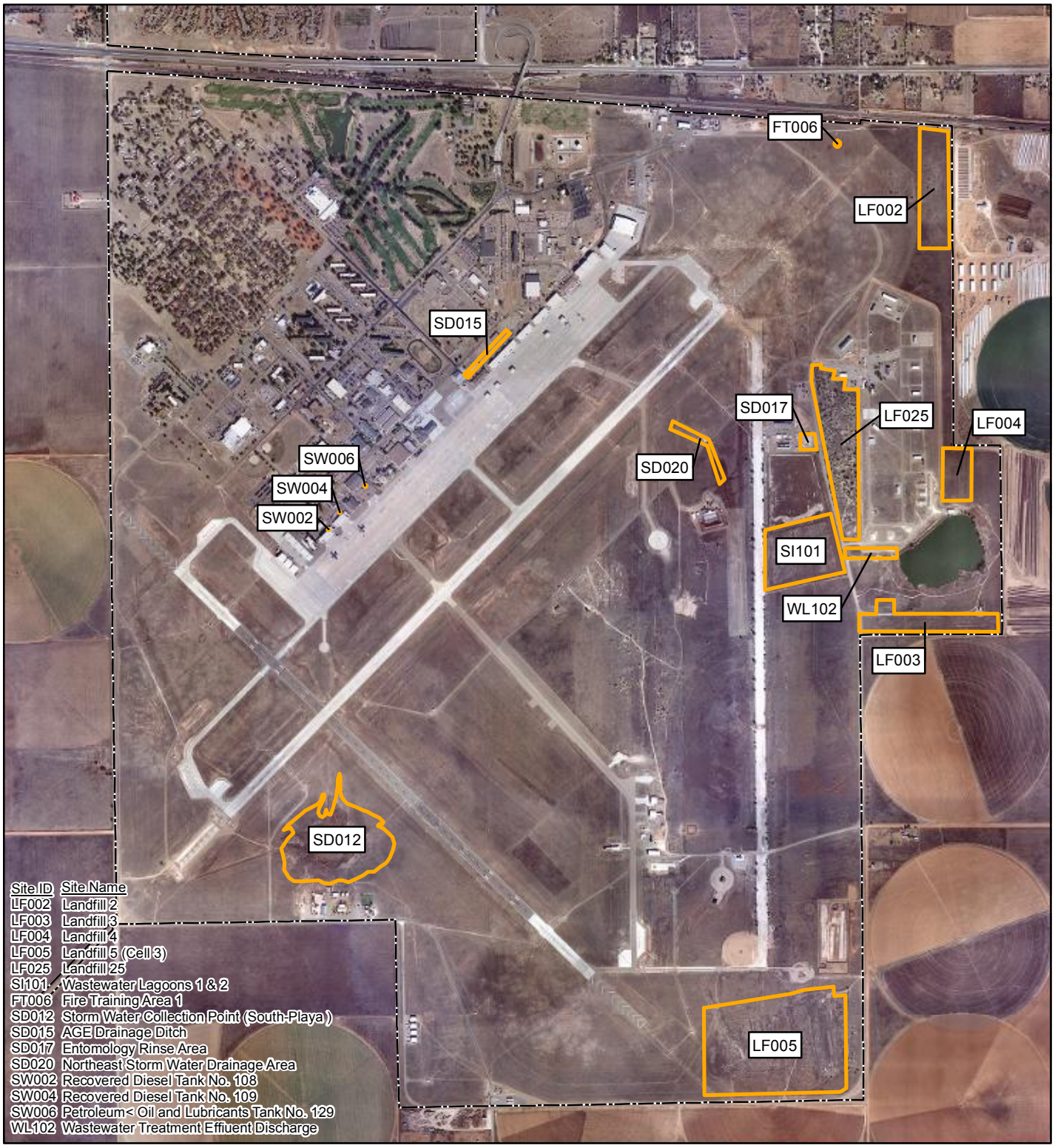
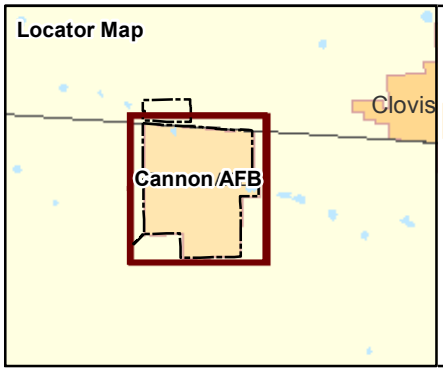


Locator Map



Legend

Base Boundary

Site Boundary

N

2,000 1,000 0 2,000 Feet

Map projection: NAD83 State Plane Feet
New Mexico East (FIPS 3001)

Site Location Map
Cannon Air Force Base, New Mexico

Drawn By: DPG	Date: 6/10/2014	Project No. 23446539	Figure 1-2
Checked By: MS	Revision: 0		

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This section provides the site descriptions, operational history, and summaries of remedial investigations and activities for LTM sites included in this WPA.

2.1 LF002 (SWMU 82)

LF002 occupies approximately 15 acres of vacant and grass-covered land in the northeast corner of Cannon AFB (**Figure 1-2**). LF002 accepted wastes from 1946 to 1947 and again from 1952 to 1959. The 4-year period of inactivity occurred when Cannon AFB was in deactivated status. The landfill's operation reportedly consisted of placing waste in trenches and burning it before burying it. The landfill reportedly received domestic solid wastes and shop wastes, which included; waste oils, solvents, paint strippers and thinners, outdated paint, pesticide containers, and various empty cans and drums (Radian 1986).

The acreage of LF002 overlaps the acreage of the Former Skeet Range (TS835). The skeet range operated from 1943 to 1946. Clay pigeon target debris extended throughout the skeet range. Polynuclear aromatic hydrocarbon (PAH) contamination was identified at the skeet range and will be addressed by FPM under a work plan for site TS835.

A geophysical survey was conducted as part of the 1993 RCRA Facility Investigation (RFI) (Woodward-Clyde Consultants, Inc. [W-C] 1993) to identify landfill cell locations. A subsurface soil investigation was then designed based on the locations of the interpreted cells. The subsurface soil investigation involved digging a 28-foot-long trench into one of the landfill cells. Landfill materials were excavated and field screened with an organic vapor analyzer. No readings were above background level. The landfill material and cap were replaced.

Twenty-seven soil borings were also drilled to depths of 76 feet below ground surface (bgs). A total of 108 samples from 13 of the borings located within the landfill were analyzed for volatile organic compounds (VOCs), semivolatile organic compounds (SVOCs), pesticides / polychlorinated biphenyls (PCBs), and target analyte list (TAL) Metals.

Low levels of two VOCs (toluene and xylene) were detected in surface soil and several VOCs (acetone, benzene, 2-butanone, chloromethane, ethylbenzene, methylene chloride, toluene, vinyl acetate, and xylene) were detected in subsurface soil. Many of these were eliminated as chemicals of potential concern (COPCs) in the 1993 RFI due to their low frequency of detection, and the possibility of laboratory contamination.

Low levels of twenty-five SVOCs, 4,4-dichlorodiphenyldichloroethylene (DDE), 4,4-dichlorodiphenyltrichloroethane (DDT), and Aroclor 1254 were also detected in surface and subsurface soils. The pesticides 4,4-DDE and 4,4-DDT were only detected in surface soils and were probably not associated with landfill waste. Total petroleum hydrocarbons (TPH) were detected in one boring at 18 feet bgs at a concentration of 97.2 milligrams per kilogram (mg/kg). Many of the metals detected were present at concentrations exceeding the background range; however, this was attributed to the presence of caliche and calcium carbonate-cemented sands

and metal fragments in the trash debris. Impacts to groundwater were considered minimal because the depth to groundwater is greater than 250 feet.

A risk assessment was completed for LF002 during the 1993 RFI which identified toluene, acenapthene, anthracene, benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluorantheen, benzo(k)fluoranthene, chrysene, fluorantheen, fluorine, indeno(1,2,3-cd)pyrene, and naphthalene as COPCs. Ecological risk screening indicated that COPCs did not pose an unacceptable risk to the environment.

As part of the 2007 RFI (URS 2007a), historical data was compared to current NMED soil screening levels (SSLs). TPH, VOCs, and pesticides/PCBs did not exceed SSLs. Maximum concentrations of the SVOCs naphthalene (0.395 mg/kg) and phenathrene (464 mg/kg) exceeded soil-to-groundwater SSLs. Impacts to groundwater were considered minimal because the depth to groundwater was greater than 250 feet. Therefore, no groundwater samples were collected. Benzo(a)pyrene (0.621 mg/kg) exceeded the residential SSL, but was not considered a COPC because it was detected in subsurface soil (approximately 20 feet bgs) where residential exposure was unlikely. None of the SVOCs were considered to be COPCs for this site.

Maximum concentrations of antimony (16.1 mg/kg), arsenic (2.8 mg/kg), iron (11,400 mg/kg), and mercury (0.048 mg/kg) exceeded soil-to-groundwater SSLs. Impacts to groundwater were considered minimal because the depth to groundwater is greater than 285 feet. Manganese (174 mg/kg) exceeded the construction worker SSL. All concentrations were under or near Cannon AFB background levels.

In response to the work completed as part of the RFI, a letter dated May 14, 2008 from NMED (NMED 2008a) stated that the RFI report was accepted, and the permittee (Cannon AFB) may petition for a Corrective Action Complete (CAC) With Controls for LF002. NMED granted CAC with Controls for LF002 on February 23, 2011. LF002 is listed on Table 2 (CAC with Controls) of the current Resource Conservation and Recovery Act (RCRA) permit. Annual site inspections are required to be completed and documented in an annual IC report.

2.2 LF003 (SWMU 105)

LF003 is an inactive landfill, formerly used for burn and disposal trenching operations. The 9-acre site is an open field in the east-central portion of Cannon AFB and is bound on the north by a road leading to a transmitter tower, on the south and east by barbed-wire fences and agricultural fields, and on the west by Perimeter Road (**Figure 1-2**). There is no evidence of a constructed berm surrounding this relatively level landfill site. Playa Lake, which lies approximately 450 feet north of LF003, is the closest surface water body to the former landfill.

The landfill was operated from 1959 to 1967 and was reported to have received domestic and industrial wastes including solvents, paints, thinners, waste oils, and peroxide containers. Disposal activities consisted of placing collected waste material into a trench, burning the accumulated waste, and then covering the burned material with soil the following day. The

disposal trench excavations were reported to be up to 16.5 feet deep and over 250 feet in length. The amount of waste material disposed within the landfill trenches has not been determined.

LF003 was investigated along with LF004 and reported in the RFI Final Report, SWMU No. 105, Landfill No. 3, Installation Restoration Program (IRP) Site LF003 (Radian 1994a). A detailed summary of the site's background and history, results of previous investigations, corrective measures, and status is presented in the CAC Proposal for Landfill No. 3 (URS 2008). Groundwater monitoring was initiated at LF003 in 1996 with the installation of monitoring well MW-O, (later replaced with MW-Oa). Quarterly monitoring was conducted in 1996, semiannual monitoring events were conducted in 1997, and annual monitoring events were performed from 1998 until 2006, at which time the current biennial sampling schedule was initiated (HydroGeologic, Inc. [HGL] 2006). The results of the groundwater sampling are discussed further in **Section 2.7**.

Cannon AFB proposed that LF003 be granted the status of CAC with Controls in the document titled Corrective Action Complete Proposals, Cannon Air Force Base, Clovis, New Mexico, dated July 2008 (URS 2008). NMED approved the proposal on November 25, 2009. In response to an NMED letter dated March 26, 2008, the Long Term Monitoring and Maintenance Work Plan (Tetra Tech 2009a) addressed biennial groundwater monitoring and annual inspection and maintenance of the vegetative cover.

2.3 LF004 (SWMU 104)

LF004 is an inactive landfill, formerly used for burn and disposal trenching operations. The 7-acre site is located in the east-central portion of Cannon AFB and lies approximately 800 feet west of the Munitions Storage Area. It is bound on the north and east by Aderholt Loop, on the west by a barbed-wire fence, and on the south by Playa Lake (**Figure 1-2**).

The 7-acre landfill was operated for 1 year from 1967 to 1968. The landfill reportedly received domestic and industrial wastes including solvents, paints, thinners, waste oils, and peroxide containers. Disposal activities consisted of placing collected waste material into a trench, burning the accumulated waste, and then covering the burned material with soil the following day.

LF004 was investigated, along with LF003, during the RFI Final Report, SWMU No. 104, Landfill No. 4, IRP Site LF004 (Radian 1994b). A detailed summary of the site's background and history, results of previous investigations, corrective measures, and status is presented in the CAC Proposal for LF004 (URS 2008). Groundwater monitoring was initiated at LF004 in 1996 with the installation of monitoring well MW-N (later replaced with MW-Na). Quarterly groundwater monitoring was conducted in 1996, semiannual monitoring events were conducted in 1997, and annual monitoring events were performed from 1996 until 2006, at which time the current biennial sampling schedule was initiated (HGL 2006). The results of the groundwater sampling are discussed further in **Section 2.7**.

Cannon AFB proposed that LF004 be granted the status of CAC with Controls in the document titled Corrective Action Complete Proposals, Cannon Air Force Base, Clovis, New Mexico, dated July 2008 (URS 2008). NMED approved the proposal on November 25, 2009. In response to an NMED letter dated March 26, 2008, the Long Term Monitoring and Maintenance Work Plan (Tetra Tech 2009a) addressed biennial groundwater monitoring, annual inspection, and maintenance of the vegetative cover.

2.4 LF005 (SWMU 113)

LF005 is a 70-acre inactive landfill located in the southeastern area of Cannon AFB (**Figure 1-2**). Cell No. 3 of LF005 is RCRA regulated because the cell received hazardous waste until mid-1981. From 1981 until the cell was closed in 1983, it did not receive additional hazardous waste. Closure consisted of placing an impermeable cap over the cell in accordance with NMED and United States Environmental Protection Agency (USEPA) requirements (Bhate 2013). The current regulatory status of LF005 is that of a closed site. The site appears in Table 2 of the 2006 Hazardous Solid Waste Act Permit modification - List of SWMUs and Areas of Concern with CAC with Control status.

Six monitoring wells (MW-A [upgradient], MW-B, MW-C, MW-S, MW-U [downgradient], and MW-D [side-gradient]) are associated with LF005 (**Figure 4-1**). Monitoring was initiated at LF005 when MW-A (background), monitoring wells MW-B, MW-C, and MW-D were installed and sampled during the IRP Phase II Stage I investigation in 1984 (Radian 1986) to meet RCRA release detection monitoring requirements. Although first monitored in 1984, the historical schedule of sampling events at LF005 is unclear prior to being reintroduced into the current approved Work Plan.

In 2011, wells associated with LF005 were added to the Cannon AFB Facility-Wide Long-Term Ground Water Monitoring Plan (AECOM 2011). The results of the groundwater sampling are discussed further in **Section 2.7**.

2.5 LF025 (SWMU 97)

LF025 is an inactive construction and demolition debris landfill located in the east-central portion of Cannon AFB. The former landfill covers a 32-acre area, roughly trapezoidal in shape, located east of Perimeter Road and approximately 500 feet northwest of Playa Lake.

The landfill was used as a waste disposal site from approximately 1945 into the 1980s, but the exact period of operation is unknown. After World War II, construction and demolition debris was disposed at the landfill. The debris consisted of concrete, wood, asbestos tiles, metal, transite and cement pipe, and asphalt mixed with soil. In 2001, exposed non-friable asbestos-containing material was observed at the site. Remediation activities associated with asbestos removal were conducted in 2000, as documented in Construction Completion Report for the Remedial Action at SWMU 97 – Landfill No. 25 (Foster Wheeler Environmental 2001a).

The site includes multiple rubble piles that vary in height up to a maximum of 15 feet above ground surface in the northern portion of the unit. Topography of the LF025 area slopes gently from north to south due to burial of construction and demolition material and the addition of the cover system.

In 2001, a 6-inch topsoil cover was installed using clean fill generated from site grading to minimize percolation through the landfill, leachate production, and potential impacts to groundwater. The cover system was revegetated by seeding and mulching with native grasses. A 2-foot-high earthen berm was installed adjacent to the southern and eastern borders of the unit to prevent stormwater runoff from leaving the site. Near the northeastern corner of the site, base personnel have placed concrete slabs (rip-rap) to control erosion. A three-strand barbed-wire fence with gates and signage was installed around the site boundary. Cover construction activities are documented in Construction Completion Report for the Remedial Action at SWMU 97 - Landfill No. 25 (Foster Wheeler Environmental 2001a).

LF025 was investigated during the RFI Final Report, SWMU No. 97, Landfill No. 25, IRP Site LF025 (Radian 1994c). A detailed summary of the site's background and history, results of previous investigations, corrective measures, and status is presented in the CAC Proposal for LF025 (URS 2008). Groundwater sampling and reporting was initiated at LF025 in 1997 with the installation of monitoring well MW-K, which was abandoned after it went dry. MW-K was replaced with MW-R, which was constructed with a 15-foot stainless steel screen straddling the water table. MW-R was replaced with MW-Ra in December 2000, which was replaced by MW-Rb in 2012. MW-Rb was installed at a depth that gave it an expected effective well life of approximately 6 years (three biennial events) (Bhate 2013). The results of the groundwater sampling are discussed further in **Section 2.7**.

Cannon AFB proposed that LF025 be granted the status of CAC with Controls in the document titled Corrective Action Complete Proposals, Cannon Air Force Base, Clovis, New Mexico dated July 2008 (URS 2008). NMED approved the proposal on November 25, 2009. In response to an NMED letter dated March 26, 2008, the Long Term Monitoring and Maintenance Work Plan (Tetra Tech 2009a) addressed biennial groundwater monitoring and annual inspection and maintenance of the vegetative cover.

2.6 SI101 (SWMU 101)

The former Sewage Lagoons were constructed in 1966. The lagoons consisted of two unlined surface impoundments (the north and south lagoons) that received combined sanitary and industrial wastewater from base facilities. The lagoons had concrete-lined banks and unlined earthen bottoms, operated in series, and had a combined surface area of approximately 39 acres. In 1998, a new wastewater treatment plant was put into operation at Cannon AFB. Although sewage discharge to the lagoons stopped in 1998, the base continued to discharge treated wastewater to the former lagoons in order to allow them to dry gradually.

SI101 was investigated in 1992 during the Appendix I RFI (W-C 1992). Based on the results, the lagoons were recommended for continued annual groundwater monitoring. A Corrective Measures Study (CMS) for closure identified potential corrective actions (Foster Wheeler Environmental 2001b). Human health risk assessments (HHRAs) and ecological risk assessments were conducted as part of the CMS to determine the requirements for contaminant containment and source control. The CMS recommended sludge removal from the former north lagoon, in-place consolidation in the former south lagoon, and closure using an engineered cover with a biotic barrier as voluntary corrective actions for closing the lagoons. The same solution to close the lagoons permanently was identified in two separate reports, Sludge Management, Compliance Evaluation, and Requirements Identification Phase III (Ecology and Environment, Inc. 1998) and Sewage Lagoons Closure Final Specifications (United States Army Corps of Engineers [USACE] 2002). The solution involved dewatering, consolidation, and compaction of the contaminated material, followed by installation of a protective cover. The cover design assumed that the contaminated media at the site consisted of approximately 2 feet of sludge overlying a 1-foot layer of soil.

In 2003, a voluntary corrective measure was implemented at SI101 to construct an engineered earthen cover to minimize any potential threat to human health and the environment from contaminated material within the lagoons. Sludge and the underlying contaminated soil from the north lagoon were excavated and consolidated into the south lagoon. The south lagoon area was then graded and compacted to prepare a substrate. Finally, a 20-acre engineered earthen cover system with a biotic barrier of recycled, crushed concrete and a 6-inch erosion/vegetation layer was installed over the south lagoon area to reduce infiltration of moisture into the underlying layer of contaminated material. The Final Construction Completion Report for the Remedial Action at SWMU 101 - Sewage Lagoons (Foster Wheeler Environmental 2006) documents the activities. A detailed summary of the site's background and history, results of previous investigations, corrective measures, and status is presented in the No Further Action report for SI101 dated July 2008 (USACE 2008). Currently, a shallow earthen drainage swale surrounds the capped area, which is surrounded by a five-strand barbed-wire fence to control access.

Monitoring wells MW-E, MW-F, MW-G, and MW-H were initially installed and monitored for groundwater field parameters on a quarterly basis. These wells were first sampled for laboratory parameters during the 1992 RFI (W-C 1992). In response to an NMED letter dated March 26, 2008, the Long Term Monitoring and Maintenance Work Plan (Tetra Tech 2009a) included sampling of four monitoring wells: MW-E (upgradient), MW-F, and MW-G (within the footprint of the Sewage Lagoon) and MW-H (downgradient) of the Sewage Lagoons. The results of the groundwater sampling are discussed further in **Section 2.7**.

SI101 is currently listed on Table 1 of the Cannon AFB RCRA permit as a SWMU requiring corrective action. All corrective actions have been completed at SI101 and no further action was recommended in a Final No Further Action Report for SWMU 101 - Sewage Lagoons dated July 2008 (USACE 2008). In a November 25, 2009 letter, NMED indicated that SWMU 101 is eligible for a Class III Permit Modification. This requirement is currently being coordinated as

part of the PBR. Upon completion of the CAC proposal process, SI101 will achieve CAC with Controls status and be moved to Table 2 of the Cannon AFB RCRA permit.

2.7 HISTORICAL GROUNDWATER MONITORING SUMMARY

The United States Geological Survey and other IRP contractors have been monitoring groundwater levels and quality at selected Cannon AFB wells through a LTM program since 1994. LTM has been conducted at LF005 and SI101 since 1994, at LF003 and LF004 since 1996, and at LF025 since 1997. LTM has not been conducted at LF002 as no wells are associated with this landfill. Analytes measured by the LTM at these five sites include cyanide, sulfide, organic carbon, major cations, perchlorate, trace metals, organic halogens, VOCs, SVOCs, dioxins and furans, polynuclear aromatics, organochlorine pesticides, PCBs, chlorinated herbicides, dissolved solids, nitrate/nitrite, and sulfate.

Groundwater monitoring is currently conducted at 18 wells located throughout Cannon AFB. The results of the sampling have been used to determine the potential impact of the former operations at LF003, LF004, LF005, LF025, and SI101 to the groundwater at Cannon AFB. Groundwater sampling began with quarterly sampling in 1996. Based on the initial results, groundwater sampling frequency was reduced to semiannual in 1997. Groundwater sampling frequency was further reduced to annual sampling from 1997 to 2006 and biennial sampling from 2006 to the present.

2.7.1 2004 to 2007 Groundwater Monitoring

The analytical data indicate that there has been very little impact to groundwater from base activities. From 2004 through 2007, there were 38,152 analyses for organic constituents in groundwater. The target constituent was only detected 276 times (0.7 percent), and less than 0.5 percent of the detections were greater than the analytical reporting limit. There have been three reported exceedances of the methylene chloride USEPA Maximum Contaminant Level (MCL) of 5 micrograms per liter (µg/L) but no reported exceedances of the New Mexico Groundwater Quality Standard (NMGWQS) of 100 µg/L. There have been two reported exceedances of the phenol NMGWQS of 5 µg/L. There is no federal MCL for phenol. These isolated exceedances have not reoccurred since 2004 and may be due to laboratory error or may have been introduced to the sample during collection or analysis (small concentrations of these compounds have been found in field equipment and method blank samples on occasion) (Langman et al, 2006).

There were over 4,000 analyses for metals that have primary or secondary MCLs or NMGWQSs. Of these, 37 percent were detected, but only 18 percent of the detections were greater than the analytical reporting limit. Metals can be naturally occurring as part of aquifer material. Therefore, some of the detections may be due to the presence of particulates in the unfiltered groundwater samples (Langman et al, 2006). There were only five exceedances of primary drinking water standards: one exceedance of the selenium standard of 50 µg/L and four

exceedances of the thallium MCL of 2 µg/L. The most recent exceedance occurred during a 2005 sampling event and has not reoccurred.

The inorganic constituents chloride, nitrate, sulfate, and total dissolved solids have been detected in groundwater. Some exceedances of secondary MCLs or domestic water supply NMGWQS for chloride, sulfate, and total dissolved solids have occurred and may be due to their natural presence in groundwater. The primary nitrate (as N) MCL and NMGWQS for nitrate of 10 milligrams per liter (mg/L) was exceeded at wells MW-G and MW-P associated with the Sewage Lagoons (SWMU 101). Nitrate concentrations decreased in groundwater near the Sewage Lagoons during and following decommissioning of the lagoons, and concentrations decreased to levels detected in groundwater at wells not affected by the infiltrated wastewater (Langman et al, 2006).

2.7.2 2008 Biennial Sampling Event

Monitoring wells associated with LF003, LF004, and LF025 were sampled. Laboratory analysis identified a single detection of an organic contaminant. Tetrachloroethene was detected at a concentration of 0.28 µg/L, which was less than the reporting limit. Several metals were detected but at concentrations well below MCLs and NMGWQS. Nitrate concentrations did not exceed the groundwater standards (AECOM 2011).

2.7.3 2010 Biennial Sampling Event

Monitoring wells associated with LF003, LF004, and LF025 were sampled. VOCs, metals, and perchlorate were reported at concentrations below applicable groundwater standards in samples collected from monitoring wells MW-Oa, MW-Na, and MW-Pa. Two inorganics, nitrate nitrogen (11 mg/L) and nitrate-nitrite nitrogen (11 mg/L), slightly exceeded the USEPA MCL (10 mg/L) and New Mexico Water Quality Control Commission (WQCC) groundwater standard (10 mg/L) in well MW-Oa. This well is downgradient of North Playa Lake, which receives treated effluent from the base wastewater treatment plant. The data are consistent with previous sampling events and indicate that LF003, LF004, and LF025 are not impacting groundwater quality (Bhate 2010).

Monitoring wells MW-E, MW-F, MW-G, and MW-H are associated with SI101 and were sampled to evaluate potential impacts to groundwater associated with the former Sewage Lagoons. VOCs were detected in all of the wells except MW-F. Toluene was detected at monitoring wells MW-G and MW-H and at upgradient monitoring well MW-E. The detections in MW-E and MW-G were reported at estimated concentrations below the reporting limit, and all three detections were significantly less than the applicable USEPA MCL and New Mexico WQCC groundwater standards. Two additional VOCs, 1,2,4-trimethylbenzene and naphthalene, were detected at estimated concentrations below the reporting limit at well MW-G. No groundwater standards have been established for these compounds (Bhate 2010).

Based on the groundwater elevation and potentiometric flow, monitoring well MW-H is downgradient of SI101, while MW-G is side-gradient to this site, with only a small contributing downgradient component. Both of these wells are downgradient from MW-E, where a low concentration of toluene was detected. The distribution of reported toluene concentrations suggests that toluene contamination at wells MW-E and MW-G, and some or all of the toluene reported in MW-H, may have a source upgradient from the former Sewage Lagoons. This detection pattern suggests that the 1,2,4-trimethylbenzene and naphthalene concentrations reported at MW-G also have a potential upgradient source. There is no direct evidence from the distribution of VOCs that the former Sewage Lagoons are adversely impacting groundwater quality (Bhate 2010).

Based on laboratory analytical results, no VOCs or perchlorate detections were reported at concentrations exceeding the USEPA primary MCLs, secondary MCLs, or the New Mexico WQCC standards in groundwater samples collected from monitoring wells MW-Oa, MW-Na, MW-Pa, MW-E, MW-F, MW-G, or MW-H. The detected concentrations of nitrate nitrogen and nitrate-nitrite nitrogen at well MW-Oa slightly exceeded the USEPA MCL and New Mexico WQCC groundwater standard. One metal (lead) exceeded the USEPA MCL in MW-E, located upgradient of the SI101. The low concentrations of VOCs detected at three of the wells associated with SI101 are also potentially attributable to an upgradient source. The groundwater sample results from the 2010 biennial LTM sampling event indicate sites LF003, LF004, LF025, and SI101 are not adversely impacting groundwater quality (Bhate 2010).

2.7.4 2012 Biennial Sampling Event

Monitoring wells associated with LF003, LF004, LF005, LF025, and SI101 were sampled. Total thallium exceeded the USEPA MCL of 2 μ/L at MW-Oa (4.58 μg/L) and MW-Pa (4.89 μg/L). Dissolved thallium exceeded the USEPA MCL criteria of 2 μg/L at MW-Oa (4.18 μg/L), MW-Na (5.06 μg/L), MW-A (5.77 μg/L), MW-C (3.51 μg/L), MW-U (3.4 μg/L), and MW-T (3.43 μg/L). Nitrate-nitrogen exceeded the USEPA MCL criteria of 10 mg/L at MW-Oa with a result of 11.8 mg/L. At background well MW-X, arsenic was reported at a concentration of 11.4 μg/L, slightly exceeding the 10 μg/L screening criteria (Bhate 2013).

Laboratory analyses indicate that nitrate-nitrogen at MW-Oa slightly exceeded the USEPA MCL of 10 mg/L. Nitrate concentrations at Cannon AFB have a history of being sporadically detected above the MCL but are not necessarily attributable to the SWMUs. Several groundwater samples analyzed from downgradient wells slightly exceeded the USEPA MCL for thallium. It should be noted that thallium does not appear to be a historically problematic parameter at Cannon AFB, indicating an anomalous event with regard to thallium. Dissolved arsenic slightly exceeded the USEPA MCL standard of 10 μg/L in the sample collected from MW-X (background). Groundwater sample results from the 2012 biennial LTM sampling event do not indicate adverse impacts to groundwater quality at Cannon AFB from IRP sites LF-03, LF-04, LF-05, LF-25, and SI101 (Bhate 2013).

2.7.5 Summary

Considering the levels of reported contamination and the depth to groundwater of approximately 300 feet bgs, it is unlikely that soil contamination will impact groundwater. Based on historical groundwater monitoring data, the impact to groundwater appears to have been limited to seepage from SI101.

A HHRA was performed as part of the 2001 CMS (Foster Wheeler Environmental 2001b). This HHRA concluded that there is no potential risk to receptors from groundwater at SI101. Groundwater beneath SI101 is not used by industrial workers, nor does it discharge naturally through seeps or springs in the area to affect ecological receptors. Groundwater monitoring at SI101 indicated metals were the only analytes detected and results showed all concentrations were below respective MCLs. Fate and transport modeling was performed in the CMS to support the risk assessment and the evaluation of corrective action alternatives to simulate contaminant migration through the vadose zone. The fate and transport of chemicals of concern (COCs) that exceeded risk-based screening criteria were modeled based on the current, normal site conditions. Results of the 50-year simulations for the current, normal conditions at Cannon AFB predicted vertical pollution migration does not reach groundwater. The modeling illustrated that degradation to groundwater, due to COCs in sludge, was unlikely under current, normal conditions.

SI101 is currently listed on Table 1 of the Cannon AFB RCRA permit as a SWMU requiring corrective action. All corrective actions have been completed at SI101 and no further action was recommended in a Final No Further Action Report for SWMU 101 - Sewage Lagoons dated July 2008 (USACE 2008). In a November 25, 2009 letter, NMED indicated that SWMU 101 is eligible for a Class III Permit Modification. This requirement is currently being coordinated as part of the PBR. Upon completion of the CAC proposal process, SI101 will achieve CAC with Controls status and be moved to Table 2 of the Cannon AFB RCRA permit.

No additional corrective action is required at LF003, LF004, or LF025 other than groundwater monitoring (NMED 2007). No further action is required for LF005 (AECOM 2011).

This section provides the site descriptions, operational history, and summaries of remedial investigations and activities for IC sites included in this WPA.

3.1 FT006 (SWMU 78)

3.1.1 Site Description and Background

FT006 is located in an open, grassy area in the northeast corner of the Base, south of the railroad tracks and northeast of E Perimeter Road (**Figure 1-2**). The training area is an unlined circular surface approximately 100 feet in diameter. Between 1959 and 1968, the site was used twice monthly when approximately 300 gallons of waste oils, solvents, and fuels were poured on the ground surface to create fires. There is no record of any activities taking place at FT006 past 1968. Currently FT006 remains unused, however, the circular burn area used between 1959 and 1968 is still visible. FT006 can easily be identified because the vegetation within its boundary is more sparse and there is black and grey burn debris scattered throughout the area. Currently, there is no construction in or around FT006.

3.1.2 Previous Investigation Results

3.1.2.1 IRP Phase I (CH2M Hill 1983)

A Phase I IRP records search was conducted for Cannon AFB and included a review of installation records and existing site conditions to identify and evaluate sites with suspected hazardous waste contamination. No data was collected from FT006 as part of the Phase I IRP.

3.1.2.2 IRP Phase II Field Investigation (Radian 1986)

FT006 was included in a Phase II Stage 1 study because of the known disposal of hazardous wastes within the site boundaries and the close proximity to the installation boundary. Two deep soil borings were drilled at FT006 to evaluate the extent of potential environmental contamination associated with the past fire training exercises and to define subsurface conditions. Samples were analyzed for oil and grease, lead, and purgeable halocarbons/purgeable aromatics. Sample results indicated low levels of oil and grease and the absence of volatile halocarbons and aromatics. The IRP Phase II recommended to eliminate FT006 from further IRP studies with no further action required.

3.1.2.3 RI/BRA (W-C 1992)

The Remedial Investigation (RI) of 18 SWMUs included the completion of two deep soil borings at FT006. Soil samples were collected near the surface and at depths of 4, 10, 20, 30, 40, 50, 60, 70, 75, and 100 feet bgs. The samples were analyzed for VOCs, SVOCs, PCBs, pesticides, and TPH. However, the laboratory exceeded the holding times for VOCs and/or TPH, therefore the VOC and TPH results from these two deep borings are not available. A second round of sampling included two soil borings drilled to a depth of 12 feet bgs and six surface soil samples

collected from ground surface to 0.5 feet bgs. All samples were analyzed for metals, TPH, and pesticides. Two surface soil samples were collected from locations near the original two borings, three from additional locations within the site, and one from a location outside the site boundary (to be used as a background sample).

A Baseline Risk Assessment (BRA) was completed as part of the RI. The BRA assessed potential adverse human health and ecological effects by comparing analytical data to risk-based RFI criteria and proposed RCRA action levels, and by calculating site-specific health risks, where appropriate. The BRA concluded that potential impacts to human health and to the environment were insignificant at FT006.

The results identified dichlorodiphenyldichloroethane (DDD), DDE, TPH, lead, and zinc as COCs because these chemicals exceeded site-specific and regional background concentrations. Based on the RI analytical results and the BRA conclusions, the RI concluded that no unacceptable human health or ecological risks due to chemical releases were expected from FT006.

3.1.2.4 RFI (URS 2007a)

The RI/BRA analytical results were reevaluated and compiled into the RFI Report, which was submitted to NMED. The results of previous investigations were reviewed as part of the RFI, and the conclusions for FT006 were presented in the RFI report.

The RFI compared maximum soil concentrations with 2006 NMED SSLs. The maximum TPH concentration (12,500 mg/kg) exceeded the 2006 TPH residential and industrial screenings guideline for unknown oils (both 200 mg/kg). Samples at three other borings also exceeded these guidelines. These detections were all near surface samples collected between 0 to 0.5 feet bgs. Risks due to TPH cannot be evaluated quantitatively due to the unknown characteristics of the chemical mixture; however, individual organic constituents of petroleum mixtures were not detected above the SSLs in any of the samples.

Only the maximum soil lead concentration (529 mg/kg) exceeded the 2006 NMED residential SSL (400 mg/kg) but not the 2006 industrial/construction worker SSL (800 mg/kg). The average lead concentration was 275 mg/kg. No lead concentrations exceeded the 2006 industrial SSLs, which was the appropriate scenario for this site, given the current and anticipated future land uses.

The maximum concentrations of vinyl chloride and manganese in surface soil exceeded the 2006 soil-to-groundwater SSL, but in the case of manganese, fell below the background level. Vinyl chloride, arsenic, iron, manganese, and mercury maximum concentrations in combined surface and subsurface soil also exceeded the 2006 soil-to-groundwater or construction worker SSL, but in the case of the metals, fell below the background levels. Impacts to groundwater were considered minimal because the depth to groundwater was greater than 250 feet, and in the case of vinyl chloride, the concentrations detected were very low (0.011 mg/kg maximum).

The RFI indicated that TPH and lead exceeded the 2006 NMED residential SSLs. TPH was detected above the 2006 NMED screening levels in four shallow soil samples, and lead was detected above the screening levels in one shallow soil sample collected as part of an RI previously completed at FT006 (W-C 1992).

3.1.2.4.1 2007 Conceptual Site Model

As part of the RFI, a conceptual site model was developed based on historical site information. The most significant exposure pathways include inhalation of fugitive dust and direct contact with soil resulting in incidental ingestion or dermal absorption of chemicals from soil. Human receptors for these pathways include adult general duty workers and construction workers. Future residential exposure is unlikely because of the industrial nature of this site and the surrounding area. In addition, the site is less than one-half acre in size, so the potential for major soil excavation and future construction of residential homes within the area of FT006 is low. The adult base worker that potentially visits the site a few days per year for grounds-keeping activities and/or a short-term excavation worker are expected to be the most significant receptor population under current and future exposure conditions.

One lead result collected from the 0 to 0.5 foot bgs sample interval at soil boring 0785 was above the NMED residential and industrial SSL of 400 mg/kg. It was determined that it is unlikely that exposure to human receptors of the lead level above the NMED residential and/or industrial SSL would occur due to the heterogeneous distribution of lead particles in soil. The average lead concentration (180 mg/kg) for samples collected during all investigations at FT006 before 2008 was below the NMED residential SSL of 400 mg/kg. TPH results were above the 2006 residential guidance for TPH. The RFI concluded that risks due to TPH cannot be evaluated due to the unknown characteristics of the chemical mixture; however, the individual components of petroleum mixtures were not detected at concentrations above NMED SSLs in any of the sample (URS 2007a).

3.1.2.4.2 2007 BRA

In addition, the RFI Report included a preliminary risk screening. The preliminary risk assessment also indicated that contaminants present at the site posed an acceptable level of risk for industrial/occupational and construction worker receptors. However, the preliminary risk assessments indicated that the contaminants present at the site posed an unacceptable risk for receptors in a residential scenario. As a result, NMED requested that Cannon AFB perform preliminary risk screening assessments using the residential screening levels and TPH value for unknown oil.

NMED reviewed the RFI Report and subsequently requested additional sampling at FT006 to further characterize the site due to the elevated lead and TPH results (NMED 2008).

3.1.2.5 RFI Addendum (URS 2010a)

RFI Addendum Activities were performed in 2008. Elevated lead and TPH concentrations were not detected in the subsurface during previous investigations; therefore, only surface samples were collected. The investigation consisted of collecting three soil borings (0 to 2 feet bgs) near the previous sampling locations with TPH or lead levels above residential and industrial NMED SSLs. Head space samples measured using a photoionization detector (PID) and x-ray fluorescence (XRF) analyses for lead were collected in 6-inch intervals from the surface to 2 feet bgs at each sample location.

Samples for TPH-diesel range organics (DRO) and TPH-gasoline range organics (GRO) analysis were submitted to the laboratory based on visible staining/odor and elevated PID readings. Visible staining was present from 0 to 2 inches in all three soil borings. No odors were present and no elevated PID readings were encountered at the three soil boring locations. The 0- to 6-inch interval at each location was submitted to the laboratory for analysis for TPH-DRO and TPH-GRO.

Lead samples were submitted to the laboratory based on XRF field screening results. All XRF field screening levels were below the 2006 NMED residential SSL (400 mg/kg) for lead with the exception of the 0- to 6-inch sample interval from SS01. The average field XRF lead analysis for the 0- to 6-inch interval for sample SS01 was 408 parts per million. The sample from each soil boring interval with the highest XRF field screening result was submitted to the laboratory for lead analysis. Based on the XRF field screening results the 0 to 6 inch interval at each location was submitted to the laboratory for lead analysis.

TPH-DRO and lead were detected in all three primary samples. The maximum TPH-DRO concentration was compared with 2006 NMED SSLs. The maximum TPH-DRO concentration in near surface soil (410 mg/kg) was above the NMED residential screening guideline at the time of the RFI Addendum (URS 2010a) for unknown oil (200 mg/kg). The maximum lead concentration in near surface soil from soil boring SS01 (894 mg/kg) exceeded the NMED residential SSL (400 mg/kg) and the industrial and construction worker SSLs (both 800 mg/kg). TPH-GRO was nondetect in all 2008 RFI Addendum samples. The comparison with current 2012 SSLs demonstrates that while lead is still above the residential and industrial screening levels, TPH-DRO is below the residential screening level for unknown oil.

Based on the findings of the 2008 RFI Addendum fieldwork, the elevated TPH levels that were identified by previous investigations no longer appear to be present at FT006. The decrease in the TPH levels at FT006 can likely be attributed to natural attenuation of TPH in the soil. Elevated lead was observed above the NMED residential SSL (400 mg/kg) in two soil samples (529 and 894 mg/kg) and above the industrial SSL (800 mg/kg) in one soil sample (894 mg/kg) collected during all investigations. Because the average lead concentration at the site is 180 mg/kg, which is below the residential screening level for lead and only a single lead concentration exceeded the industrial SSL, CAC with Controls was recommended for FT006.

The May 2010, Final Addendum Report was approved by NMED on June 7, 2010 and FT006 is listed on Table 2 (CAC with Controls) of the current RCRA permit. Annual site inspections are required to be completed and documented in an annual IC report.

3.2 SD012 (SWMU 85)

3.2.1 Site Description and Background

SD012 is a naturally occurring 9-acre playa lake located in the southwestern part of the Base (**Figure 1-2**). Since 1943, stormwater runoff from the flightline has collected in this lake. Stormwater runoff flows toward the center of the site where it either evaporates or percolates into the soil.

3.2.1.1 1986 IRP Phase II (Radian 1986)

The IRP Phase II included drilling and sampling eight borings at depths of 1 and 5 feet bgs. Samples were analyzed for metals, oil and grease, and VOCs. No VOCs were detected in any of the samples and only one sample contained a low concentration of oil/grease. Metal concentrations were generally within background range; however, the soil boring sample collected in the deepest portion of the basin seemed to contain the highest concentrations of metals. Further investigation was recommended to evaluate the potential concentration of heavy metals toward the center of the basin.

3.2.1.2 1990 Remedial Investigation (Walk-Haydel 1990)

In addition to three borings drilled as part of the IRP Phase II Stage 1 (Radian 1986), the Final IRP RI for SD012 included drilling and sampling eight soil borings. Soil samples were collected from depths of 5 to 70 feet bgs. Near surface and subsurface samples were analyzed for VOCs, base/neutral extractable compounds, and for total and extraction procedure (EP) toxicity metals. Barium, mercury, and selenium were detected in several samples in concentrations slightly above area background levels during the RI (Walk Haydel 1990).

A human health screening was completed for SD012. The conclusion of the risk screening was that metals concentrations at SD012 are indicative of background metals concentrations. Ecological screening at SD012 concluded that selenium was present in concentrations considered toxic to wildlife, but these concentrations are within the range of normal background concentrations (Walk Haydel 1990).

3.2.1.3 Initial RFI (URS 2007a)

The results and conclusions of the SD012 RI and risk screening were reviewed and compared to current NMED SSLs. The RI analytical results, with a current evaluation, were presented to the NMED RCRA section in the RFI Report. URS completed a preliminary risk screening of this

site following current NMED guidance. The results of the screening were presented in further detail in the RFI report.

The results of previous investigations were reviewed as part of the RFI and the conclusions for SD012 were presented in the RFI report. The RFI review indicated that arsenic results exceeded the current NMED residential SSLs in surface and subsurface soil samples. However, it is plausible that the elevated concentrations and elevated reporting limits associated with the arsenic data in the RI (Walk-Haydel 1990) may be attributable to inter-element interference that was not properly accounted for during laboratory analysis and may not be representative of site conditions. The RFI report was reviewed by NMED, and based on NMED comments regarding arsenic levels, additional sampling at SD012 was suggested to further characterize the site.

3.2.1.4 RFI Addendum (URS 2009)

RFI Addendum fieldwork was completed, which consisted of collecting one surface soil sample and completing two soil borings. The lone surface soil sample was collected from 0 to 0.5 feet bgs with a stainless steel hand auger near the large concrete pile in the middle of the stormwater collection point due the presence of water. The two soil borings were advanced to depths of 15 feet bgs. Samples were collected and analyzed for arsenic to determine if the elevated concentrations and elevated reporting limits associated with the arsenic data in the RI (Walk-Haydel 1990) may be attributable to inter-element interference that was not properly accounted for during laboratory analysis and may not be representative of site conditions. With the exception of one arsenic level (6.0 mg/kg), which slightly exceeded Cannon AFB background levels (4.3 mg/kg), and the residential SSL (3.9 mg/kg) in the 0 to 0.5 feet bgs interval at near surface soil location SS01 (collected under water), no elevated arsenic concentrations were identified.

Based on the RFI Addendum 2008 sample results, the RI data was considered invalid since previous arsenic data in the RI (Walk-Haydel 1990) may be attributable to inter-element interference. Because the maximum arsenic concentration detected during the RFI (6.0 mg/kg) was above the residential NMED SSL, but below the industrial NMED SSL (17.7 mg/kg) CAC with Controls was appropriate for SD012.

The May 2010, Final Addendum Report was approved by NMED on June 7, 2010 and SD012 is listed on Table 2 (CAC with Controls) of the current RCRA permit. Annual site inspections are required to be completed and documented in an annual IC report.

3.3 SD015 (SWMU 34)

3.3.1 Site Description and Background

SD015 originates on the flightline side of the AGE Maintenance Shop Pad Building 186 and runs parallel to Buildings 191 and 190 in a northeast direction (**Figure 1-2**). The ditch terminates at a culvert inlet near Argentina Avenue. Stormwater runoff from SD015 flows under Argentina

Avenue via the culvert to a second drainage ditch that directs the water to the Northeast Stormwater Drainage Area (SD020).

3.3.2 Previous Investigation Results

3.3.2.1 1983 Phase I and II Investigation (CH2M Hill 1983)

In 1983, a Phase I IRP Records Search was performed by CH2M Hill at Cannon AFB to identify and evaluate suspected problems associated with past hazardous material disposal and spill sites. Specifically, the records search evaluated the existence and potential for migration of hazardous material contaminants at SD015 via document review and analysis (Harza 1997).

During 1984 and 1985, a Phase II Investigation was conducted by Radian to determine if environmental contamination had resulted from runoff into SD015. During this investigation, a soil boring was drilled at the site to depths of approximately 50 feet bgs. Soil samples for chemical analysis were collected to evaluate the impact of past and ongoing activities, and to define site-specific hydrogeologic conditions. Soil samples were analyzed for oil and grease, lead, and organic compounds (Harza 1997). Analytical results for this investigation are not available in the administrative record.

3.3.2.2 1987 RFA/SI (A.T. Kearney, Inc. 1987)

Visual site inspections were performed in May 1987 to verify and determine the location of all SWMUs on Cannon AFB as required for RCRA hazardous waste management facility permitting under the RCRA Hazardous and Solid Waste Amendments of 1984. The objective of the evaluation was to determine whether there had been, or was likely to be, release of hazardous wastes or hazardous materials and to provide information to establish priorities for a subsequent RFI, if needed. No samples were taken during the 1987 inspection.

The AGE Drainage ditch was designated as SWMU 34 (SD015) and due to the potential for soil and groundwater contamination, further investigation was recommended.

3.3.2.3 1987 Soil Removal Investigation (Radian 1987)

In March 1987, a follow-up soil removal investigation was completed based on results of the Phase II investigation at SD015 (Radian 1987). This investigation was completed to determine whether contaminated soil existed, and if so, to properly remove and dispose of the soil. The investigation consisted of hand-augering 15 shallow boreholes (21 samples collected) in the areas where the most visible staining occurred to a depth of 2 feet bgs. Soil samples were analyzed for petroleum hydrocarbons, lead, EP-toxicity, metals, and purgeable organic compounds (Radian 1987). The drainage ditch soil was tilled in October 1988 to provide aeration and aid in microbial degradation of contaminants (W-C 1992); this tilling would have mixed the site's former surface and subsurface. Historical analytical results were compared with current 2012 residential and industrial NMED SSLs. Lead was found at concentration exceeding

NMED SSLs in two samples, both collected in the top 1 foot of the soil; the concentrations were 500 and 682 mg/kg relative to the NMED SSL of 400 mg/kg. No other samples had exceedances for lead and all samples did not exceed the TPH GRO and DRO guidelines.

3.3.2.4 1991 Remedial Investigation (W-C 1992)

The RI of 18 SWMUs, including SD015, was completed in 1991 (W-C, 1992). During the RI, two soil borings were advanced and soil samples were collected. The laboratory missed the holding times for VOC analysis which resulted in the recollection of one surface soil sample, the re-drilling of one soil boring, and the recollection of one subsurface soil sample. The resampled locations from this RI were analyzed for VOCs, SVOCs, TAL metals, and TPH (W-C 1992). Several VOCs (toluene, tetrachlorethene, and 1,1,2-trichloroethane) and one PAH (carbazole) were detected in these samples.

A BRA (W-C 1992) was conducted based on the results of the RI. The BRA assessed potential adverse human health and ecological effects by comparing analytical data to risk-based RFI criteria and proposed RCRA action levels, and by calculating site-specific health risks. The BRA identified toluene, lead, selenium, and zinc as chemicals of potential environmental concern (COPECs) for SD015, since these metals exceeded site-specific and regional background concentrations and toluene exceeded residential screening levels. The BRA concluded that potential impacts to human health and the environment were insignificant at SD015. Based on the analytical results from the investigation, and the risk assessment conducted as part of the RI, the BRA recommended that no further investigation or action was required at SD015 (W-C 1992).

3.3.2.5 2007 RFI (URS 2007a)

The results and conclusions of the SD015 RI/BRA were reviewed and compared to current NMED SSLs. The RI analytical results were presented to the NMED in the RFI Report (URS 2007a). A preliminary risk screening of this site was completed following NMED guidance. Preliminary assessments indicated that contaminants present at the site posed an acceptable level of risk for industrial/occupational and construction worker receptors. However, NMED requested that all chemical results for Cannon AFB be screened using residential SSLs (NMED 2006). The results of this screening were presented in further detail in the RFI report (URS 2007a).

Screening of historical analytical data against the 2006 NMED residential SSLs showed that the maximum TPH concentration in near surface (1,180 mg/kg at boring 0341) exceeded the NMED residential screening guideline for kerosene and jet fuel (760 mg/kg in 2006, and 1,000 mg/kg in 2012) but not the NMED (2012) industrial SSLs (1,810 mg/kg in 2006 and 2400 mg/kg in 2012); however, a residential scenario was considered highly unlikely given the industrial nature of this portion of Cannon AFB (URS 2009). Arsenic, iron, and mercury exceeded the 2006 NMED soil-to-groundwater SSLs; but all fell below the background levels for Cannon AFB. The maximum lead concentration in near surface soil (500 mg/kg) also exceeded the 2006 NMED

residential SSL (400 mg/kg) but not the industrial SSL or construction worker SSL (both 800 mg/kg). The average lead concentration (66 mg/kg) and 95% upper confidence limit (152 mg/kg) were below the lowest 2006 direct contact SSL but exceed the soil-to-groundwater SSL (9.17 mg/kg). However, the soil-to-groundwater exposure pathway was not considered relevant at this site because the depth to groundwater is greater than 250 feet, the infiltration rate is approximately 1.5 feet/year, and the rate of evapotranspiration generally exceeds precipitation (URS 2007a).

The RFI review indicated that TPH and lead exceeded 2006 NMED residential SSLs. Lead and TPH were detected above the NMED screening level in the one near-surface soil sample collected as part of an RI previously completed at SD015 (Radian 1987). Additionally, lead was detected above the site-specific surface background values (URS 2009). A comparison of the original analytical data with 2012 NMED residential SSLs indicates that this analysis holds true. The RFI report was reviewed by NMED, and based on NMED comments issued in reference to the above-mentioned lead and TPH levels; additional sampling at SD015 was suggested to further characterize the site (NMED 2008).

3.3.2.6 RFI Addendum (URS 2009)

Based on the elevated TPH and lead results, near surface soil samples were collected in October 2008. RFI Addendum fieldwork consisted of collecting 20 near surface soil samples (0 to 2 feet bgs) from six soil borings (4 samples per boring) near the previous sampling locations with TPH or lead levels above NMED residential SSLs (2012). Eight soil samples were submitted to the laboratory for analysis.

Samples for TPH-DRO and TPH-GRO analysis were planned to be submitted to the laboratory based on visible staining/odor and elevated PID readings. However, visible staining/odors were not present in any samples collected, and no elevated PID readings were encountered. Therefore, the 0 to 6 inch sample interval from each soil boring was submitted to the laboratory for TPH-DRO and TPH-GRO analysis.

A total of eight samples were submitted to the laboratory for analysis. Five samples were collected from the 0 to 6 inch interval and were analyzed for TPH GRO, TPH DRO, and lead; one sample was from the 0 to 6 inch interval and was analyzed for TPH GRO and DRO; and one sample was collected from the 6 to 12 inch interval and was analyzed for lead only. Samples for lead analysis were submitted to the laboratory based on XRF field screening results. All XRF field screening results were below the NMED residential SSLs (2012) (400 mg/kg) for lead. The sample from each soil boring interval with the highest XRF field screening result was submitted to the laboratory for lead analysis. Based on the XRF field screening results, five samples from the 0 to 6 inch interval and two samples from the 6 to 12 inch interval were submitted to the laboratory for lead analysis.

TPH-DRO and lead were detected in all samples. The maximum TPH-DRO concentration was compared to 2006 NMED SSLs. The maximum TPH-DRO concentration in near surface soil

(62 mg/kg) was below the 2006 NMED residential screening guideline for diesel #2/crankcase oil of 520 mg/kg (as well as the 2012 residential value for unknown oil of 1000 mg/kg). The maximum lead concentration in near surface soil (682 mg/kg) exceeded the 2006 NMED residential SSL (400 mg/kg). The sample with elevated lead was collected from the 6 to 12 inch interval from soil boring SS01. TPH-GRO was nondetect in all samples; therefore, results were not compared with NMED SSLs.

The Final RFI Addendum Report was approved by the NMED on June 7, 2010. SD015 was proposed for CAC with Controls in a CAC proposal dated April of 2013. SD015 is listed on Table 2 (CAC with Controls) of the current RCRA permit. Annual site inspections are required to be completed and documented in an annual IC report.

3.4 SD017 (SWMU 96)

3.4.1 Site Description and Background

SD017 was located behind Building 2160, pesticide storage building, which was abandoned in October 1983 and demolished in September 1984 (**Figure 1-2**). During the site's use, pesticide and herbicide application equipment was cleaned in a sink located inside Building 2160. The sink drained into a 3-foot-square and 2-foot-deep pit at the rear of the building. The bottom of the pit was reported to be unlined and open to the soil (W-C 1992).

3.4.2 Previous Investigation Results

3.4.2.1 IRP Phase II – Confirmation/Quantification Stage I (Radian 1986)

Three soil borings were drilled to depths of approximately 60 feet bgs and analyzed for arsenic, mercury, herbicides, pesticides, and VOCs. Low concentrations of 4,4-DDD, 4,4-DDE, 4,4-DDT, dieldrin, and toxaphene were detected at the 2 to 4 feet bgs depth interval and the herbicide 2,4-Dichlorophenoxyacetic Acid was also detected at 5 feet bgs. The IRP Phase II investigation for SD017 detected potentially significant concentrations of pesticides and herbicides in samples collected from two soil borings.

3.4.2.2 1990 Remedial Investigation (Walk-Haydel 1990)

An RI of SD017 was completed to confirm and delineate the potential contamination detected during the IRP Phase II investigation. Eight soil borings were drilled by Walk, Haydel and Associates during the Phase IV investigation of SD017, and one 356-foot well was installed downgradient of the site. The borings were sampled in 10-foot intervals to a total depth of 100 feet. The pesticides 4,4-DDE, 4,4-DDD, 4,4-DDT, and chlordane were detected in the first foot. Only one boring, located near the open pit adjacent to building 2160, showed pesticides to a depth of 6 feet bgs. No herbicides were detected. Based on these data it was concluded that conditions at the site were not conducive to downward contaminant migration.

3.4.2.3 RI Report for 18 SWMUs (W-C 1992)

The objective of the RI was to provide additional information regarding the nature and extent of contaminants. One surface soil sample was analyzed for PCBs and pesticides and one monitoring well sample was collected and analyzed for PCBs, pesticides, and TAL metals. The data were used to further evaluate the extent of potential contamination and to perform a BRA to determine if the area poses risk to human health or the environment. Low concentrations (micrograms per kilogram [µg/kg] range) of the pesticides 4,4-DDE, 4,4-DDT, alpha chlordane, gamma chlordane, and heptachlor epoxide were detected in the soil sample collected adjacent to the concrete foundation for Building 2160. Six metals were detected in the groundwater sample and compared with established MCLs for groundwater quality standards. Only lead slightly exceeds the MCL; however, there was no indication that groundwater has been adversely impacted by activities at the old entomology rinse area because no pesticides or PCBs were identified in the groundwater sample.

The COCs for SD020, SD017, and the two wastewater lagoons (SI101 and WL102) were combined and evaluated as Risk Assessment Area 3 in the BRA. The COCs identified for the combined Risk Assessment Area were: toluene, barium, cadmium, chromium, cobalt, lead, mercury, nickel, zinc, DDE, DDT, chlordane, and heptachlor epoxide. None of the compounds exceeded the RFI soil/criteria/proposed RCRA levels. Cobalt and lead did not have published toxicity values for development of RCRA action levels but were qualitatively evaluated. Noncarcinogenic hazard indices and carcinogenic health risks were calculated for the current and future maintenance worker, future construction worker, and hypothetical adult and child resident. The hazard indices were below the USEPA level of concern (1.0) indicating that no adverse health effects are anticipated for these receptors. The lifetime excess cancer risks were within or below the target risk range of 1 x E-06 to 1 x E-04 for all receptors.

The ecological risk assessment also identified cadmium, chromium, cobalt, copper, lead, and zinc as metals of concern in soil. No organic chemicals of concern were identified in soil. The metals are of most concern to ground-dwelling organisms; therefore, the focus of the ecological risk assessment was on the exposure of small mammals to chemicals in soil. The risks to small ground-dwelling rodents and species of concern that may feed on small mammals were evaluated. Only chemicals considered to be above background and potentially related to site activities were evaluated. Based on the calculation of toxicity values for a mouse from incidental soil ingestion, none of the six metals are considered to pose a risk to small mammal populations through direct exposure. Also, none of six metals are thought to bioaccumulate through the food chain to levels that would pose a risk to higher trophic organisms. No unacceptable human health or ecological risks due to chemical releases were expected from SD017 and no further action was recommended.

Impacts to groundwater were considered minimal because the depth to groundwater is greater than 285 feet and soil sampling results demonstrated that contaminants are not being transported significantly in a vertical direction.

3.4.2.4 Supplemental RFI (Woodward-Clyde 1994)

The objective of the Supplemental RFI was to collect additional data requested by USEPA to define the deeper soil beneath the suspected rinse sink pit location. One soil boring was drilled to 102 feet and samples were collected at 10-foot intervals starting at 10 feet bgs. The soil samples were analyzed for VOCs, SVOCs, PCBs, TAL metals, TPH, and pesticides. Two pesticides (4,4-DDE and 4,4-DDT) were detected at 10 feet bgs in the duplicate samples but were not detected from 10 to 100 feet bgs. The concentrations of pesticide are lower than the RCRA corrective action levels and lower than concentrations detected at other SWMUs, which were not related to pesticide use. Low concentrations of acetone, methylene chloride, toluene, and TPH were detected at multiple depths, at levels well below the corrective action levels and attributed to laboratory contamination. Seventeen metals were detected within the range of naturally occurring background levels.

3.4.2.5 2007 RFI (URS 2007a)

Maximum soil concentrations for all detected chemicals were compared with NMED SSLs for surface soil, combined soils, and groundwater, respectively. None of the pesticides or metals detected above the reporting limits exceeded the industrial or construction worker SSLs. Arsenic and mercury in combined soil exceeded the soil-to-groundwater SSL; however, impacts to groundwater are considered minimal because the depth to groundwater is greater than 285 feet, downgradient groundwater was not impacted, and soil sampling results demonstrated that soil contaminants were not being transported significantly in a vertical direction and downgradient groundwater was not impacted.

Although arsenic concentrations exceeded the residential SSL, arsenic was not considered a COPC in soil for SD017 based on the following.

- SD017 was an unlined rinse water pit associated with Building 2160, a pesticide storage building. The pit was demolished when the building was razed in 1984. Therefore, there is no longer an active source. During the demolition activities, the surface soil around the pit would have been disturbed, graded, and potentially covered over by surrounding soil.
- Arsenic was detected at a concentration (5.6 mg/kg) slightly above background levels (4.3 mg/kg for subsurface soil) for Cannon AFB, indicating that SD017 was not a hotspot associated with activities at the former pesticide storage area.
- Soil concentrations were compared to the residential SSLs. The NMED Risk Assessment Guidance for Site Investigations (NMED 2012) states that residential receptors (and commercial/industrial receptors) are typically exposed only to surface soils (ground surface to a depth of 2 feet bgs). Construction workers are typically the only receptor considered to be exposed to soils at a depth of greater than 2 feet bgs. USEPA's Risk Assessment Guidance for Superfund (RAGS) (USEPA 1989) also recommends these soil horizons for residential, commercial/industrial, and construction worker receptors. This is a highly conservative comparison because SD017 is a very small site, less than 10 square feet. Therefore, it would be

unlikely that any receptor would be exposed to the site maximum concentrations for any extended period of time, such as the assumed daily residential exposures (350 days per year for 30 years) used to calculate the residential SSL. Additionally, the concentration of arsenic that exceeds the residential SSL was detected in subsurface soil and is unlikely to represent concentrations to which residential receptors would be exposed at the site.

- Only reasonable and predictable land use scenarios should be evaluated as described in USEPA Solid Waste and Emergency Response (OSWER) Directive 9355-7.04. Commercial/industrial land use at Cannon AFB is reasonable and predictable for current and future land use. The site is surrounded by industrial use areas and there are no plans to develop the site. If the land use were to change, then the risk assessment would be re-visited at that time.

Based on the evaluation of site concentrations, the locations of detected concentrations, and potential receptors, the site was recommended for CAC without controls. A response received from NMED on May 14, 2008 indicated that SD017 could be recommended for CAC with Controls. The site could not be recommended for CAC without controls due to the presence of arsenic in the soils.

3.4.2.6 2010 Corrective Action Complete Proposal (URS 2010b)

In March 2010, a CAC Proposal considering all results and conclusions was compiled. Due to concentrations of arsenic and mercury exceeding general soil-to-groundwater SSLs, site-specific soil-to-groundwater SSLs were calculated. The site-specific calculations resulted in an acceptable dilution attenuation factor (DAF).

The proposal concluded that CAC with Controls is appropriate for the site because the building has been removed, the site has been adequately characterized in accordance with applicable regulations, and the available data indicated that contaminants pose an acceptable level of risk under current and projected land use.

NMED granted CAC with Controls for SD017 on February 23, 2011. SD017 is listed on Table 2 (CAC with Controls) of the current RCRA permit. Annual site inspections are required to be completed and documented in an annual IC report.

3.5 SD020 (SWMU 95)

3.5.1 Site Description and Background

SD020 is a shallow, open ditch that begins near the end of the northeastern runway, Runway 4/22, and extends to the southeast under an access road before emptying into an open field (**Figure 1-2**). The northwest end of the ditch is marked by a concrete culvert and is surrounded by heavy vegetation. The drainage ditch is approximately 40 feet wide and runs for approximately 550 feet until it reaches the field.

3.5.2 Previous Investigation Results

3.5.2.1 1990 Remedial Investigation (Walk-Haydel 1990)

The site was investigated during a Final IRP RI. The investigation included drilling and sampling of eleven soil borings. Soil samples were collected from depths that ranged from 5 to 61.5 feet bgs. Samples were analyzed for total metals, EP toxicity characteristics, VOCs, and base/neutral extractable compounds. Long chain organic compounds were detected at a shallow depth in one soil boring near the northwest end of the drainage ditch. Selenium and barium were detected in concentrations above area background concentrations, but within the range of concentrations typical of area soils.

3.5.2.2 RI Report for 18 SWMUs (W-C 1992)

An RI was completed at SD020. Two soil borings were drilled and sampled to depths of 10 feet bgs. The soil borings were located near the upstream end of SD020 to evaluate possible contaminant contributions from areas upstream of the already sampled reach of the ditch. Samples were analyzed for VOCs, SVOCs, TAL metals, and TPH. A BRA was completed based on data collected during the RI (W-C 1992). Lead and zinc were identified as the only COPC for human health risk evaluation. Calculations of risk to human health for non-carcinogenic and carcinogenic risks indicated no unacceptable risk. No unacceptable ecological risks were identified.

3.5.2.3 Initial RFI (URS 2007a)

The results and conclusions of the SD020 RI/BRA were reviewed and compared to current NMED SSLs. All of the RI analytical results with a current evaluation were presented to the NMED RCRA section in the RFI Report. A preliminary risk screening of this site was completed following current NMED guidance. The results of this screening were presented in further detail in the RFI report.

The results of previous investigations were reviewed as part of the RFI and the conclusions for SD020 were presented in the RFI report (URS 2007). The RFI review indicated that arsenic results exceeded the current NMED residential SSLs in surface and subsurface soil samples. However, it is plausible that the elevated concentrations and elevated reporting limits associated with the arsenic data in the RI (Walk-Haydel 1990) may be attributable to inter-element interference that was not properly accounted for during laboratory analysis and may not be representative of site conditions. The RFI report was reviewed by NMED, and based on NMED comments regarding arsenic levels, additional sampling at SD020 was suggested to further characterize the site.

3.5.2.4 RFI Addendum (URS 2009)

RFI Addendum fieldwork was completed, which consisted of the completion of four soil borings. Four soil borings were advanced to 15 feet bgs. Samples were collected and analyzed for arsenic to determine if the elevated concentrations and elevated reporting limits associated with the arsenic data in the RI (Walk-Haydel 1990) may be attributable to inter-element interference that was not properly accounted for during laboratory analysis and may not be representative of site conditions. With the exception of one arsenic level (4.6 mg/kg), which slightly exceeded Cannon AFB background levels (4.3 mg/kg) and the residential SSL (3.9 mg/kg) in the 0 to 4 foot bgs interval at soil location SB01, no elevated arsenic concentrations were identified. Based on the RFI Addendum sample results, the RI data was considered invalid since previous arsenic data in the RI (Walk-Haydel 1990) may be attributed to inter-element interference. Because the maximum arsenic concentration detected during the RFI (4.6 mg/kg) was above the residential SSL (3.9 mg/kg), but below the industrial SSL (17.7 mg/kg) CAC with Controls was recommended for SD020.

NMED granted CAC with Controls for SD020 on June 4, 2010. SD020 is listed on Table 2 (CAC with Controls) of the current RCRA permit. Annual site inspections are required to be completed and documented in an annual IC report.

3.6 SW002 (SWMU 2)

3.6.1 Site Description and Background

Site SW002 is near former Hangar 108 in the west-central portion of the base (**Figure 1-2**). It is the site of a former 2,000-gallon underground storage tank (UST) that supplied diesel fuel heating oil to Hangar 108. Hangar 108 was approximately 3,000 feet east of the base's western boundary fence and 6,200 feet south of the base's northern boundary fence.

3.6.2 Previous Investigation Results

3.6.2.1 1987 RCRA Facility Assessment (A.T. Kearney 1987)

A RCRA Facility Assessment (RFA) (A.T. Kearney 1987) described Hangar 108 as having a recovered diesel tank connected to an oil/water separator (OWS). This led to the suspected UST being listed as an Appendix II site in the historical RCRA permit. However, the only storage tank ever associated with Hangar 108 was a 2,000-gallon UST approximately 100 feet east of the OWS that was used to store diesel fuel as heating oil for the building. In 1989, Hangar 108 was demolished and replaced with Hangar 125. During demolition, a 2,000-gallon heating oil tank was removed from the suspected location of SW002, and the former UST location was covered with the concrete floor of the new hangar.

3.6.2.2 2007 RCRA Facility Investigation (URS 2007a)

Because documentation of previous sampling was not available, a field investigation was completed using the following procedures: Institutional knowledge and available demolition drawings for Hangar 108 were used to locate the former position of the removed heating oil UST. Typically, a 2,000-gallon UST is 5 feet, 4 inches in diameter and 12 feet long. Diamond-coring equipment was used to remove a concrete plug from the hangar floor at two of the four sampling points. Direct push drilling equipment was used to advance two of four soil borings to depths of 15 feet bgs and the other two soil borings to depths of 16 feet bgs. Soil samples were collected at the 8 to 10 foot bgs and the 13 to 15 foot bgs depth intervals and submitted for laboratory analysis for individual fuel oil constituents: VOCs, SVOCs, and TAL metals (URS 2007a).

Maximum subsurface soil concentrations for all detected chemicals were compared with NMED SSLs. No VOCs or SVOCs were detected above the reporting limits in any of the samples. Selenium and sodium were not detected above the reporting limits in any of the samples. None of the metals were detected above the construction worker SSLs. The maximum concentration of arsenic in subsurface soil (9.9 mg/kg) exceeded the soil-to-groundwater SSL (0.29 mg/kg), the residential SSL (3.9 mg/kg), and the background concentration for soils (4.3 mg/kg). The maximum concentrations of iron (8,610 mg/kg), mercury (0.021 mg/kg), and thallium (4.3 mg/kg) exceeded the soil-to-groundwater SSLs but did not exceed the residential SSLs. Impacts to groundwater were considered minimal because the depth to groundwater was greater than 250 feet and soil sampling results did not indicate that metals were being transported significantly in a vertical direction (URS 2007a).

A site conceptual exposure model (SCEM) was developed based on current and historical site information. Under current use, direct contact with subsurface soils was considered to be an incomplete exposure pathway because the area sampled was under the hangar concrete floor and no contact occurred at the depths sampled. It was considered unlikely that future construction would occur at the hangar. In addition, any contamination that may be associated with the site was considered present at depths greater than typical construction activities (i.e., greater than 10 feet bgs). Although exposure to the subsurface soil was considered unlikely, it was evaluated in the event that site conditions change significantly and the subsurface soils were disturbed, mixed with surface soils, and/or exposed. The most significant exposure pathway was direct contact with the soil, resulting in incidental ingestion or dermal absorption of chemicals from soil over a short duration and frequency. Human receptors for this pathway were limited to construction workers. Future industrial or residential exposure was considered to be unlikely because the potential for major soil excavation and future construction of buildings or residential homes at this site was low (URS 2007).

The primary release mechanisms by which COPCs could be released from the site were by direct contact during soil disturbance or excavation activities and by infiltration to groundwater affecting the potable water supply. The data used for screening against SSLs were limited to samples collected from the 8- to 15-foot bgs depth intervals. Based on the evaluation of site

concentrations, the location of the detected concentrations, and potential receptors, Cannon AFB petitioned that the site be considered for CAC without Controls status (URS 2007).

3.6.2.3 NMED Correspondence Regarding RFI

In 2008, NMED indicated, without performing additional work at this site, that Cannon AFB may seek a CAC with Controls determination as defined in 20.4.2.7 New Mexico Administrative Code (NMAC) as follows: NMED has determined that no additional remedial activity is required at a unit, but the unit requires continued performance of operation and maintenance, or monitoring actions for engineering controls, or ICs. If Cannon AFB completes additional corrective action and reduces contaminant concentrations to levels below residential SSLs, then Cannon AFB may seek a CAC without Controls determination as defined in 20.4.2.7 NMAC as follows: NMED has determined that no additional remedial activity is required at a unit (Bhate 2012).

Based on the response from NMED, Cannon AFB petitioned for CAC with Controls. NMED approved SW002 for CAC with Controls on February 23, 2011 (Bhate 2012). SW002 is listed on Table 2 (CAC with Controls) of the current RCRA permit. Annual site inspections are required to be completed and documented in an annual IC report.

3.7 SW004 (SWMU 4)

3.7.1 Site Description and Background

Site SW004 is near former Hangar 121 in the west-central portion of the base (**Figure 1-2**). It is the site of a former 2,000-gallon UST that supplied diesel fuel heating oil to Hangar 121. Hangar 121 was approximately 3,200 feet east of the base's western boundary fence and 5,980 feet south of the base's northern boundary fence.

3.7.2 Previous Investigation Results

3.7.2.1 1987 RCRA Facility Assessment (A.T. Kearney 1987)

An RFA (A.T. Kearney 1987) described Hangar 121 as having a recovered diesel tank connected to an OWS. This led to the suspected UST being listed as an Appendix II site. However, the only storage tank ever associated with Hangar 121 was a 2,000-gallon UST located approximately 50 feet east of the OWS which stored diesel fuel as heating oil for the building. In 1989, Hangar 121 was demolished and replaced with Hangar 126. During demolition, a 2,000-gallon heating oil tank was removed from the suspected location of SW004, and the former UST location was covered with the concrete floor of the new hangar.

3.7.2.2 2007 RCRA Facility Investigation (URS 2007a)

Because documentation of previous sampling was not available, a field investigation was completed using the following procedures. Institutional knowledge and available demolition drawings for Hangar 121 were used to locate the former position of the removed heating oil UST. Typically, a 2,000-gallon UST is 5 feet, 4 inches in diameter and 12 feet long. Diamond-coring equipment was used to remove a concrete plug from the hangar floor at two of the four sampling points. Direct push drilling equipment was used to advance each of four soil borings to a depth of 16 feet bgs. Soil samples were collected at the 8-to 10-foot bgs and the 13- to 15-foot bgs depth intervals and submitted for laboratory analysis for individual fuel oil constituents: VOCs, SVOCs, and metals (URS 2007a).

Maximum subsurface soil concentrations for all detected chemicals were compared with NMED SSLs. No VOCs or SVOCs were detected above the reporting limits. Copper, selenium, silver, and thallium were not detected above the reporting limits in any of the samples, and none of the metals were detected above the construction worker SSLs. The maximum concentration of arsenic in subsurface soil (7.7 mg/kg) exceeded the soil-to-groundwater SSL (0.29 mg/kg) and the residential SSL (3.9 mg/kg). The maximum concentrations of iron (9,360 mg/kg) and mercury (0.027 mg/kg) exceeded the soil-to-groundwater SSLs, but both were below site-specific background levels. Impacts to groundwater were considered minimal because the depth to groundwater was greater than 250 feet and soil sampling results did not indicate that metals were being transported significantly in a vertical direction (URS 2007a).

An SCEM was developed based on current and historical site information. Under current use, direct contact with subsurface soils was considered an incomplete exposure pathway because the area sampled was under the hangar concrete floor and no contact occurred at the depths sampled. It was considered unlikely that future construction would occur at the hangar. In addition, any contamination that was associated with the site was likely to be present at depths greater than typical construction activities (i.e., greater than 10 feet bgs). Although exposure to subsurface soil was unlikely, it was evaluated in the event that site conditions change significantly and the subsurface soils were disturbed, mixed with surface soils, and/or exposed. The most significant exposure pathway was direct contact with the soil, resulting in incidental ingestion or dermal absorption of chemicals from soil over a short duration and frequency. Human receptors for this pathway were limited to construction workers. Future industrial or residential exposure was unlikely because the potential for major soil excavation and future construction of buildings or residential homes within the subsurface of the site was low (URS 2007a).

Based on comparison of current maximum site soil concentrations with current applicable human health-based SSLs, no COPCs were identified for the exposure scenario applicable to this site. The available data indicate the chemicals present do not pose an unacceptable level of risk under current and projected future land uses (URS 2007a).

3.7.2.3 NMED Correspondence Regarding RFI

In 2008, the NMED approved the right to petition for CAC with Controls. Based on the response from NMED, Cannon AFB petitioned for CAC with Controls. NMED approved SW004 for CAC with Controls on February 23, 2011 (Bhate 2012). SW004 is listed on Table 2 (CAC with Controls) of the current RCRA permit. Annual site inspections are required to be completed and documented in an annual IC report.

3.8 SW006 (SWMU 6)

3.8.1 Site Description and Background

An RFA (A.T. Kearney 1987) described the suspected SW006 location, Hangar 129, as having a recovered diesel tank connected to an OWS. This led to the UST being listed as an Appendix II site. However, the only storage tank ever associate with Hangar 129 was a 2,000-gallon UST located approximately 60 feet east of the OWS, which stored diesel fuel as heating oil for the building. The tank was originally located 30 feet south of this location, but was moved when Cannon AFB buildings were converted to natural gas heat. In 1992, the 2,000-gallon heating oil tank was removed from the suspected location of SW006 and confirmatory samples were collected following NMED UST regulations.

3.8.2 2007 RCRA Facility Investigation (URS 2007a)

Because documentation of sampling in the vicinity of the original (southern) UST location was not found, a field investigation was completed in 2006 to address this data gap. Institutional knowledge and available record drawings were used to locate the likely position of the removed heating oil UST. Typically, a 2,000-gallon UST is 5 feet, 4 inches in diameter and 12 feet long. Direct push drilling equipment was used to advance each of four soil borings to a depth of 16 feet bgs. Soil samples were collected at the 8 to 10 feet bgs and the 13 to 15 feet bgs depth intervals and submitted for laboratory analysis for individual fuel oil constituents: VOCs, SVOCs, and metals.

A documentation search was completed for SW006 in June 2005 that located the confirmatory sampling results associated with the final UST removal from the tank's second (northern) location. Based on the findings of the document search, sampling was not required in the northern area because previous sampling results were successfully located. The samples submitted for laboratory analysis during the tank removal were analyzed for TPH and individual fuel oil constituents including methyl tert-butyl ether, and benzene, toluene, ethylbenzene, and xylenes. As part of the RFI, these confirmatory samples collected during the tank removal were reevaluated using current methods and screening criteria.

Maximum subsurface soil concentrations for all detected chemicals were compared with NMED SSLs. No SVOCs were detected above the reporting limits. Benzene (0.003 mg/kg) and TPH (6.438 mg/kg) were detected in concentrations below the respective residential SSLs (3.32 mg/kg

for benzene and 760 mg/kg for TPH) in samples collected during tank removal activities. No other VOCs or SVOCs were detected above the reporting limits in samples collected during either investigation. Selenium was also not detected above the reporting limit in any of the samples. None of the metals exceed the construction worker SSLs. Arsenic (5.9 mg/kg) exceeded the residential SSL (3.9 mg/kg). Arsenic (5.9 mg/kg), iron (9,430 mg/kg), mercury (0.017 mg/kg), and thallium (4.6 mg/kg) exceeded the soil to groundwater SSL; however, all of these but arsenic and thallium were below site-specific background levels. In addition, impacts to groundwater were considered minimal because the depth to groundwater at Cannon AFB is greater than 285 feet bgs and soil sampling results do not indicate that metals are being transported significantly in a vertical direction.

Although arsenic concentrations exceeded the residential SSL, arsenic was not considered a COPC in soil for SW006 based on the following:

- SW006 is a former diesel UST. There is no active source at this SWMU because the tank was removed.
- Arsenic is not considered a major component of diesel fuel; therefore, site activities do not support arsenic as a site-related COPC.
- Arsenic was detected at concentrations (5.9 mg/kg maximum) slightly above background levels (4.3 mg/kg for subsurface soil) for Cannon AFB, indicating that SW006 is not a hotspot associated with activities at Hangar 129.
- Soil concentrations were compared to the residential SSLs. The NMED Risk Assessment Guidance for Site Investigations (NMED 2012) states that residential receptors (and commercial/industrial receptors) are typically exposed only to surface soils (ground surface to a depth of 2 feet bgs). Construction workers are typically the only receptor considered to be exposed to soils at a depth of greater than 2 feet bgs. USEPA's RAGS (USEPA 1989) also recommends these soil horizons for residential, commercial/industrial, and construction worker receptors. The tank was located deeper than 2 feet bgs; therefore, surface soil is not considered a medium of concern for the site. In fact, the most likely release point from a UST is below the tank. Based on this, site samples were collected from the 8 to 15 foot bgs depth intervals. Therefore, the comparison of the site's subsurface soil concentrations to screening levels designed for daily exposures (350 days per year for 30 years) to the top 2 feet of soil (0 to 2 feet bgs) is highly conservative and does not represent true exposure and potential risk from the site.
- Only reasonable and predictable land use scenarios were evaluated as described in USEPA Office of OSWER Directive 9355-7.04. Commercial/industrial land use is reasonable and predictable for current and future land use in this area of Cannon AFB. The site was surrounded by industrial use areas and there were no plans to develop the site. If the land use were to change, then the risk assessment would be re-visited at that time.

Based on the evaluation of site concentrations, the locations of detected concentrations, and potential receptors, the site was recommended for "CAC without Controls."

A response received from NMED on May 14, 2008 indicated that SW006 could be recommended for CAC with Controls. The site could not be recommended for CAC without controls due to the presence of arsenic in the soils. NMED granted CAC with Controls for SW006 on February 23, 2011. SW006 is listed on Table 2 (CAC with Controls) of the current RCRA permit. Annual site inspections are required to be completed and documented in an annual IC report.

3.9 WL102 (SWMU 102)

3.9.1 Site Description and Background

This site was an integral part of the lagoon wastewater treatment system (**Figure 1-2**). The former Sewage Lagoons (SI101) were constructed in 1966. The lagoons consisted of two unlined surface impoundments (the north and south lagoons) that received combined sanitary and industrial wastewater from base facilities. The lagoons had concrete-lined banks and unlined earthen bottoms, operated in series, and had a combined surface area of approximately 39 acres. In 1998, a new wastewater treatment plant was put into operation at Cannon AFB. Although sewage discharge to the lagoons stopped in 1998, the base continued to discharge treated wastewater to the former lagoons in order to allow them to dry gradually. WL102 consists of a discharge pipe from SI101 and an inlet chamber equipped with two slide gates. The discharge was directed to SWMU 103, a self-contained playa lake located near the eastern boundary of Cannon AFB.

3.9.2 2007 RCRA Facility Investigation (URS 2007a)

Because documentation of previous sampling is not available, a field investigation was completed during the 2007 RFI (URS 2007a). Institutional knowledge and Base drawings were used to locate the discharge area. Direct push drilling equipment was used to advance three of four soil borings to depths of 17 feet bgs and to advance a fourth soil boring to a depth of 16 feet bgs. Soil samples were collected at the 5- to 7- foot bgs depth intervals and at the 15- to 17-foot bgs depth intervals (in the three 17-foot borings) or at the 14- to 16-foot bgs depth intervals (in the 16-foot boring) to determine if the discharge piping impacted the subsurface soils. Samples were submitted for laboratory analysis and analyzed for VOCs, SVOCs, pesticides/PCBs, and TAL metals.

Maximum subsurface soil concentrations for all detected chemicals were compared with NMED SSLs. Two VOCs (toluene and m,p-xylene) were detected in one sample at a very low concentration greater than 3 orders of magnitude below the lowest SSL. No SVOCs or PCBs were detected above the reporting limits. Five pesticides were detected (4,4-DDE, 4,4-DDT, alpha chlordane, gamma chlordane, and gamma-BHC) well below the lowest SSL. Selenium was not detected above the reporting limit in any of the samples. None of the metals exceed the construction worker SSLs. Arsenic (5.8 mg/kg), iron (7,460 mg/kg) and mercury (0.03 mg/kg), and thallium (5.2 mg/kg) exceeded the soil to groundwater SSL but were below or within the range of site-specific background levels. Impacts to groundwater were considered minimal

because the depth to groundwater is greater than 285 feet and soil sampling results do not indicate that metals are being transported significantly in a vertical direction.

The first step in the Screening-Level Ecological Assessment Risk Assessment process was to determine if there is any reason to believe that ecological receptors and/or complete exposure pathways exist at or in the locality of the site. Given the small size of the site, limited exploitable habitat (i.e., tree line for nesting and pond), and very limited potential for natural biomass production (i.e., either plant or animal), there was a very low exposure potential for ecological receptors at the site. The area of concern was the soil beneath the discharge pipes from 7 to 17 feet bgs. Exposure pathways for ecological receptors do not apply to soils deeper than 5 feet bgs. Therefore, it was determined that the site did not pose an unacceptable risk to ecological receptors and no formal ecological risk assessment was warranted.

Although the maximum arsenic and thallium concentrations exceeded the residential SSLs, arsenic and thallium are not considered COPCs in soil for WL102 based on the following:

Arsenic was detected at concentrations (5.7 mg/kg maximum) slightly above background levels (4.3 mg/kg for subsurface soil) for Cannon AFB, indicating that WL102 is not a hotspot. Thallium was detected in one sample at a concentration of 5.2 mg/kg which only slightly exceeds the residential SSL of 5.16 mg/kg. All other detected concentrations of thallium were below the residential SSL. Therefore, thallium does not represent a widespread problem at the site.

Soil concentrations were compared to the residential SSLs. The NMED Risk Assessment Guidance for Site Investigations (NMED 2012) states that residential receptors (and commercial/industrial receptors) are typically exposed only to surface soils (ground surface to a depth of 2 feet bgs). Construction workers are typically the only receptor considered to be exposed to soils at a depth of greater than 2 feet bgs. USEPA's RAGS (USEPA 1989) also recommends these soil horizons for residential, commercial/industrial, and construction worker receptors. The discharge pipe was located deeper than 2 feet bgs; therefore, surface soil is not considered a medium of concern for the site. In fact, the most likely release point from the pipe is below the pipe. Based on this, site samples were collected from the 5- to 17-foot bgs depth intervals. Therefore, the comparison of the site's subsurface soil concentrations to screening levels designed for daily exposures (350 days per year for 30 years) to the top 2 feet of soil (0 to 2 feet bgs) is highly conservative and does not represent true exposure and potential risk from the site.

The NMED Risk Assessment Guidance for Site Investigations (NMED 2012) states that residential receptors (and commercial/industrial receptor) are typically exposed only to surface soils (ground surface to a depth of 2 feet bgs). Construction workers are typically the only receptor considered to be exposed to soils at a depth of greater than 2 feet bgs. Therefore, subsurface concentrations detected at SW006 do not represent concentrations to which residential receptors would be exposed at the site and the comparison to residential SSLs was a very conservative evaluation.

USEPA OSWER Directive 9355-7.04 states that only reasonable and predictable land use scenarios should be evaluated. Commercial/industrial land use is reasonable and predictable for current and future land use in this area of Cannon AFB. The site is surrounded by industrial use areas and there are no plans to develop the site. If the land use were to change, then the risk assessment would be re-visited at that time.

3.9.3 2010 Corrective Action Complete Proposal (URS 2010b)

Based on the evaluation of site concentrations, the location of the detected concentrations, and potential receptors, the site was recommended for CAC without controls. A response received from NMED on May 14, 2008 indicated that WL102 could be recommended for CAC with Controls. The site could not be recommended for CAC without controls due to the presence of arsenic in the soils. NMED granted CAC with Controls for WL102 on February 23, 2011. WL102 is listed on Table 2 (CAC with Controls) of the current RCRA permit. Annual site inspections are required to be completed and documented in an annual IC report.

This section provides a description of the field sampling plan including revisions to the existing Facility-Wide Long Term Groundwater Monitoring Plan (AECOM 2011).

4.1 GROUNDWATER MONITORING SAMPLING PLAN

Based on a review of the historical groundwater monitoring data, the groundwater has not been impacted by the historical activities at landfills LF003, LF004, LF005, LF025, or sewage lagoon SI101. Therefore, an optimization of the groundwater monitoring plan is included in this WPA. The rationale supporting the optimization of the groundwater monitoring plan is as follows:

- There is no evidence to indicate that LF003, LF004, LF005, LF025, or SI101 are adversely affecting human health or the environment. The investigation activities completed at LF003, LF004, LF005, LF025, and SI101 indicate that the landfill wastes have not contributed to unacceptable impacts to site media, including regional groundwater, and landfill cover/caps are in place. In addition, the climate is sufficiently arid to prevent potential leachate impact to groundwater.
- The potential for leachate production and subsurface contamination and/or migration at LF003, LF004, LF005, LF025, and SI101 is limited by the soil cover/caps and the arid climate. As such, there are no known or anticipated release mechanisms at this site.
- Administrative land use controls include restrictions requiring the future use of the site as vacant industrial land as administered by Cannon AFB.

Groundwater samples will be collected from all 18 monitoring wells in 2014. Subsequent to the completion of the 2014 sampling event, groundwater sampling will be reduced from the current 18 monitoring wells to the following 11 monitoring wells: MW-C, MW-F, MW-G, MW-Na, MW-Oa, MW-Pa, MW-Rb, MW-S, MW-T, MW-U, and MW-X (**Figure 4-1**). The schedule of the sampling events, monitoring well locations, and rationale for optimization of the monitoring well sampling are included in **Table 4-1**. Those wells not included in the revised monitoring well program will be abandoned in accordance with NMED regulations.

All groundwater samples collected will be analyzed for VOCs, TAL metals (including mercury), chromium VI, perchlorate, chloride, nitrate/nitrite, sulfate, ammonia, total organic carbon (TOC), and field water quality parameters (pH, dissolved oxygen [DO], specific conductance, turbidity, and temperature). Groundwater analytical methods as well as information regarding sample containers, preservation, and hold times are included in **Table 4-2**.

4.2 WATER LEVEL MEASUREMENT

Water level measurements will be collected on an annual basis concurrent with landfill and IC inspections. Prior to groundwater sampling activities, a full round of water levels will be collected from all monitoring wells associated with this LTM investigation using an electronic water level indicator.

Water levels will be measured in the shortest time practical to minimize the effects of water table fluctuations, ideally within a 24-hour period. Water level measurements will be documented on a Water Level Data Summary form (**Appendix B**) and in a bound, numbered, site-specific field logbook. The depth to groundwater will be measured from the top of well casing (i.e. top of casing) to the nearest 0.01 foot and always from the same reference point or survey mark on the well casing. If there is no reference mark, the measurement will be from the highest point of the well casing where possible, and from the northern side of the casing if not possible to determine the highest point on the well casing. In either case, notes must be made on the summary form and in the logbook to foster standardization of the measuring point for future sampling events.

The total depth of the well will be measured in the same manner as above and recorded on the Water Level Data Sheet and applicable logbook. Field procedures for water level measurements were developed in general accordance with guidance provided by NMED.

4.3 GROUNDWATER SAMPLE COLLECTION

The selection of the purging technique and equipment is dependent on the hydrogeologic properties of the aquifer, especially depth to groundwater and hydraulic conductivity. The intent of proper purging is to stabilize the water quality parameters in the well and minimize the hydraulic stress to the hydrogeologic formation. Every attempt must be made to match the pumping rate with the recharge rate of the well before evaluating the purging completion criteria. Based on the low yield of wells at Cannon AFB "low-flow" sampling methodologies are necessary. Therefore, a low-flow electronic submersible or bladder pump will be used to minimize drawdown in the wells. It should be noted that a minimum column of water (i.e. hydrostatic pressure) is necessary for proper equipment function. As water levels decline, adjustments to sampling protocol and equipment use may be required. The submersibles or bladder pumps will be set within the screened interval of the respective wells during the purging and collection of the groundwater samples. Well construction details are summarized in **Table 4-3**.

A flow-through cell attached to the pump discharge will be used to measure stabilization parameters. Purging will continue until all field parameters have stabilized for three consecutive readings (collected at 5-minute intervals) according to the following criteria:

- Turbidity ≤ 10 NTUs or ± 10% where > 10 NTUs
- pH ± 0.1 units
- Specific Conductance ± 10% of reading
- DO ± 0.3 mg/L of reading
- Temperature ± 10% of reading

4.4 INVESTIGATION-DERIVED WASTE

Investigation-derived waste (IDW) generated during groundwater sampling activities will include monitoring well purge water, decontamination water, and personal protective equipment (PPE). All wastewater generated during well purging and equipment decontamination will be placed in bulk liquid storage tanks located adjacent to each monitoring well. Each container will be clearly labeled to identify the contents, date of generation, generation location, media, contact information, container number, restrictions for adding or removing contents, and the statement "Waste Classification Pending Analytical Results."

Monitoring well analytical results from the associated samples will be used to characterize the IDW by applying the "20 Times Rule" (40 Code of Federal Regulations [CFR] §261.24). If analytical results are greater than or equal to 20 times any of the Toxicity Characteristic Leaching Procedure (TCLP) regulatory limits (40 CFR §261.24), then a waste characterization sample will be collected and analyzed for TCLP. TCLP regulatory limits are summarized in **Table 4-4**. The results from these analyses will be compared directly to TCLP regulatory limits. IDW that is characterized as hazardous waste will be sent to an off-site waste management service for disposal.

If monitoring well analytical results are less than 20 times any of the TCLP regulatory limits, then groundwater screening criteria will be used to characterize IDW. If analytical results are less than the residential screening values, then IDW will be discharged to the ground surface from where the aqueous IDW was generated. If analytical results for any site-related contaminants are greater than the residential screening values, then the IDW will be handled as non-hazardous RCRA solid waste and disposed offsite at a subtitle D facility.

PPE, decontamination plastic, and similar waste material will be consolidated into contractor trash bags and placed in a solid waste dumpster designated by Cannon AFB personnel.

4.5 MONITORING WELL INSPECTION

During each sampling event, monitoring well inspections will be conducted to assess the overall condition of the wells located at Cannon AFB. Inspections will be documented using the Well Inspection Form included in **Appendix B**. The following items will be noted on the inspection forms and in the logbook:

- Verify the identification of the monitoring well by examining markings, sign plates, placards, or other designations.
- Remove the exterior well cover and remove all standing water around the top of the well casing before opening the well cap, if applicable.
- Inspect pad, bollards, and exterior protective casing (if present and/or applicable) of the monitoring well or supply well for damage and document the results of the inspection if there is a problem.

- Inspect the well lock and determine whether the cap fits tightly. Replace the cap and/or lock if necessary.
- Repairs will be performed within two weeks of groundwater sampling unless otherwise directed by Cannon AFB. If repairs to the well alter the top of casing for the well, it will be resurveyed prior to the next sampling event.

4.6 MONITORING WELL REHABILITATION PROGRAM

Various issues can impact the volume of water present in a monitoring well. The most common issues include, but are not limited to, a drop in water levels, sedimentation in the filter pack/well screens, and sedimentation in the bottom of the well. Groundwater levels at Cannon AFB decline on average between 1.5 and 3.1 feet per year (see **Table 4-3**). Therefore, a drop in water level is the most likely problem to be associated with monitoring wells at Cannon AFB.

Water levels will be collected prior to completing groundwater sampling. The depth to water will be measured along with the total depth of the well and recorded in the field log book. This will allow for a comparison of the known depth of the well with the measured depth at the time of sampling. Those wells with water present will be sampled in accordance with the groundwater sample collection procedures identified in **Section 4.3**. If no water is present in the well at the time of the groundwater sampling or a water sample could otherwise not be obtained (sediments in the water, etc.), these wells will be evaluated for potential rehabilitation.

The 2012 biennial monitoring report (Bhate 2013) indicated that wells MW-B and MW-D will require rehabilitation prior to completing sampling for the 2014 sampling event. These wells are currently scheduled to be rehabilitated in June of 2014 with the biennial sampling scheduled to be completed in July of 2014.

4.6.1 Wells Evaluation

For monitoring wells where no water is present, the total measured depth of the well will be compared with historic groundwater levels, the anticipated groundwater elevation, and the original depth to the bottom of the well. If the measured depth to the bottom of the well does not correspond with the original depth to the bottom of the well, the difference between the numbers will be utilized to calculate the thickness of the sediment in the bottom of the well. If it is determined that the sediment in the well is interfering with the sample collection (based on the anticipated groundwater elevation) then the monitoring well will be rehabilitated to remove the sediment from the well. If it is determined that the groundwater elevation is at or below the bottom of the screened interval (based on the anticipated groundwater elevation), then the well will be abandoned in accordance with NMED regulations.

The groundwater depth anticipated to be present in the well will be calculated using the following formula:

Elevation – (Years x Average Decline) = anticipated groundwater elevation

Where:
Elevation = the last measured groundwater level for the well for the well
Years = the number of years since the well was last measured
Decline = the average decline in groundwater elevation per year for that well (in **Table 4-3**)
Anticipated groundwater elevation = the elevation of groundwater anticipated to be present in the monitoring well

4.6.2 Monitoring Well Rehabilitation

Well rehabilitation methods at Cannon AFB are anticipated to be limited to air lifting and pump and surge. Air lifting consists of using high pressure air to lift sediment and/or debris out of the well. Pump and surge consists of pumping clean water into the well and using a pneumatic pump placed at the bottom of the well to pump the sediments and/or debris from the well as it is mixed into the aqueous solution.

TABLE 4-1
FUTURE MONITORING WELL SAMPLING EVENTS

Monitoring Well Number	Monitoring Well Location	Future Biennial Sampling Events		Rationale
		2014	2016, 2018, 2020, 2022	
MW-A	1,000 feet North-Northwest of LF005	X		This well is located 1,000 feet upgradient from LF005. Due to the distance of the well from the landfills and the estimated groundwater flow direction, this well is not representative of background conditions nor would it be useful for indicating migration of contaminants.
MW-B	Eastern Boundary of LF005	X		Two existing monitoring wells (MW-T and MW-U) are located along the eastern border of LF005. No contaminants have historically been identified in MW-B. MW-B and MW-T are located in close proximity to one another. MW-T has a 40-foot screen while MW-B has a 15-foot screen. Therefore, MW-T monitors more of the groundwater formation than MW-B.
MW-C	Southern Boundary of LF005	X	X	None
MW-D	Southern Boundary of LF005	X		Two existing monitoring wells (MW-C and MW-S) are located along the southern border of LF005. No contaminants have historically been identified in MW-D. Based on historical information, Cell 3 is the portion of the landfill that represents the greatest concern. Cell 3 is located in the eastern portion of LF005. Based on the estimated groundwater flow direction and the location of MW-D, this well is not in the optimal location to monitor potential migrating contaminants from LF005.
MW-E	1,100 feet North-Northwest of SI101 and 1,000 feet West of LF025	X		MW-E is located 1,000 feet upgradient from SI101 and LF025. Due to the distance of the well from the landfills and the estimated groundwater flow direction, this well is not representative of background conditions nor would it be useful for indicating migration of contaminants.
MW-F	Western Boundary of LF025	X	X	None
MW-G	Eastern Boundary of SI101	X	X	None

TABLE 4-1
FUTURE MONITORING WELL SAMPLING EVENTS

Monitoring Well Number	Monitoring Well Location	Future Biennial Sampling Events		Rationale
		2014	2016, 2018, 2020, 2022	
MW-H	Southern Boundary of SI101	X		Based on the estimated groundwater flow direction, MW-H is located crossgradient from SI101 and is not optimal for indicating migration of potential contaminants from SI101. Based on historical screening levels and human health risk assessment evaluations, groundwater is not being impacted by seepage from SI101.
MW-Na	200 feet east of LF004	X	X	None
MW-Oa	Southern Boundary of LF003	X	X	None
MW-Pa	100 feet East of SI101	X	X	None
MW-Rb	Eastern Boundary of LF025	X	X	None
MW-S	Southeastern Boundary of LF005	X	X	None
MW-T	Eastern Boundary of LF005	X	X	None
MW-U	Eastern Boundary of LF005	X	X	None
MW-V	Northwestern Boundary of Cannon AFB	X		No contaminants have historically been identified in MW-V. MW-V is utilized as a background well. However, groundwater measured at this location is migrating onto the base from the adjoining properties to the west. Therefore, this well is not representative of background conditions nor would it be useful for indicating migration of contaminants.
MW-W	500 Feet South of LF002	X		MW-W is located approximately 500 feet south of LF002 which does not require any further inspection (beyond IC inspections) or groundwater monitoring. No contaminants have historically been identified in MW-W. MW-W is located approximately 1,600 feet northeast of SI101 and 2,300 feet northwest of LF004. MW-W is not located upgradient from either SI101 or LF004. Due to the distance of the well from the landfills and the estimated groundwater flow direction, this well is not representative of background conditions nor would it be useful for indicating migration of contaminants.

TABLE 4-1
FUTURE MONITORING WELL SAMPLING EVENTS

Monitoring Well Number	Monitoring Well Location	Future Biennial Sampling Events		Rationale
		2014	2016, 2018, 2020, 2022	
MW-X	Southwestern Boundary of Cannon AFB	X	X	None

Note: the estimated groundwater flow direction at Cannon AFB is to the southeast.

TABLE 4-2
GROUNDWATER SAMPLE ANALYTICAL METHODS, SAMPLE CONTAINERS, PRESERVATION, AND HOLD TIMES

Analytical Group	Method/SOP	Sample Volume	Containers	Preservation Requirements (chemical, temperature, light protected)	Maximum Holding Time (preparation, analysis)	Data Package Turnaround
Volatile organic compounds (VOCs)	USEPA 8260C	40 milliliter (mL)	3 x 40 mL Volatile Organic Analysis (VOA) vial	4 C ± 2°C, three vials with HCl (pH < 2)	14 days	21 Days
Total analyte list (TAL) metals	USEPA 6020A and 7470A	500 mL	1 x 500 mL high density polyethylene (HDPE)	4°C ± 2°C, nitric acid (HNO_3) pH<2	6 months (28 days for mercury)	21 Days
Hexavalent chromium	USEPA 218.6	250 mL	1 x 250 mL HDPE	4°C ± 2°C	5 days	21 Days
Perchlorate	USEPA 6860	125 mL	1 x 125 mL HDPE	4°C ± 2°C	28 days	21 Days
Chloride, Sulfate, Nitrate, and Nitrite	USEPA 9056	250 mL	1 x 250 mL HDPE	4°C ± 2°C	28 days, 48 hours for nitrate	21 Days
Ammonia	SM 4500 NH3	250mL	2 x 250mL Amber	4°C ± 2°C, sulfuric acid (H_2SO_4) pH<2	28 days	21 Days
Total organic carbon (TOC)	USEPA 9060A	250mL	2 x 250mL Amber	4°C ± 2°C, sulfuric acid (H_2SO_4) pH<2	28 days	21 Days

TABLE 4-3
MONITORING WELL CONSTRUCTION DETAILS

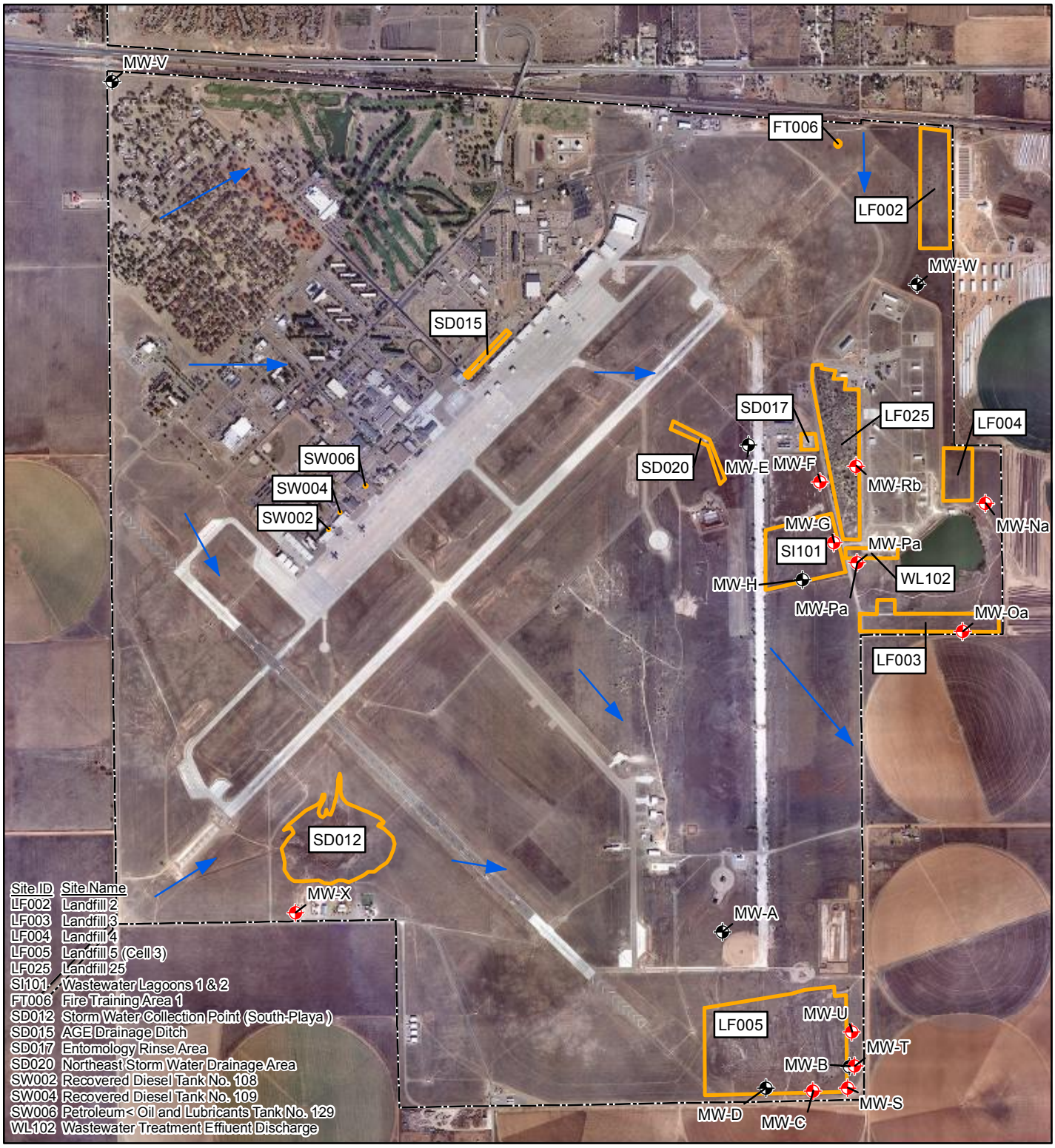
Monitoring Well Number	Land Surface Elevation (feet above NAVD88)	Latitude (NAVD83)	Longitude (NAVD83)	Top of Casing Elevation (feet above NAVD88)	Well Depth (feet below ToC)	Casing Material	Screen Length (feet)	Top of Screen Elevation (feet above NAVD88)	Bottom of Screen Elevation (feet above NAVD88)	Average Decline in Groundwater Elevation (feet per year)
MW-A	4267.0	34.221891	103.183144	4269.2	343	PVC	15	3939.0	3924.0	2.4
MW-B	4265.8	34.220267	103.181036	4268.1	360	PVC	15	3920.8	3905.8	3.1
MW-C	4266.9	34.215668	103.181650	4269.2	361.8	PVC	15	3920.1	3905.1	2.8
MW-D	4265.8	34.215713	103.182444	4267.6	355	PVC	15	3925.8	3910.8	2.7
MW-E	4283.0	34.232651	103.182623	4285.9	367.1	PVC	15	3930.9	3915.9	1.8
MW-F	4279.4	34.231290	103.181432	4282.3	368.9	PVC	15	3925.5	3910.5	2.0
MW-G	4280.0	34.231286	103.181207	4283.1	368.9	PVC	15	3926.1	3911.1	2.0
MW-H	4279.6	34.230722	103.181743	4282.6	371.9	PVC	20	3927.7	3907.7	2.0
MW-Na	4269.8	34.388364	103.296278	4271.0	356.9	PVC	60	3972.9	3912.9	2.0
MW-Oa	4273.0	34.383425	103.297389	4273.7	364.5	PVC	60	3968.5	3908.5	2.3
MW-Pa	4274.0	34.386125	103.302297	4274.8	358.2	PVC	60	3975.9	3915.9	2.0
MW-Rb	4275.8	34.232350	103.180823	4278.4	331	PVC	30	3974.8	3944.8	1.9
MW-S	4264.7	34.215701	103.181070	4266.7	365	PVC	40	3939.7	3899.7	2.6
MW-T	4264.7	34.220007	103.180947	4266.6	365.1	PVC	40	3939.6	3899.6	2.6
MW-U	4266.0	34.220481	103.180993	4267.9	364.6	PVC	40	3941.4	3901.4	2.6
MW-V	4327.8	34.405000	103.336839	4329.8	368.9	PVC	60	4018.9	3958.9	1.5
MW-W	4299.8	34.396844	103.396844	4302.1	367	PVC	60	3995.2	3935.2	2.2
MW-X	4268.0	34.372822	103.328650	4269.2	335.7	PVC	60	3992.3	3932.3	1.6

NAVD83 = North American Vertical Datum 1983 NAVD88 = North American Vertical Datum 1988 PVC = polyvinyl chloride ToC = Top of Casing
Note: Monitoring well construction information was obtained from the 2012 Biennial Groundwater Monitoring and Annual Landfill Inspection Report (Bhate 2013).

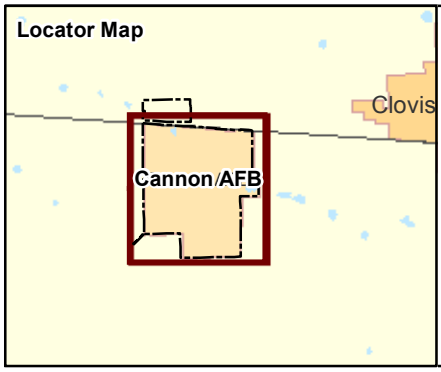
TABLE 4-4
TCLP REGULATORY LIMITS

Contaminant (VOCs)	Regulatory Level (mg/L)	Contaminant (Metals)	Regulatory Level (mg/L)
Benzene	0.5	Arsenic	5
Carbon tetrachloride	0.5	Barium	100
Chlorobenzene	100	Cadmium	1
Chloroform	6	Chromium	5
1,2-Dichloroethane	0.5	Lead	5
1,1-Dichloroethylene	0.7	Mercury	0.2
Methyl ethyl ketone	200	Selenium	1
Tetrachloroethylene	0.7	Silver	5
Trichloroethylene	0.5		
Vinyl chloride	0.2		

mg/L = milligrams per liter
TCLP = Toxicity Characteristic Leaching Procedure
VOCs = volatile organic compounds



Locator Map



Legend

- Monitoring Well Location Included in in Optimized Sampling Plan
- Monitoring Well Location
- Base Boundary
- Site Boundary
- General Groundwater Flow Direction (Based on data from 2012 Biennial Report(Bhate 2013))

Map projection: NAD83 State Plane Feet New Mexico East (FIPS 3001)

N

2,000 1,000 0 2,000 Feet

Groundwater Monitoring Well Locations

Cannon Air Force Base, New Mexico

Drawn By: DPG	Date: 6/10/2014	Project No. 23446539	Figure 4-1
Checked By: MS	Revision: 0		

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This section presents the field documentation required for the groundwater sampling.

5.1 FIELD LOGBOOK AND/OR SAMPLE FIELD SHEETS

During field work, records will be maintained in the field, with digital copies maintained by the Field Site Manager. Records will include daily summary sheets and related field and daily logs (included in **Appendix B** of this WPA).

Field logbooks will be maintained to record site activities and field data in a neat, legible manner. Logbooks will be bound and pages consecutively numbered. Personnel will make logbook entries in indelible ink. The following information, at minimum, will be entered during the course of the project activities:

- Date and location
- Weather
- Personnel onsite (including subcontractors) and work performed
- Equipment and instrument checks
- Injuries and/or illnesses
- Changes to work instructions
- Work stoppage
- Visitors
- Other relevant events

Personnel will supplement logbooks and records by the use of preprinted forms (i.e., safety inspection forms and tailgate safety briefings). These forms help to ensure uniformity of activities being conducted, inspected, and reviewed. Project forms are located in **Appendix B** of this WPA. All handwritten records and logbook entries will be scanned into an acceptable digital form and submitted to Cannon AFB and the AFCEC as part of the digital data package.

5.2 PHOTOGRAPHIC RECORDS

A Photographic Log will be maintained by the Field Site Manager. The field logbook, described in **Section 5.1**, will be used to record all photographs taken at the site. Photographic information will include the following details:

- Date and time taken;
- Unique identifying number(s) relating to the Photographic Logbook;
- Location photograph was taken including Global Positioning System coordinates; and
- Brief description of the subject matter.

5.3 SAMPLE NUMBERING SYSTEM

Sample containers will be labeled using existing well IDs. The sample identification number will be logged in the field logbook and on the chain of custody (CoC) form. Quality assurance/quality control samples are denoted by adding an extension at the end of the sample identification number. The extensions are as follows:

- -a – field duplicate
- -c – trip blank
- -d – equipment blank
- -MS – matrix spike
- -MDS – matrix spike duplicate

5.4 CHAIN OF CUSTODY RECORDS

During field sampling activities, sample tracking will be maintained from the time the samples are collected until the time at which the laboratory data are issued. Initial information concerning collection of the sample(s) will be recorded in the field logbook. Information on the custody, transfer, handling, and shipping of samples to an off-site laboratory will be recorded on a CoC form.

The sampler will be responsible for initiating and filling out the CoC form. The person responsible for packaging samples for delivery to the off-site laboratory will sign the CoC form, retain the last copy of the three-part form, document the method of shipment, and send the original and the second copy of the CoC form with the samples. A custody seal will be placed on each sample cooler prior to transfer of the cooler to the delivery company (i.e., FedEx) or the laboratory. Upon receipt of the cooler by the laboratory, the person receiving the samples will sign the CoC form and return the second copy.

This section describes landfill inspection, maintenance and repair activities to be completed at LF002, LF003, LF004, LF005, LF025, and SI101. **Figure 4-1** shows the location and boundaries of each landfill.

6.1 FREQUENCY

The vegetative cover inspections and maintenance will be conducted on an annual basis at LF002, LF003, LF004, LF005, LF025, and SI101. The annual landfill cover inspections and maintenance will be documented in the long-term groundwater monitoring report to be submitted to Cannon AFB and NMED. Any issues identified during a site inspection that require immediate attention will be communicated to the Cannon AFB RPM.

6.2 INSPECTION

Inspections shall consist of a review of the condition of the cover system, including vegetation and any associated drainage and erosion control features, to determine whether all components are functioning as designed. The perimeter fence, gates, and signage will be included in the inspection, if present at the site.

All site inspections will be recorded on the Landfill Cover System Inspection forms, as provided in **Appendix C** of the WPA. A copy of the site map will accompany the inspection forms and will be manually updated as necessary during the inspection to reflect any changes to the site condition, maintenance activities performed, and areas requiring repairs. A complete photographic record will be taken during inspections to document site conditions.

6.3 MAINTENANCE AND REPAIR

Maintenance will be performed as required to ensure all erosion and subsidence control features and other protection measures are in effective operating condition. Sediment or debris accumulations in areas that threaten proper function of an erosion control feature will be removed. Areas impacted by erosion will be filled in and contoured to maintain proper grade. Similarly, low graded areas designed to control stormwater runoff will be recontoured to maintain proper function. Perimeter fence, signage, and locks will be replaced if found to be missing or damaged.

Tumbleweeds and other uprooted vegetation will be removed from areas within the landfill where they accumulate, such as along perimeter fence lines. The uprooted vegetation will be loaded on trucks for disposal as clean construction debris at a local municipal landfill or other approved facility. No material or debris will be disposed of within the limits of LF002, LF003, LF004, LF005, LF025, or SI101.

Repairs will be performed within two weeks of inspection unless otherwise directed by Cannon AFB. Repairs are those performed to restore original site conditions, such as backfilling gullies, rebuilding berms, and replacing signage. Repair activities may be scheduled jointly at the six

sites to increase efficiency and limit the number of required mobilizations. Repair activities will be documented by photographs taken prior to and after completion of necessary repairs. Landfill Cover System Inspection forms will be submitted to Cannon AFB and NMED documenting details of repair actions, including a site map showing the locations of all completed repairs.

6.3.1 LF002, LF003, and LF004

6.3.1.1 Inspection and Maintenance Activities

LF002, LF003, and LF004 are addressed in this plan together, due to similar features. Landfill caps (with vegetative cover) and signage are present at landfill sites LF003 and LF004. The inspection and maintenance requirements for LF002, LF003, and LF004 are summarized in **Table 6-1**.

TABLE 6-1
INSPECTION AND MAINTENANCE ACTIVITIES AT LF002, LF003, AND LF004

Feature	Location	Inspection	Routine Maintenance
Cover surface	Over entire cover	– Integrity of cover – Exposure of buried waste – Surface contours in low areas/depressions graded to prevent stormwater runoff from discharging off-site – Buildup of excessive debris that diverts intended stormwater flow – Surface erosion, gully formation – Tumbleweed/uprooted vegetation	– Fill in gullies as necessary to restore grade – Maintain original contours of cover surface to prevent stormwater runoff from leaving the site – Clean out excess debris – Remove uprooted vegetation – Cover/remove exposed waste as needed
Vegetation	Over entire cover	– Extent of vegetation cover – Type of vegetation – General condition	– Reestablish vegetation as needed
Signage (at LF003 and LF004 only)	Various	– Inspect signage for damage – Note missing signage	– Replace damaged or missing signage

6.3.1.2 Repair Activities

The basic categories of potential repairs at LF002, LF003, and LF004 include:

- Grade and fill to repair erosion of surface cover.
- Grade surface to prevent stormwater flows from discharging off-site.
- Remove excessive silt and debris that diverts intended direction of stormwater flows.
- Reseed localized areas where vegetation is sparse or where repairs have been performed.
- Maintain signage.

6.3.2 LF005 and LF025

6.3.2.1 Inspection and Maintenance Activities

LF005 and LF025 are addressed in this plan together, due to similar features. Landfill caps (with vegetative cover), fences, berms (LF025), and/or signage are present at these landfill sites. The inspection and maintenance requirements for the LF005 and LF025 are summarized in **Table 6-2**.

TABLE 6-2
INSPECTION AND MAINTENANCE ACTIVITIES AT LF005 AND LF025

Feature	Location	Inspection	Routine Maintenance
Cover surface, especially steeper slopes	Over entire cover	– Integrity of cover – Exposure of buried waste – Surface contours in low areas/depressions graded to prevent stormwater runoff from discharging off-site – Buildup of excessive debris that diverts intended stormwater flow – Surface erosion; gully formation – Tumbleweed/uprooted vegetation	– Fill in gullies as necessary to restore grade – Maintain original contours of cover surface to prevent stormwater runoff from leaving the site – Clean out excess debris – Remove uprooted vegetation – Cover/remove exposed waste as needed
Berm (LF025 only)	Southern and eastern edge of LF025	– Erosion along and adjacent to berm – Ponding and leakage through berm	– Restore berm to original contours to prevent runoff from the landfill – Minor grading
Perimeter fence and gates	Fence line	– Structural integrity – Tumbleweed and debris accumulation – Locks on gates	– Repair fence as needed – Remove tumbleweed and debris – Replace damaged or missing locks
Signage on perimeter fence	Various	– Inspect signage for damage – Note missing signage	– Replace damaged or missing signage
Vegetation	Over entire cover	– Extent of vegetation cover – Type of vegetation – General condition	– Reestablish vegetation as needed

6.3.2.2 Repair Activities

The basic categories of potential repairs at LF005 and LF025 include:

- Grade and fill to repair erosion of cover surface.
- Restore grade at low areas/depressions to maintain original contours designed to prevent stormwater runoff from discharging off-site.

- Grade and fill low areas along and adjacent to berm to prevent ponding and leakage through the berms.
- Remove excessive silt and debris that diverts intended direction of runon/runoff flows.
- Restore structural integrity of affected sections of the perimeter fence and gates.
- Replace faulty or missing locks on gates.
- Replace or repair damaged or missing perimeter fence signage as necessary.
- Remove tumbleweeds or other uprooted vegetation from fence line.
- Reseed localized areas where vegetation is sparse or where repairs have been performed.

6.3.3 SI101

6.3.3.1 Inspection and Maintenance Activities

A landfill cap (with vegetative cover), fence, drainage ditches, and signage are present at SI101. The inspection and maintenance requirements for SI101 are summarized in **Table 6-3**.

TABLE 6-3
INSPECTION AND MAINTENANCE ACTIVITIES AT SI101

Feature	Location	Inspection	Routine Maintenance
Cover surface, especially steeper slopes	Over entire cover	– Surface erosion, gully formation – Buildup of excessive silt and debris – Accumulation of weeds – Exposure of crushed concrete in eroded areas	– Fill in gullies to restore grade – Clean out excess debris, silt, and weeds – Restore all areas of cover to original contours
Drainage ditches	Perimeter of cover	– Erosion – Exposure/displacement of crushed concrete in eroded areas – Excess silt buildup – Tumbleweed accumulation	– Replace soil – Remove excess silt, debris, and tumbleweeds – Replace crushed concrete as needed – Repair fence as needed
Perimeter fence and gates	Fence line	– Structural integrity – Tumbleweed and debris accumulation – Locks on gates	– Remove tumbleweed and debris – Replace damaged or missing locks
Signage on perimeter fence	Various	– Inspect signage for damage – Note missing signage	– Replace damaged or missing signage
Vegetation	Over entire cover	– Extent of vegetation cover – Type of vegetation – General condition	– Reestablish vegetation as needed

6.3.3.2 Repair Activities

The basic categories of potential repairs at the SI101 include:

- Grade and fill to repair erosion of the engineered cover.
- Grade and fill low spots to original configuration.
- Remove silt or debris and accumulated tumbleweeds from drainage channels and fill in eroded areas to original configuration.
- Repair erosion along or adjacent to the drainage channels to direct stormwater into channels.
- Replace crushed concrete displaced by stormwater flows.
- Remove any excessive silt and debris that diverts intended direction of runon/runoff flows.
- Replace faulty or missing locks on gates.
- Replace damaged or missing perimeter fence signage as necessary.
- Reseed localized areas where vegetation is sparse or where repairs have been performed.

This section describes the required components of the groundwater monitoring and landfill inspection report.

7.1 GROUNDWATER MONITORING AND LANDFILL INSPECTION REPORT REQUIREMENTS

A groundwater monitoring and landfill inspection report summarizing the results of the groundwater sampling events will be submitted for regulatory approval as outlined in the approved Facility-Wide Long Term Groundwater Monitoring Plan (AECOM 2011). Each report will describe the field method and results from the latest monitoring event compared to preceding events for comparison. Each report will include:

- An Executive Summary providing a brief summary of the purpose, and results of the groundwater monitoring;
- A summary of the results of the annual well inspection and groundwater level measurements;
- A summary of the annual landfill cover inspections and maintenance;
- A summary of all activities actually performed during the latest groundwater sampling event;
- Information regarding the applicable groundwater cleanup standards;
- A summary of the results of the groundwater monitoring conducted;
- A summary table of the groundwater analytical results from the three previous groundwater sampling events (tables in Microsoft Excel®), test methods used, dates of sample collection, practical quantitation limits for each analyte, and regulatory evaluation criteria;
- Appropriate figures with trend analyses;
- An assessment of whether groundwater results are indicative of a release;
- An assessment of whether proposed new or existing base activities could pose a threat to groundwater; and
- An analysis of whether to adjust sampling frequency, locations, or parameters.

The Report will conclude with a final summary of the groundwater sampling events covered under the reporting period and analytical testing results. If routine groundwater sampling is required out of the current approved sampling interval, NMED will receive the sampling results in tabular format with a discussion of the full results included in the following sequential Report.

Tables presented in the Report will include:

- A summary table showing the latest depth to groundwater measurements;
- A summary table of the latest groundwater quality data plus water quality data from the three previous sampling events; and

- A summary table of the groundwater analytical results, test methods used, dates of sample collection, and regulatory comparison requirements.

Figures presented in the Report will include:

- A site vicinity map including topography;
- A site plan showing monitoring well locations;
- A potentiometric surface map indicating the groundwater flow direction; and
- Figures and trend analyses presenting the historical and most recent groundwater analytical data.

Appendices will include the field forms completed by crews during the sampling event and the laboratory analytical reports, including analytical data reviews and validations.

7.2 DATA REPORTING

All laboratory analytical data will be reported in the AFCEC level IV format and submitted in a format compatible with the AFCEC Environmental Resources Program Information Management System (ERPIMS) database. The latest version of Environmental Resources Program Tools (ERPTools) will be used to facilitate data entry and meet quality assurance/quality check requirements.

The range of data submissions will include analytical chemistry samples, tests, and results in addition to hydrogeological information, site/location descriptions, and monitoring well characteristics. The information will be generated from the long term monitoring studies.

7.3 HISTORICAL DATABASE CREATION AND MAINTENANCE

The database that will be used to house both future and historical data is the AFCEC ERPIMS database. ERPIMS is maintained by AFCEC to validate and manage data from environmental projects at all AFBs. The information within ERPIMS maintains table and record relationships by having common fields within separate, interrelated tables.

All new information will be added to the database and historical information will continue to be added. Summary tables in the Long Term Groundwater Monitoring Reports will include analytical results from the four latest groundwater sampling events and will be provided to NMED in Microsoft Excel® format, as well as included in the reports.

7.4 DATA ANALYSIS

For the Reports, the latest groundwater sampling results will be included and will be compared to those from the previous events for historical assessment, evaluated in terms of current regulatory limits, and development of groundwater trend plots as described below.

7.4.1 Comparison to Regulations

Groundwater analytical results will be compared to the current USEPA MCLs and NMGWQS (20 NMAC 6.2). In the event that no evaluation criteria are listed for an analyte in the USEPA MCLs or the NMGWQS, the results will be evaluated against the criteria specified in NMED risk assessment guidance (NMED 2012).

7.4.2 Trend Analysis

Trend analysis will be completed for each COC at individual monitoring wells. Trends will be developed using the most recent groundwater analytical data and comparing to previous sampling events. Trend analysis will be one tool used to determine necessary changes in the long term monitoring well network, sampling frequency, and COCs, as well as whether a release has occurred.

This section provides a description of the IC inspections to be completed at Cannon AFB sites FT006, SD012, SD015, SD017, SD020, SW002, SW004, SW006, and WL102.

8.1 INSTITUTIONAL CONTROL INSPECTIONS

IC inspections will include the following:

- Documenting that land at the sites has not changed from industrial to residential.
- Documenting conditions at the sites have remained unchanged since the last IC inspection.
- Documenting no future changes are anticipated in connection with the sites.
- Documenting no construction activities are planned with regard to subsurface areas at the sites.
- IC will be reviewed at the time of the site inspections to ensure they remain protective of human health.

IC inspections will be documented on forms contained in **Appendix A** and included in an IC report to be submitted to Cannon AFB. Any sites moved from Table 1 to Table 2 on Cannon AFB's RCRA Permit that will require IC inspections will be added to this Work Plan Addendum, and all said inspections will comply with this Work Plan. The sites currently requiring IC inspections are discussed below.

8.2 INSTITUTIONAL CONTROL INSPECTION PLAN

Currently IC inspections are completed annually for the following ten sites at Cannon AFB: FT006, SD012, SD015, SD017, SD020, SW002, SW004, SW006, and WL102.

8.2.1 FT006 and SD015

Corrective actions are planned for FT006 and SD015 that will remove the source of contamination at the site to achieve CAC without controls. IC inspections will be completed annually for FT006 and SD015 until CAC without controls is achieved, a CAC proposal is completed, and the sites are moved to Table 3 of the Cannon AFB RCRA permit.

8.2.2 SD012, SD017, SD020, SW006, and WL102

Arsenic was identified as the sole COC at these sites. Further investigation and/or evaluation of these sites is planned as part of an RFI for SW006, SD012, SD017, SD020, and WL102. The goal of the RFI is to reevaluate the arsenic contamination present at these sites and achieve CAC without controls. IC inspections will be completed for SW006, SD012, SD017, SD020, and WL102 until CAC without controls is achieved, a CAC proposal is completed, and the sites are moved to Table 3 of the Cannon AFB RCRA permit.

8.2.3 SW002 and SW004

Investigation activities completed at SW002 and SW004 indicate arsenic-containing soils are present near the former location of petroleum USTs. The arsenic-containing soils at SW002 and SW004 are capped by the floor and foundations of Hangars 125 and 126 that were constructed over the sites. As such, there are no known or anticipated release mechanisms at these sites.

Hangars 125 and 126 are active hangars and no changes in use have been identified for these hangars by Cannon AFB personnel. Based on the location of the contamination beneath an active hangar, an optimization of the inspection schedule is proposed. Annual inspections will continue through the 2017 annual inspection. Subsequent to 2017, inspections will be reduced in frequency to coincide with the five-year reviews conducted at Cannon AFB (e.g. 2022, 2027, etc.). IC inspections will be completed for SW002 and SW004 until CAC without controls is achieved, a CAC proposal is completed, and the sites are moved to Table 3 of the Cannon AFB RCRA permit.

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LUC Site Inspection Report

Cannon Air Force Base, Curry County, New Mexico

Site Name: _____ Date: _____

Site Alias: _____ Weather: _____

_____

Location: _____

Inspection: Annual Semiannual Other: _____

Current Site Status: CAC with Controls Other: _____

Current Land Use Designation: _____

Brief Site History: _____

_____

Current Site Configuration: _____

_____

_____

Site Conditions: Surface Erosion Exposed Waste Stormwater

Odors Litter Vegetation Cond

Monitoring Wells _____

Other _____

_____

_____

Signage: Present? _____ Condition? _____

Security: Gates/Fences Locks Not Applicable

Notes: _____

_____

_____

_____

_____

_____

_____

_____

_____

_____

Inspector's Name/Title: _____ Initials:

URS Corp.

CHAIN OF CUSTODY RECORD

12120 Shamrock Plaza, Suite 300, Omaha, NE 68154 (402) 334-8181 Fax (402) 334-1984

Project Name	Project No.
Project Location	Project Manager
Sampler(s)	

Analytical Parameters

Sample		Type		Sample Identification	Matrix	Containers															Remarks
Date	Time	Comp.	Grab			No.	Type														

Signatures	Date	Time	Shipping Details	Special Instructions
Relinquished by:			Method of Shipment	
Received by:			Airbill No.	
Relinquished by:			Lab Address	
Received for Laboratory by:				

Custody.frm/rrm

White copy - Laboratory Yellow copy - Laboratory Pink copy - URS

No. 150000

DAILY QUALITY CONTROL REPORT

Date

Day	S	M	T	W	TH	F	S

On Site Hours	
Travel Time	
Office Time	

Weather	Bright Sun	Clear	Overcast	Rain	Snow
Temp	To 32	32-50	50-70	70-85	85 up
Wind	Still	Moderate	High	**Report No.**	
Humidity	Dry	Moderate	Humid		

Site Name and Location	Cannon Air Force Base
URS Project Manager	Corey Anderson
Project	NM-AZ Group PBR
Project No.	23446539/23446540
Contract No.	FA8903-13-C--0008

Subcontractors on Site:

Equipment on Site:

Visitors on Site:

URS Personnel on Site:

Field Work Performed (including sampling):

Quality Control Activities (including field calibration):

Health and Safety and Activities:

Observations/Problems Encountered/Corrective Action Taken:

By **Title** *Site Manager*

EXAMPLE SAMPLE LABEL

URS

12120 Shamrock Plz
Omaha, NE 68154

Phone (402) 334-8181
Fax: (402) 334-1984

Project:	**Cannon AFB**		**23446540**
Sample ID:	**OW545-SB01-10**		
Analysis:	**8260B - VOCs**		
Preservative:	**4°C**	Date:	**06-15-14**
Samplers:	**DB, MM**	Time:	**1045**

WATER SAMPLE COLLECTION FIELD SHEET

GENERAL INFORMATION

SITE NAME _____ PROJECT NO. _____

SAMPLE NO. _____ WELL NO. _____

DATE/TIME COLLECTED _____ PERSONNEL _____

SAMPLE METHOD _____ _____

SAMPLE MEDIA:	Groundwater	Surface Water
SAMPLE QA SPLIT:	YES	NO
SAMPLE QC DUPLICATE:	YES	NO
MS/MSD REQUESTED	YES	NO

SPLIT SAMPLE NO. _____

DUPLICATE SAMPLE NO. _____

SAMPLE CONTAINERS, PRESERVATIVES, ANALYSIS

Sample Container	Preservative	Analysis Requested

WELL PURGING DATA

Date _____

Time Started _____

Time Completed _____

PID Measurements

Background _____

Breathing Zone _____

Well Head _____

Well Depth (ft. BTOC) _____

Depth to Water (ft BTOC) _____

Water Column Length _____

Volume of Water in Well (liters) _____

Stabilized Purge Rate (liters/min) _____

Stabilized Level of Drawdown (ft. BTOC) _____

Total Amount Purged (liters) _____

FIELD MEASUREMENTS

Time	Amount Purged (liters)	pH	Temperature (ºC)	Conductivity (mS/cm)	DO (mg/L)	ORP (mV)	Turbidity (NTU's)	Purge Rate (liters/min)	Water Level (ft)

FIELD EQUIPMENT AND CALIBRATION

	Model	Serial Number	Calibration
Water Level Probe			
Water Quality Meter			

COMMENTS / OBSERVATIONS

WELL DEVELOPMENT LOG

Project: _____ Well No: _____
Project No: _____ Date: _____

WELL MEASUREMENTS

Well inside diameter: _____ feet.
Depth of well casing: _____ feet.
Initial water level: _____ feet below MP.
Measuring point (MP): _____
Fluid well casing volume: _____ gallons.
Air temperature: _____
Weather conditions: _____

SAMPLING MEASUREMENTS

DISCHARGE DATA

Water level (ft. BMP)												
Time												
Discharge (Gallons)												

WATER QUALITY DATA

Temperature (°C)												
pH												
Spec. Conduct. (µMHOS/cm)												
Dissolved Oxygen (mg/L)												
Oxidation/Reduction Potential (mV)												
Turbidity (NTUs)												
Color												
Odor												

Total discharge gallons: _____ Casing volumes removed: _____
Method of disposal of discharged water: _____

QUALITY ASSURANCE

Sampling Method: _____
Method to measure water level: _____
Bailer rope new or cleaned (circle).
pH meter no: _____ Calibrated: _____
Conductivity meter no. _____ Calibrated: _____
Collected water sample for final well development photograph: Yes or No (circle).
Comments: _____

WELL DEVELOPMENT LOG

Project: _____

Well No: _____

Date: _____

Time: _____

Final Turbidity: _____

Cover System Inspection Report
SITE HERE
Cannon AFB, New Mexico

Inspectors Name and Title: _____ Date: _____

Days since last rain fall: _____ Amount of rainfall: _____

1. Fences and Gates?	Yes	No
• Structural Integrity?		
• Gates locks in place?		
• Signage in place?		
• Tumbleweeds and silt built up?		
Problems observed with the fences/gates/signage:		
Maintenance or repairs required:		
Maintenance to be performed by (Subcontractor name and date):		
2. Cover:	Yes	No
• Overall structural integrity maintained?		
• Surface erosion present?		
• Gullies/washouts present?		
• Exposed buried waste?		
• As-constructed contours (topographic highs) intact?		
• As-constructed contours (depressions) intake?		
• Storm water runoff contained within boundaries of site?		
• Evidence of drainage pathways/diverted runoff?		
• Tumbleweeds or silt built up?		
Problems observed with the cover:		
Maintenance or repairs required:		
Maintenance to be performed by (Subcontractor name and date):		

Cover System Inspection Report
SITE HERE
Cannon AFB, New Mexico

3. Berms (Indicate NA if not present)?	Yes	No
• Is any erosion present?		
• Is any ponding present?		
• Storm water runoff contained onsite?		
Describe location and condition:		
Problems observed with berms:		
Maintenance or repairs required:		
Maintenance to be performed by (Subcontractor name and date):		
4. Drainage Ditches/Channels (Indicate NA if not present):	Yes	No
• Is any erosion present?		
• Is buildup of sediment/silt debris present?		
• Is displaced crushed concrete present?		
• Is storm water runoff contained onsite?		
• Excess accumulation of tumbleweeds present?		
Describe location and condition:		
Problems observed with drainage ditches/channels:		
Maintenance or repairs required:		
Maintenance to be performed by (Subcontractor name and date):		

Cover System Inspection Report
SITE HERE
Cannon AFB, New Mexico

5. Vegetation	Yes	No
• Vegetation native perennial?		
• Vegetation in good condition?		
• Bare/sparse areas?		
Describe overall condition:		
Estimate extent and type of vegetative cover:		
Maintenance or repairs required:		
Maintenance to be performed by (Subcontractor name and date):		
6. Monitoring Wells	Yes	No
• Evidence of tampering?		
• Damage?		
Problems observed with the wells:		
Changes required to the Monitoring and Maintenance Plan?		

_____
Inspector's Signature

_____
Inspector's Name

_____
Date