1/20/2012

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

ENTERED

A. David Budak
Deputy Base Civil Engineer
550 Tabosa Avenue
Holloman AFB NM 88330-5840

RECEIVED
JAN 2012
NMED Hazardous Waste Bureau

New Mexico Environment Department
Attn: Mr. John Kieling
Hazardous Waste Bureau
2905 Rodeo Park Drive East, Building 1
Santa Fe NM 87105-6303

Dear New Mexico Environment Department

Holloman Air Force Base is pleased to submit the Nitrate Characterization Study Work Plan for your review.

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

If you have any questions, please contact Mr. David Scruggs of our Asset Management Flight at (575) 572-5395.

Sincerely

20120119

A. DAVID BUDAK, GS-14, DAFC

Attachment:
Nitrate Characterization Study Work Plan

cc:

(w/ Atch)
Mr. David Strasser
Hazardous Waste Bureau
5500 San Antonio Dr. NE
Albuquerque NM 87109

(w/o Atch)
Mr. Will Moats
Hazardous Waste Bureau
5500 San Antonio Dr. NE
Albuquerque NM 87109

(w/o Atch)
Ms. Laurie King
USEPA, Region 6 (6PD-F)
1445 Ross Ave., Ste 1200
Dallas TX 75202

7009 2820 0003 6257 5505

FINAL

Nitrate Characterization Study
Work Plan
Holloman Air Force Base, New Mexico

Prepared For:

49 CES/CEAN
Holloman Air Force Base
New Mexico

Under Contract To:

U.S. Army Corps of Engineers
Omaha, Nebraska

Contract No. W9128F-11-D-0029
Task Order No. 0001

January 2012

Prepared by:

NATIONVIEW

1608 13th Avenue South, Suite 160
Birmingham, Alabama 35205
NationView Project Number: 8090013

FINAL
NITRATE CHARACTERIZATION STUDY
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HOLLOMAN AIR FORCE BASE
NEW MEXICO

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U.S. Army Corps of Engineers
Omaha District
1616 Capitol Avenue
Omaha, Nebraska 68102-1618

Prepared by:

NationView, LLC
1608 13th Avenue South, Suite 160
Birmingham, Alabama 35205
NationView Project No. 11-0017

Contract No. W9128F-11-D-0029
Task Order No. 0001

January 2012

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NITRATE CHARACTERIZATION STUDY
WORK PLAN
HOLLOMAN AIR FORCE BASE
NEW MEXICO

REVIEW SHEET

This Work Plan has been reviewed and approved by:

	J H Moore	1/5/2012
Jim Moore, P.G. Sr. Geologist, Field Manager	Signature	Date
		1/5/2012
J. Mark Stapleton, Ph.D., P.E., AEE Technical Director	Signature	Date
	Frank Gardner	1/5/2012
Frank Gardner, P.G. Program Manager	Signature	Date

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NITRATE CHARACTERIZATION STUDY WORK PLAN HOLLOMAN AIR FORCE BASE NEW MEXICO

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Appendix A Site-Specific Addendum to the Basewide Health and Safety Plan
Appendix B Site-Specific Addendum to the Basewide Quality Assurance Project Plan
Appendix C Field Forms

ACRONYMS AND ABBREVIATIONS

AEE	Associate to the American Academy of Environmental Engineering
AAF	Army Air Field
ACM	Accelerated Corrective Measures
AF Fm	Air Force Form
amsl	Above mean sea level
ANSI	American National Standards Institute
AOC	Area of Concern
ASTM	American Society for Testing and Materials
bgs	Below ground surface
Bhate	Bhate Environmental Associates, Inc.
CES/CEAN	Civil Engineering Squadron/Environmental Asset Management Flight
COC	Chain-of-custody
COPCs	Chemicals of potential concern
DL	Detection Limit
DO	Dissolved oxygen
DQCR	Daily Quality Control Reports
DQO	Data quality objective
DRMO	Defense Reutilization and Marketing Office
EDD	Electronic data deliverable
ERP	Environmental Restoration Program
ERPIMS	Environmental Restoration Program Information Management System
°F	Degrees Fahrenheit
FID	Flame ionization detector
ft	Feet
GPS	Global positioning system
HAFB	Holloman Air Force Base
HASP	Health and Safety Plan
HSA	Hollow Stem Auger
I.D.	Inner Diameter
IDLs	Instrument detection limits
IDW	Investigation-Derived Waste
IRFNA	Inhibited Red Fuming Nitric Acid
IWFNA	Inhibited White Fuming Nitric Acid
JP-4	Jet Propulsion Fuel, Type 4
LCS	Laboratory control samples
LCSD	Laboratory control sample duplicates
LF-58	Incinerator Landfill
LOX	Liquid Oxygen
LTM	Long Term Monitoring
MCL	Maximum Contaminant Limit
MDL	Method Detection Limit

ACRONYMS AND ABBREVIATIONS (CONTINUED)

mg/L	Milligrams per liter
MS	Matrix spike
MSD	Matrix spike duplicate
NAD	North American Datum
NationView	NationView, LLC
NMAC	New Mexico Administrative Code
NMED	New Mexico Environment Department
NMWQCC	New Mexico Water Quality Control Commission
NOD	Notice of disapproval
NTU	Nephelometric Turbidity Units
O.D.	Outer Diameter
OSHA	Occupational Safety and Health Administration
OSWER	Office of Solid Waste and Emergency Response
OT-04	Acid Trailer Burial Site
OT-37	Early Missile Test Site
OT-38	Test Sled Maintenance Area
OVA	Organic vapor analyzer
P.E.	Professional Engineer
P.G.	Professional Geologist
pH	Potential of Hydrogen
PhD	Physical Doctorate
PID	Photoionization detector
PPE	Personal protective equipment
ppm	Parts per million
PQL	Practical quantitation limit
PVC	Polyvinyl Chloride
QA	Quality assurance
QC	Quality control
QAPP	Quality Assurance Project Plan
QL	Quantitation Limit
%R	Percent Recovery
RCRA	Resource Conservation and Recovery Act
RFI	RCRA Facility Investigation
RI	Remedial Investigation
RL	Reporting Limit
RPD	Relative Percent Difference
SS-36	Unconventional Fuels Area Spill Site
SS-39	Missile Fuel Spill Area
SM	Standard Method
SOP	Standard Operating Procedure
SWMU	Solid Waste Management Unit
TDS	Total dissolved solids

ACRONYMS AND ABBREVIATIONS (CONTINUED)

TKN	Total Kjeldahl Nitrogen
UCL	Upper Confidence Level
UDMH	Unsymmetrical Dimethylhydrazine
USACE	United States Army Corps of Engineers
USCS	Unified Soil Classification System
USDA	United States Department of Agriculture
USEPA	United States Environmental Protection Agency
UTL	Upper Tolerance Limit
VOC	Volatile organic compound
WRCC	Western Regional Climate Center
WSMR	White Sands Missile Range
WWTP	Wastewater Treatment Plant

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1 INTRODUCTION

NationView, LLC (NationView) has been retained by the United States Army Corps of Engineers (USACE) Omaha District, under contract W9128F-11-D-0029, Task Order No. 0001, to conduct a Nitrate Characterization Study at Holloman Air Force Base (HAFB), New Mexico (USACE, 2011). On October 28, 2010, the New Mexico Environment Department (NMED) issued a Notice of Disapproval (NOD) letter on the *Final Basewide Background Study Report, Holloman AFB, New Mexico* (NationViewIBhate JV III, 2009) (hereinafter referred to as the "Background Study") to the HAFB 49th Civil Engineering Squadron/Environmental Asset Management Flight (CES/CEAN). One of the primary reasons for the NOD letter was that some of the groundwater samples collected as part of the background study may have been impacted by anthropogenic source areas of nitrogen compounds (e.g., nitrate, nitrite, or ammonia); therefore these groundwater samples may not be representative of natural conditions. A copy of the NMED NOD letter is provided as Attachment 1.

1.1 Objectives

The primary objectives of this Work Plan are twofold; first to conduct a basewide background investigation of nitrate and other nitrogen-bearing compounds in groundwater and soil to establish reliable background levels (Nitrate Background Study) and secondly to conduct a Nitrate Source Area Investigation at Environmental Restoration Program (ERP) sites where nitrate is a suspected groundwater contaminant of anthropogenic (manmade) origin (e.g., ERP sites which were used for manufacturing, storing, or disposing liquid or solid rocket fuel propellants which contained nitrogen compounds).

1.2 Scope of Work

The following list is a summary of the work to be performed in order to complete the Nitrate Characterization Study.

- Prepare and submit a Draft and Final Work Plan
- Implement the work plan which includes the following:
- <u>Nitrate Background Study</u>
  - Identification of upgradient background soil boring locations appropriate for the nitrate soil background study (24 soil boring locations)
  - Identification of drainage outcrop surface soil locations appropriate for the nitrate soil background study (40 surface soil locations)
  - Identification of clean monitoring well locations appropriate for the nitrate groundwater background study (24 monitoring well locations)
  - Development of statistical methodology

  - Collection and analysis of surface soil, subsurface soil, and capillary fringe subsurface soil samples from 24 soil borings and groundwater samples from 24 monitoring wells located within the northeastern portion of HAFB which are upgradient of ERP sites and HAFB infrastructure (including sewer and water lines)
  - Collection and analysis of 40 caliche and evaporate drainage outcrop surface soil samples from the Lost River, Lost River Basin, Hay Draw, Malone Draw, Carter's Draw, Gullez Draw, Sheep Camp Draw, Ritas Draw, and Dillard Draw.
  - Statistical evaluation of nitrogen compound sampling data (nitrate, nitrite, ammonia, and Total Kjeldahl Nitrogen [TKN]) to establish background values.
- Nitrate Source Area Investigation
  - Identification of suspected nitrate source areas (6 ERP sites with elevated nitrate concentrations detected in previously collected groundwater samples. These sites are located within the central portion of HAFB).
  - Collection and analysis of surface soil, subsurface soil, and capillary fringe subsurface soil samples from 18 soil borings located at suspected nitrate source areas (6 ERP sites).
  - Collection and analysis of groundwater samples from 49 existing monitoring wells and 11 new wells at suspected nitrate source areas (6 ERP sites).
  - Compare the concentrations of nitrogen compounds detected in the soil and groundwater samples collected from the suspected nitrate source areas to the values established in the Nitrate Background Study.
- Prepare and submit Nitrate Characterization Report which will provide a statistical summary of the soil and groundwater background concentrations for nitrogen bearing compounds (i.e., nitrate, nitrite, and ammonia) and a summary of the nature and extent of nitrogen bearing compounds at six ERP sites with suspected nitrate groundwater contamination.
- Prepare and submit sampling data in the appropriate format for inclusion in the Environmental Restoration Program Information Management System (ERPIMS).

1.3 Document Organization

The Nitrate Characterization Study Work Plan is organized into the following sections and appendices:

- ***Section 1 – Introduction.*** This section discusses the objectives of the Nitrate Characterization Study and provides a brief description the ERP sites which are suspected of releasing nitrogen compounds to the environment during historical operations.
- ***Section 2 – Environmental Setting.*** This section provides a description of the physiography and topography, surface water and hydrology, regional geology and soils, regional hydrogeology, climate, and current and future land and water use at HAFB.

- ***Section 3 – Statistical Technical Approach.*** This section provides a description of how the data collected for the Nitrate Background Study will be graphically and statistically analyzed.
- ***Section 4 – Sampling and Analysis Plan.*** This section provides a description of all field activities to be conducted for the Nitrate Background Study and the Nitrate Source Area Investigation.
- ***Section 5 – Project Quality Assurance.*** This section provides a summary of the data quality objectives, standard operating procedures, sample identification, and project documentation.
- ***Section 6 – Health and Safety Requirements.*** This section provides the health and safety requirements associated with the investigation activities for this Nitrate Study Characterization Work Plan.
- ***Section 7 – Project Management and Schedule.*** This section provides key personnel and the schedule for the implementation of this Nitrate Characterization Study Work Plan.
- ***Section 8 – References.*** This section provides references used in this Nitrate Characterization Study Work Plan.

The ***Tables*** and ***Figures*** referenced throughout this Nitrate Characterization Study Work Plan are included following the text (after Section 8).

- ***Attachment 1 –*** NMED Correspondence
- ***Appendix A –*** Site-Specific Addendum to the Basewide Health and Safety Plan
- ***Appendix B –*** Site-Specific Addendum to the Basewide Quality Assurance Project Plan
- ***Appendix C –*** Field Forms

1.4 HAFB Facility Description and Operational History

HAFB is situated in south central New Mexico, in the northwest central part of Otero County, approximately 75 miles north-northeast of El Paso, Texas (Figure 1-1). HAFB has a population of 6,000 and occupies 59,600 acres in the northeast quarter of Section 1, Township 17 South, Range 8 East. The White Sands Missile Range (WSMR) testing facilities occupy additional land extending northward from the Base. Private and public owned lands border the remainder of HAFB. The major highway servicing HAFB is Highway 70, which runs southwest from the town of Alamogordo and separates HAFB from publicly owned lands to the south. Alamogordo which has a population of approximately 35,000 is located approximately 7 miles east of the base.

HAFB was first established in 1942 as Alamogordo Army Air Field (AAF). From 1942 through 1945, Alamogordo AAF served as the training grounds for over 20 different flight groups, flying primarily B-17s, B-24s, and B-29s. After World War II, most operations had ceased at the base. In 1947, Air Material Command announced the air field would be its primary site for the testing and development of un-manned aircraft,

guided missiles, and other research programs. On January 13, 1948, the Alamogordo installation was renamed Holloman Air Force Base, in honor of the late Col. George V. Holloman; a pioneer in guided missile research. In 1968, the 49th Tactical Fighter Wing arrived at HAFB and has remained since. Today, HAFB also serves as the training center for the German Air Force's Tactical Training Center.

1.5 Summary of Sites with Suspected Nitrate Contamination

Based on a review of the HAFB Administrative Record, historical operations at several ERP sites associated with the Sled Test Track and the testing and development of guided missiles and rockets may have contributed to the elevated nitrate concentrations detected in previously collected groundwater samples in the central portion of HAFB. As part of the Nitrate Source Area Investigation, soil and groundwater water samples will be collected at the ERP sites where rocket fuel propellants and unconventional fuels (containing nitrogen compounds) were either manufactured, used, stored, or disposed. The concentrations of nitrogen compounds detected in the soil and groundwater samples collected from these suspected nitrate source areas will be compared to the background values to assist with determining if the detected nitrogen compounds are anthropogenic in origin. In addition, there are numerous active and inactive septic/leachfield systems and sites used for sewage disposal (e.g. DP-30/SD-33 disposal pits), located throughout HAFB which may also have contributed anthropogenic releases of nitrogen compounds to the environment. However, the sites/buildings which have septic/leachfield systems or were used as sewage disposal areas are being investigated under separate contracts.

The following sections provide a brief description the ERP sites which are suspected of releasing nitrogen compounds to the environment as a result of historical activities associated with rocket fuel propellants. Each site description also includes a summary of the historical nitrate-nitrite and nitrate groundwater data (if available). The suspected nitrogen compound source areas (ERP Sites) are shown on Figure 1-2.

1.5.1 OT-04, Acid Trailer Burial Site

Site OT-04 (Acid Trailer Burial Site) is located adjacent to Ritas Draw, which is an arroyo that drains into the Lost River (Figure 1-2). The Acid Trailer Burial Site is a Solid Waste Management Unit (SWMU), and is listed on Table B (no further corrective action required) of the HAFB Hazardous Waste Facility Permit as SWMU 102. In 1958, it was reported that two empty fuming nitric acid transport trailers and waste materials were dumped and buried on a one-half acre tract of land along three small side channels of Ritas Draw arroyo. The majority of the waste at OT-04 may have originated from the former Unconventional Fuels Storage Area (SS-36) located one-half mile to the south. The Unconventional Fuels Storage Area housed propellants, oxidizers, and other fuel components that were used for rocket and sled tests conducted at HAFB (Radian, 1992).

The site was initially investigated during the 29 Waste Sites Remedial Investigation (RI) conducted by Radian in 1991. Four monitoring wells (MW-04-01 through MW-04-04) were installed around the perimeter of the site to determine if a release to the groundwater had occurred. Groundwater samples were analyzed for chemicals of potential concern (COPC), and water quality parameters including nitrate-nitrite. Nitrate-nitrite concentrations ranged from 4.5 milligrams per liter (mg/L) (MW-04-04) to 46 mg/L (MW-04-02) and exceeded the United States Environmental Protection Agency (USEPA) *National Primary Drinking Water Regulations* (USEPA, 2009), maximum contaminant level (MCL) and the New Mexico Water Quality Control Commission (NMWQCC) groundwater standard (New Mexico Administrative Code [NMAC], 20.6.2.3103) of 10 mg/L in two of the four wells. In addition, nitrate was detected above the USEPA MCL at a concentration of 17 mg/L (MW-04-01) during the Basewide Background Study sampling conducted in 2008. The historical groundwater results for nitrate-nitrite and nitrate (1991 and 2008) are presented in Table 1-1 and the OT-04 monitoring well network is shown on Figure 1-3. Based on the elevated concentration of nitrate –nitrite (46 mg/L) detected in the downgradient well (MW-04-02), the acid trailer burial site may be a source area of anthropogenic nitrate.

1.5.2 SS-36, Unconventional Fuels Area Spill Site

The Unconventional Fuels Area Spill Site (ERP Site SS-36 [SWMUs 129 and 178]) in the Supply Liquid Oxygen (LOX) Area near Buildings 1191 (former Oxidizer Storage Area) and 1192 (former Propellant Storage Area) is located within the east-central portion of HAFB (Figure 1-2). Site SS-36 is listed on Table B (no further corrective action required) of the HAFB Hazardous Waste Facility Permit. The fuels handled in this area included Unsymmetrical Dimethylhydrazine (UDMH); Jet Propulsion Fuel, Type 4 (JP-4); Inhibited Red Fuming Nitric Acid (IRFNA); Inhibited White Fuming Nitric Acid (IWFNA), and Aniline. The Supply LOX Area stored, mixed, and transported unconventional fuels to the test track. Prior to 1957, nitric acid was stored in the First Acid Storage Area across the street and to the west. The foundations of these buildings are still in place and the concrete is pitted (possibly from acid spills) and the drains in the concrete appear to lead directly into the ground. The site has been converted into the Base Equestrian Facility and is no longer used for unconventional fuels storage (Radian, 1992).

Site SS-36 was initially investigated during the 29 Waste Sites RI (Radian, 1992). As part of the RI, five monitoring wells (MW-36-01 through MW-36-05) were installed and sampled for COPCs and water quality parameters including nitrate-nitrite. Nitrate-nitrite concentrations ranged from 29 mg/L (MW-36-02) to 97 mg/L (MW-36-04) and exceeded the USEPA MCL and the NMWQCC groundwater standard of 10 mg/L in each of the five samples. A Phase II investigation was conducted at SWMUs 129 and 178 (SS-36) in 1993 (Radian, 1994). Four additional monitoring wells (129-MW01 through 129-MW04) were installed and sampled for nitrate-nitrite and other COPCS. Nitrate-nitrite concentrations ranged from 0.345 mg/L (129-MW04) to 31.9 mg/L (129-MW01) and exceeded the USEPA MCL and the NMWQCC groundwater standard of 10 mg/L in two

of the four samples. The five wells installed during the initial RI were not sampled during the Phase II investigation. The historical nitrate-nitrite (1991 and 1993) are presented in Table 1-2 and the SS-36 monitoring well network is shown on Figure 1-4. Based on the elevated concentrations of nitrate-nitrite detected above the USEPA MCL in seven of the nine wells, the Unconventional Fuels Area Spill Site may be a source area of anthropogenic nitrate.

1.5.3 OT-37, Early Missile Test Site

The Early Missile Test Site (OT-37) was used from 1947 to 1955 and is located along Tula Peak Road east of the Test Sled Maintenance Area along the southern side of the Lost River Basin (Figure 1-2). The Site is an Area of Concern (AOC) and is listed on Table A (further corrective action required) of the HAFB Hazardous Waste Facility Permit the HAFB Hazardous Waste Facility Permit as AOC-L. The Early Missile Test Site was used to develop rocket and guided missile systems and covers an area of approximately 160 acres and includes the inclined test track and three vertical launch pads. Fuels used at these sites included JP-4, kerosene, and solid rocket propellants. Solid rocket fuel propellants were thought to have been primarily used including nitrocellulose, nitroglycerine, potassium perchlorate, and polysulfide. Waste products thought to have been spilled at the site as a result of these fuels include lead oxide, nitrate compounds, and hydrochloric and sulfuric acids (CH2M Hill, 1983).

OT-37 has been the subject of several environmental investigations and was initially investigated during the 29 Waste Sites RI (Radian, 1992). During the RI, six wells (MW-37-01 through MW-37-06) were installed and sampled for nitrate-nitrite and other COPCs. Nitrate-nitrite was detected above the USEPA MCL and the NMWQCC groundwater standards of 10 mg/L in each of the six samples with concentrations ranging from 48 mg/L (MW-37-01 and MW-37-03) to 75 mg/L (MW-37-04 and MW-37-05).

In 2007 and 2010 Bhate Environmental Associates, Inc. (Bhate) and NationView, conducted Accelerated Corrective Measures (ACM) investigations at OT-37 (NationVIew, 2011). As part of the ACM investigations, 13 new monitoring wells were installed (OT37-MW07 through OT37-MW19) up and downgradient of the inclined test track and the three vertical launch pads. The 13 new wells and 6 previously installed wells (designated as OT37-MW01 through OT37-MW06) were sampled for nitrate, ammonia, and several other COPCs in 2010. Nitrogen, nitrate concentrations ranged from 5.6 mg/L (OT37-MW19) to 143 mg/L (OT37-MW16) and exceeded the USEPA MCL and the NMWQCC groundwater standard for nitrate of 10 mg/L in 17 of the 18 monitoring wells sampled during the ACM Addendum investigation. Furthermore, the average concentration of nitrate for the OT-37 monitoring well network (19 wells) was 42.7 mg/L.

During the 2008 Basewide Background Study nitrate was also detected at 42 mg/L in monitoring well MW-37-06 above the USEPA MCL and NMWQCC standard of 10 mg/L.

The historical groundwater results (1991, 2008, and 2010) for nitrite-nitrate and nitrate are presented in Table 1-3 and the OT-37 monitoring well network is shown on Figure 1-5. Based on the widespread detections of nitrate above 10 mg/L; the Early Missile Test Site may be a source area of anthropogenic nitrate.

1.5.4 OT-38, Test Sled Maintenance Area

This site is a SWMU and is listed on Table A (further corrective action required) of the HAFB Hazardous Waste Facility Permit as Building 1166 Test Track Drain Field, SWMU 137. The Test Sled Maintenance Area (OT-38) is located near the Building 1166 Test Track Drain Field within the central portion of HAFB (Figure 1-2). From 1951, when the test track became operational, until 1979, waste oils, solvents, and paint strippers used in the sled industrial maintenance area (Building 1166) were suspected of being discharged to a cesspool behind the building. The cesspool was described as an unlined cavity at least 6 feet (ft) deep and 10 ft long. Since 1979, all wastes have been accumulated in 55-gallon drums and turned over to the Defense Reutilization and Marketing Office (DRMO) for disposal or recycling. In the late 1980s, the cesspool was replaced with a septic tank and leach field (approximately 150 ft of perforated polyvinyl chloride [PVC] pipe) that was installed at the former cesspool location.

Site OT-38 was initially investigated during the 29 Waste Sites RI (Radian, 1992). As part of the RI, three monitoring wells (MW-38-01 through MW-38-03) were installed and sampled for COPCs and water quality parameters including nitrate-nitrite. Nitrate-nitrite concentrations ranged from 110 mg/L (MW-38-01 and MW-38-03) to 130 mg/L (MW-38-02) and exceeded the USEPA MCL and the NMWQCC groundwater standard for nitrate (10 mg/L) in each of the three samples. As part of the ACM, Bhate investigated OT-38 in 2007; however nitrate and/or nitrogen compounds were not included as part of the analytical suite for soil or groundwater samples collected during the ACM investigation. During the background study sampling event conducted in 2008, nitrate was detected above the USEPA MCL at a concentration of 28 mg/L in MW-38-01. The historical groundwater results for nitrate-nitrite and nitrate are presented in Table 1-4 (1991 and 2008) and the OT-38 monitoring well network is shown on Figure 1-6. Based on the elevated concentrations of nitrate-nitrite detected above the USEPA MCL, the Test Sled Maintenance Area may also be a source area for anthropogenic nitrate.

1.5.5 SS-39, Missile Fuel Spill Area

The Missile Fuel Spill Area (SS-39) comprises four SWMUs (165, 177, 179, and 181) that are listed on Table A (further corrective action required) of the HAFB Hazardous Waste Facility Permit. Site SS-39 is located in the central portion of HAFB along the northern slope of the Lost River Basin (Figure 1-2). The Missile Fuel Spill area consists of the Test Sled Launch Area Collection Basin, the Propellant Spill Drain Discharge Box, the Building 1176 Drainage System, and the Former Utilized Rocket Engine Storage Area. These facilities are spread out over an area of about 10 acres. Historically, spilled oxidizers and fuels were delivered to separate drains, diluted with

water, and flushed into the Lost River Basin. In 1975, catch basins were installed to collect the spilled liquid fuels. Since 1975, no propellants have been intentionally released to the open drains. Throughout the history of the test track, fuels have included at least the following; JP-4, UDMH, aniline, IRFNA, liquid oxygen, and solid rocket propellants.

The Missile Fuel Spill Area was initially investigated during the 29 Waste Sites RI (Radian, 1992). As part of the RI, four monitoring wells (MW-39-01 through MW-39-04) were installed and sampled for COPCs and water quality parameters including nitrate-nitrite. Nitrate-nitrite concentrations ranged from 0.52 mg/L (MW-39-04) to 87 mg/L (MW-39-02) and exceeded the USEPA MCL and the NMWQCC groundwater standard for nitrate (10 mg/L) in three of the four samples.

Hydrogeologic, Inc. performed a Supplemental Resource Conservation and Recovery Act (RCRA) Facility Investigation (RFI) at the Missile Fuel Spill Area (SS-39) in 2006. As part of the Supplemental RFI, four permanent monitoring wells (MW-39-05, MW-39-06, MW-39-06D and MW-39-07) were installed along the edge of the Lost River Basin. Additionally, five hand-augered pre-pack temporary monitoring wells (MW-39-08 through MW-39-12) were installed (and subsequently abandoned) to collect groundwater samples from within the Lost River Basin. However, nitrate and/or nitrogen compounds were not included as part of the analytical suite for the groundwater samples collected during the Supplemental RFI. During the Basewide Background study sampling event conducted in 2008 nitrate was detected above the USEPA MCL at a concentration of 31 mg/L in MW-39-03. In 2010, Tetra Tech installed four additional monitoring wells (MW-39-13 through MW-39-16) as part of the long term monitoring (LTM) program for SS-39. However, nitrate and nitrogen bearing compounds were not included with the suite of analyses for the SS-39 2010 LTM sampling event. The historical groundwater results for nitrate-nitrite and nitrate are presented in Table 1-5 (1991 and 2008) and the SS-39 monitoring well network is shown on Figure 1-7. Based on the elevated concentrations of nitrate-nitrite detected above the USEPA MCL the Missile Fuel Spill Area may be a source area of anthropogenic nitrate.

1.5.6 LF-58, Incinerator Landfill

The Incinerator Landfill Site (LF-58) is located within the central portion of HAFB north of the Main Base Area and approximately 3,000 ft west of the Unconventional Fuels Area (SS-36). The Incinerator Landfill Site is a SWMU, and is listed on Table B (no further corrective action required) of the HAFB Hazardous Waste Facility Permit as SWMU 231. The Incinerator Landfill site consists of an inactive incinerator and five waste disposal areas. The incinerator was a small (10-ft square) brick structure with a metal roof and a 30- to 40-ft tall stack. The incinerator operated from 1955 to 1960, and was used to dispose of unconventional fuels, including aniline, xylidine, and furfuryl alcohol. In 1994, several areas of purple stained soil were observed near the

incinerator which may have been the result of spillage of unconventional fuels (Radian, 1995).

During the Phase II RFI conducted by Radian in 1994, four monitoring wells (MW-58-01 through MW-58-04) were installed to determine if a release to groundwater had occurred from past site activities. Nitrate and/or nitrogen compounds were not included as part of the analytical suite for the groundwater samples collected during the Phase II investigation. However, nitrate was detected above the USEPA MCL at a concentration of 56 mg/L in MW-58-03 during the 2008 background study. The historical groundwater result for nitrate is presented in Table 1-6 and the LF-58 monitoring well network is shown on Figure 1-8. Based on the elevated concentration of nitrate detected above the USEPA MCL (10 mg/L) in MW-58-03, the Incinerator Landfill (LF-58) may also be a source area of anthropogenic nitrate.

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2 ENVIRONMENTAL SETTING

2.1 Physiography and Topography

HAFB is located within the Sacramento Mountains Physiographic Province on the western edge of the Sacramento Mountains (Figure 1-1). HAFB is approximately 59,600 acres in area, and is located at a mean elevation of 4,093 ft above mean sea level (amsl). The region is characterized by high tablelands with rolling summit plains; cuesta-formed mountains dipping eastward and of west-facing escarpments with the wide bracketed basin forming the basin and range complex. The Base is located in the Tularosa Sub-basin which is part of the Central Closed Basins. The bordering mountains rise abruptly to altitudes of 7,000 to 12,000 ft amsl. The San Andres Mountains bound the basin to the west (about 30 miles) with the Sacramento Mountains approximately 10 miles to the east. At its widest, the basin is about 60 miles east to west and stretches approximately 150 miles north to south.

2.2 Surface Water and Hydrology

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

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

2.3 Regional Geology and Soils

2.3.1 Geology

The sedimentary rocks which make up the adjacent mountain ranges are between 500 and 250 million years old (White Sands Missile Range [WSMR], 2003). During the period when the area was submerged under the shallow intra-continental sea, the layers of limestone, shale, gypsum, and sandstone were deposited. In time, these layers were pushed upward through various tectonic forces forming a large bulge on the surface. Approximately 10 million years ago the center began to subside resulting in a vertical drop of thousands of feet leaving the edges still standing (the present day Sacramento and San Andres mountain ranges). In the millions of years following, rainfall, snowmelt, and wind eroded the mountain sediments depositing them in the valley (i.e. Tularosa Basin). Water carrying eroded limestone, dolomite, gravel, and other matter continue to flow into the basin.

As the Tularosa Basin is a bolson, which is a basin with no surface drainage outlet, sediments carried by surface water into a closed basin are bolson deposits. The overlying alluvium generally consists of unconsolidated gravels, sands, and clays. Soils in the basin are derived from the adjacent ranges as erosional deposits of limestone, dolomite, and gypsum. A fining sequence from the ranges towards the basin's center characterizes the area with the near surface soils as alluvial, eolian, and lacustrine deposits. The alluvial fan deposits are laterally discontinuous units of interbedded sand, silt, and clay while the eolian deposits consist primarily of gypsum sands. The eolian and alluvial deposits are usually indistinguishable due to the reworking of the alluvial sediment by eolian processes. The playa, or lacustrine deposits, consist of clay containing gypsum and are contiguous with the alluvial fan and eolian deposits throughout HAFB. There has been the identification of stiff caliche layers, varying in thickness, at different areas of the Base.

2.3.2 Soils

The United States Department of Agriculture (USDA) Soil Conservation Service has identified two soil associations in the vicinity of HAFB; the Holloman-Gypsum Land-Yesum complex, and the Mead silty clay loam (Figure 2-1). The permeability of these horizons ranges from $4x10^{-4}$ to $1\ x10^{-3}$ centimeters per second.

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

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

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

2.4 Regional Hydrogeology

Groundwater occurs as an unconfined aquifer in the unconsolidated deposits of the central basin, with the primary source of recharge as rainfall percolation and minor amounts of stream run-off along the western edge of the Sacramento Mountains. Surface water/rainfall migrates downward into the alluvial sediments at the edge of the shallow aquifer near the ranges, and flows downgradient through progressively finer-grained sediments towards the central basin. Because the Tularosa Basin is a closed system, water that enters the area only leaves either through evaporation or percolation. This elevated amount of percolation results in a fairly high water table. Beneath HAFB, groundwater ranges from 5 to 50 ft bgs. Flow for the Base is generally towards the southwest with localized influences from the variations in the topography of the Base. In the northern and western portions of the Base, groundwater flows more to the west toward the Ritas Draw, Malone Draw, and Lost River drainages. Groundwater flow is affected by local topography in areas immediately adjacent to arroyos, where groundwater flows directly toward the drainages regardless of the regional flow pattern. A general groundwater contour map for HAFB is provided as Figure 2-2.

Groundwater quality in the Tularosa Basin is of potable quality at the recharge areas in close proximity to the Sacramento Mountains and becomes increasingly mineralized

toward the central portion of the basin and discharge areas. The majority (over 70 %) of the ERP Sites/SWMUs located across HAFB, have groundwater monitoring wells containing water with an average total dissolved solids (TDS) concentration greater than 10,000 mg/L. This TDS data supports the hypothesis that TDS concentrations below 10,000 mg/L at HAFB are caused by dilution of natural groundwater from leaking water lines and surface irrigation from the domestic water supply. TDS concentrations greater than 10,000 mg/L exceed the NMWQCC limit as potable water and thus, the groundwater beneath HAFB has been designated as unfit for human consumption. Likewise, the USEPA guidelines have identified the groundwater as a Class IIIB water source, characterized by TDS concentrations exceeding 10,000 mg/L. Class IIIB groundwater is also characterized by a low degree of interconnection with adjacent surface waters or groundwater of a higher class. Groundwater does not discharge or connect to any adjacent aquifers because the Tularosa Basin is a closed basin. Adjacent surface waters include Lost River and Lake Holloman, which also have high concentrations of TDS, and are not considered potential drinking water sources.

2.5 Climate

As a whole, New Mexico has a mild, arid to semi-arid continental climate characterized by light precipitation totals, abundant sunshine, relatively low humidity, and relatively large annual and diurnal temperature range (Western Regional Climate Center [WRCC], 2003). The climate of the Central Closed Basins varies with elevation. The Base is found in the low areas and is characterized by warm temperatures and dry air. Daytime temperatures often exceed 100 degrees Fahrenheit (°F) in the summer months and are in the middle 50s in the winter. A preponderance of clear skies and relatively low humidity permits rapid night time cooling resulting in average diurnal temperature ranges of 25 to 35°F. Potential evapotranspiration, at 67 inches per year, significantly exceeds annual precipitation, usually less than 10 inches. The very low rainfall amounts resulting in the arid conditions, which with the topographically induced wind patterns combining with the sparse vegetation, tend to cause localized “dust devils”. The annual rainfall for Alamogordo is 12 inches per year[1]. Much of the precipitation falls during the mid-summer monsoonal period (July and August) as brief, yet frequent, intense thunderstorms culminating to 30 – 40% of the annual total rainfall.

2.6 Current and Future Land Use

The land surrounding HAFB consists of residential areas to the east and northeast (City of Alamogordo), rangeland to the south, the White Sands National Monument to the west, and areas where military activities are conducted to the north. The desert terrain of the area immediately surrounding HAFB has limited development, and there are no agricultural operations, residential communities, or large industrial operations located

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

adjacent to the Base. HAFB is an active military installation and is expected to remain active for the foreseeable future. No transfer of military property to the public is anticipated, and public access to the Base is restricted (Foster Wheeler, 2003).

Residential development on the Base is limited by environmental and operational constraints imposed by the 100-year floodplain, historic sites, and areas identified under the Installation Restoration Program. Safety and noise zones also limit residential development on HAFB. Future plans for residential development on the Base include renovation of existing structures, replacement of inefficient buildings, and expansion into open areas in the southeast corner of the Base (HAFB, 2000). Future land use is not expected to differ significantly from current land use practices (Foster Wheeler, 2003).

2.7 Current and Future Water Use

At present, the primary fresh water resource for the City of Alamogordo and HAFB is Lake Bonita, 60 miles northeast of the Tularosa Basin. Currently, there are no potable supplies of groundwater or surface water located on the Base. HAFB obtains its water supply from the City of Alamogordo and the HAFB wells in the Boles, San Andres, and Douglas well fields at the base of the Sacramento Mountains. No water supply wells are located on or near the Base because of poor groundwater quality (TDS greater than 10,000 mg/L). The nearest production well downgradient from HAFB is a livestock well located 13 miles southwest of DP-63. There are no potable or irrigation wells near to or immediately downgradient of the Base (Foster Wheeler, 2003).

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3 STATISTICAL TECHNICAL APPROACH FOR NITRATE BACKGROUND STUDY

The following technical approach is to provide HAFB ERP teams and the NMED with details on how data that will be obtained in the nitrate background study will be graphically and statistical analyzed.

A scientific approach will be used to determine the type, quantity, and quality of environmental data needed to support establishing nitrate background values (and other nitrogen bearing compounds) at HAFB. This will provide the scientific foundation for defensible decision-making by helping to assure that representative field samples are collected at appropriate locations and times, that appropriate graphical and statistical analyses of the resulting data are conducted, and that appropriate interpretations of the data and statistical analyses are made.

3.1 Sample Location Selection

The soil and groundwater sampling locations for the Nitrate Background Study were selected using aerial photographs and historical HAFB base maps to identify areas with no apparent construction or waste disposal activities and areas which have been undisturbed. These locations were selected to encompass undisturbed areas which are upgradient of ERP sites and HAFB infrastructure (i.e., buildings, sewer, and water lines). Therefore, the selected locations for the soil and groundwater sample populations are within the northeastern portion of the base. Additionally, the monitoring wells will be screened within the same hydrostratigraphic unit (first water bearing zone encountered). The Nitrate Background Study sampling strategy is fully described in Section 4.1.

3.2 Determination of Number of Samples

Based on the regional soil descriptions (Section 2.3.2 of this Work Plan), these soils have the same parent materials, the same history, and very similar pedologic and mineralogic properties. As shown on Figure 2-1, the two primary soil types of the nitrate background study area and source area investigation (6 ERP sites) are the Holloman-Gypsum and-Yesum complex (a sandy loam) and the Mead silty clay loam which have very similar mineralogy. Accordingly, NationView plans to sample throughout the northeastern portion of the Base, treating this area as a single population for statistical purposes. Based on a study of the soils and lithology involved, it appears appropriate to collect a discrete sample from the surface from 0 to 6 inches below ground surface [bgs], the subsurface (mid-point between the surface sample and the saturated zone), and from the capillary fringe interface just above the water table). Sample depths will vary based upon depth to groundwater.

NationView proposes to:

- Collect and analyze groundwater samples from 24 monitoring wells located within the northeastern portion of HAFB which are upgradient of ERP sites and HAFB infrastructure (including sewer and water lines). Groundwater samples will be from 23 new monitoring wells and 1 existing monitoring well.
- Collect and analyze surface soil, subsurface soil, and capillary fringe subsurface soil samples from 24 soil borings (72 soil samples).
- Collect and analyze 40 caliche, evaporate, and/or sedimentary drainage outcrop surface soil samples from the Lost River, Lost River Basin, Hay Draw, Malone Draw, Carter's Draw, Gullez Draw, Sheep Camp Draw, Ritas Draw, and Dillard Draw.

All soil borings and background soil samples will be collocated with the monitoring wells for the Nitrate Background Study.

3.3 Combining Data Sets

Combining two or more data sets to form a larger data set may improve the ability of statistical tests to detect when a contaminant is a COPC. For example, soil samples may have been collected and measured for nitrate and other nitrogen bearing compounds at several different times in the land area of concern at HAFB. Pooling the data would increase the number of samples available for conducting a statistical test for nitrate (including other nitrogen bearing compounds) and could increase the chances the test result will be accurate. However, an inappropriate combining of data sets can have the opposite effect. Ideally, the data sets being considered for pooling should have been obtained using the same sampling design that was applied to the same area of land.

On August 24, 2007, NMED indicated in the disapproval letter of the initial *Base-wide Background Study* (Radian, 1993) that both the sample size and sampling locations were either too small or poorly described and do not provide confidence that the samples were collected at locations that are representative of natural conditions. Furthermore, on October 28, 2010, the NMED issued a Notice of Disapproval (NOD) letter on the *Final Basewide Background Study Report, Holloman AFB, New Mexico* (NationViewIBhate JV III, 2009) and indicated that some of the groundwater samples collected as part of the background study may have been impacted by anthropogenic source areas of nitrogen compounds (e.g., nitrate, nitrite or ammonia); therefore these groundwater samples may not be representative of natural conditions.

To prevent potential error propagation from the Radian 1993 HAFB background study and potential anthropogenic impacts to the nitrate data in NationViewIBhate JV III, 2011, Basewide Background Study; NationView is recommending that an entirely new data set be collected. Soil sampling data will be collected from three separate horizons (surface, subsurface, and capillary fringe interface) and combined into one data set for the background statistical analysis for nitrogen bearing compounds.

3.4 Statistics and Data Analysis

3.4.1 Descriptive Summary Statistics

Descriptive summary statistics for the nitrogen bearing compound background data will be generated as part of a preliminary data review. These descriptions, in conjunction with graphical plots, should be conducted to develop an understanding of the range, variability, and shape of the underlying probability distribution of the measurements, as well as the number of non-detects and possible outliers that are present. This information is needed to help determine the quality of the data sets and how the data should be statistically analyzed.

Based on, *Guidance for Data Quality Assessment Practical Methods for Data Analysis* (USEPA, 2000a) NationView will conduct the following statistical evaluation of the background nitrogen bearing compounds concentrations data set. A preliminary data review will be conducted to include basic statistical quantities (summary statistics). The summary statistics to be developed and presented will include the number of samples; the number of detects; the number of non-detects; the number of outliers excluded from analysis as part of the summary statistics; the mean, median, range, standard deviation, type of distribution (normal, log normal, or other); 90th, 95th, and 99th percentiles; and the Upper Tolerance Limit (UTL) for each constituent. These summary statistics will be computed using the USEPA-endorsed program, ProUCL, that was distributed with the document *Calculating Upper Confidence Limits for Exposure Point Concentrations at Hazardous Waste Sites* (Office of Solid Waste and Emergency Response [OSWER] 9285.6-10) (USEPA, 2002). Note that calculation of the UTL assumes that data are normally distributed, which may not be the case for some constituents. UTLs should be calculated based on a 95% coverage and a 95% confidence limit.

3.4.2 Data Sets with No Non-Detects

The number of measurements in a data set is denoted by n. The n measurements are denoted by x1, x2,…, xn. The descriptive summary statistics that should be computed for the background data sets are: the number of samples; the number of detects; the number of non-detects; the number of outliers excluded from analysis as part of the summary statistics; the mean, median, range, standard deviation, type of distribution (normal, log normal, or other); 90th, 95th, and 99th percentiles; and the UTL for each constituent in each media.

3.4.3 Data Sets That Contain Non-Detects

Non-detects are measurements that the analytical laboratory reports are below some quantitative upper limit such as the detection limit or the limit of quantitation. Data sets that contain non-detects are said to be censored data sets.

The methods used to compute descriptive statistics when non-detects are present should be selected based on the number of non-detects and the total number of measurements, n (detects plus non-detects). If n is large (say, n > 25) and less than 15% of the data set are non-detects, the general guidance in *Guidance for the Data Quality Assessment, Practical Methods for Data Analysis, EPA QA/G-9, QA97 Update, EPA/600/R-96/084* (USEPA, 1998) is to replace the non-detects with the Detection Limit (DL), DL/2, or the method detection limit (MDL). The descriptive summary statistics may then be computed using the (now) full data set, although some of the resulting statistics will be biased to some degree. (The median, p^{th} sample percentile, and the interquartile range may not be biased if the number of non-detects is sufficiently small.) The biases may be large, even though less than 15% of the measurements are non-detects, particularly if n is small, say n < 25.

If 15% to 50% of the data set are non-detects, the guidance offered in the *Guidance for the Data Quality Assessment, Practical Methods for Data Analysis, EPA QA/G-9, QA96 Version, EPA/600/R-96/084* (USEPA, 1996) and *Guidance for the Data Quality Assessment, Practical Methods for Data Analysis, EPA QA/G-9, QA97 Update, EPA/600/R-96/084* (USEPA, 1998) is to forgo replacing non-detects with some value like the DL divided by 2, the DL itself, or a small value. Instead, one should consider computing the mean and standard deviation using the Cohen method.

If 50% to 90% of the measurements in the data set are non-detects, the loss of information is too great for descriptive statistics to provide much insight into the location and shape of the underlying distribution of measurements. The only descriptive statistics that might be possible to compute are p^{th} percentiles for values of p that are greater than the proportion of non-detects present in the sample and when no non-detects are greater than the $k(n+1)^{th}$ largest datum, where k is the order statistic. In such cases, the recommended UTL developed by the USEPA-endorsed program, ProUCL, that was distributed with the document *Calculating Upper Confidence Limits for Exposure Point Concentrations at Hazardous Waste Sites* (OSWER 9285.6-10) (USEPA, 2002) will be used.

If 90% to 99% of the measurements in the data set are non-detects, statistical analysis is not possible and the UTL value will be set at 2 times the maximum detected value. This reasoning incorporates the professional judgment of laboratory managers regarding the likelihood of a detection near the detection limit really being a detection and not a false positive. It should be pointed out that this setting of the UTL at 2 times the maximum detect value is only a convention and no statistics will be used in calculating the UTL. Therefore, in situations with 3 detections or less, the use of the value in terms of a true “UTL” is somewhat questionable. If 100% of the measurements in the data set are non-detects, statistical analysis is not possible and the UTL value will be set the lowest achievable quantitation limit (QL).

3.4.4 Determining Presence of Data Outliers

The data set will be examined to determine the center of the data set and the spread or range of the data values. The center is usually characterized by computing the arithmetic mean, denoted by x, and the spread by the standard deviations. In addition, NationView will examine the data to determine if any data seem much larger in value than most of the data. These unusually large data may be due to an error. Not removing true outliers and removing false outliers both lead to a distortion of estimates of population parameters. Potential outliers may be identified through graphical representations such as the box and whisker plot and normal probability plot which can identify observations that are much larger or smaller than the rest of the data. If some of the data are so large as to cause concern that a mistake has been made, a statistical test for outliers should be conducted. If the test indicates the suspect value(s) are indeed larger than expected, relative to the remaining data, the outliers should be examined to determine if they are mistakes or errors. If they are, they should be removed from the data set.

Prior to conducting the outlier test, a test for normality will be performed on the data set. Computation of appropriate UTL is based upon the assumption that the data set under study represents a single population. For example, a background data set should represent a defensible background data set free of outlying observations. ProUCL incorporates classical outlier identification procedures, such as the Dixon test and the Rosner test. These procedures will be used to aid in the identification of outliers.

3.4.5 Determining the Probability Distribution of a Data Set

The Shapiro-Wilk W-test is highly recommended for testing whether the data have a normal distribution; therefore this test will be used in the determination of normality for this study. It will also be used to test for a lognormal distribution, once the data is first transformed by computing the natural logarithm of each datum. The W-test is recommended in several USEPA guidance documents (USEPA, 1992 and USEPA, 1996) and in many statistical texts (Gilbert, 1987 and Conover, 1980). The W-test has been shown to have more power than other tests to detect when data are not from a normal or lognormal distribution. The W-test should be conducted in conjunction with constructing normal and lognormal probability plots in order to more thoroughly evaluate whether the normal or lognormal distribution is an acceptable fit to the data.

3.5 Graphical Data Analysis

Graphical plots of the background data sets are extremely useful and necessary tools to:

- Conduct exploratory data analyses to develop hypotheses about possible differences in the means, variances, and shapes for the background measurement distributions

- Visually depict and communicate differences in the distribution parameters (means, variances, and shapes) for the background measurement distributions
- Graphically evaluate if the background data have a normal, lognormal, or some other distribution
- Evaluate, illuminate, and communicate the results obtained using formal statistical tests

The following graphical plots will be prepared for the Nitrate Background Study Report: histogram, box and whisker plots, normal probability plots, and isoconcentration maps for nitrate in soil and groundwater.

3.5.1 Histogram Plot

One of the oldest methods for summarizing data distributions is the histogram. The histogram divides the data range into units, counting the number of points within the units, and displaying the data as the height or area within a bar graph. In a histogram, the area within the bar represents the relative density of the data. The histogram provides a means of assessing the symmetry and variability of the data. If the data are symmetric, then the structure of these plots will be symmetric around a central point such as a mean. The histogram will generally indicate if the data are skewed and the direction of the skewness. Histograms will be constructed using raw data (outliers included) so that they may be evaluated for the presence of outliers.

3.5.2 Box and Whisker Plot

A box and whisker plot or box plot is a schematic diagram useful for visualizing important statistical quantities of the data. Box plots are useful in situations where it is not necessary or feasible to portray all the details of a distribution and can be used to assess the symmetry of the data. If the distribution is symmetrical, then the box is divided in two equal halves by the median, the whiskers will be the same length and the number of extreme data points will be distributed equally on either end of the plot. Box plots will be constructed using reduced data (outliers excluded).

3.5.3 Normal Probability Plot (Quantile-Quantile Plot)

There are two types of quantile-quantile plots or q-q plots. The first type, an empirical quantile-quantile plot, involves plotting the quantiles of two data variables against each other. The second type of a quantile-quantile plot, a theoretical quantile-quantile plot, involves graphing the quantiles of a set of data against the quantiles of a specific distribution. The following discussion will focus on the most common of these plots for environmental data, the normal probability plot (the normal q-q plot); however, the discussion holds for other q-q plots.

The normal probability plot is used to roughly determine how well the data set is modeled by a normal distribution. A normal probability plot is the graph of the quantiles of a data set against the quantiles of the normal distribution using normal probability

graph paper. If the graph is linear, the data may be normally distributed. If the graph is not linear, the departures from linearity give important information about how the data distribution deviates from a normal distribution. If the graph of the normal probability plot is not linear, the graph may be used to determine the degree of symmetry (or asymmetry) displayed by the data. If the data are skewed to the right, the graph is convex. If the data are skewed to the left, the graph is concave. If the data in the upper tail fall above and the data in the lower tail fall below the quartile line, the data are too slender to be well modeled by a normal distribution, i.e., there are fewer values in the tails of the data set than what is expected from a normal distribution. If the data in the upper tail fall below and the data in the lower tail fall above the quartile line, then the tails of the data are too heavy to be well modeled using a normal distribution, i.e., there are more values in the tails of the data than what is expected from a normal distribution. A normal probability plot can be used to visually identify potential outliers. A data value (or a few data values) much larger or much smaller than the rest, will cause the other data values to be compressed into the middle of the graph, ruining the resolution. Normal probability plots for both raw (including outliers) and reduced (excluding outliers) data will be provided in the Nitrate Background Study Report.

3.5.4 Isoconcentration Maps

Laboratory analyses of soil and groundwater analytical results will be plotted to indicate the amount of a particular nitrogen analyte that is present in the soil or groundwater. Each map will include the approximate boundary of the various amounts of each analyte prepared based on the locations of the soil boring or monitoring wells and the concentrations detected in the samples. An isoconcentration map is often used in understanding the distribution of various analytes.

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4 SAMPLING AND ANALYSIS PLAN

The purpose of this section is to describe the investigation activities associated with the Nitrate Background Study and the Nitrate Source Area Investigation. As a result, the Nitrate Characterization Study Work Plan will be implemented in two separate phases. The first phase (Nitrate Background Study) involves soil and groundwater data collection to establish reliable background values for the occurrence of nitrogen-bearing compounds. The background soil and groundwater sample locations have been strategically located in areas which are upgradient of any known ERP sites and HAFB infrastructure (including sewer and water lines).

The second phase (Nitrate Source Area Investigation) will involve the collection of soil and groundwater data at six ERP sites (OT-04, SS-36, OT-37, OT-38, SS-39, and LF-58) which were historically associated with the Sled Test area and were involved with the testing and development of guided missiles and rockets. Solid rocket fuel propellants and unconventional fuels (containing nitrogen compounds) were manufactured, used, stored, and/or disposed of at each of these sites. Section 1.4 of this work plan provides a brief site description and summary of the historical nitrate groundwater data collected at each of these ERP sites. In review, each of these six ERP sites has historical nitrate groundwater concentrations which significantly exceed the USEPA MCL and the NMWQCC groundwater standard for nitrate (10 mg/L). The purpose of the Nitrate Source Area Investigation is to collect additional soil and groundwater data at these sites for comparison to the values for nitrogen-bearing compounds established from the Nitrate Background Study. This comparison will determine if the nitrate detected in groundwater and soil samples collected at these sites is of anthropogenic or geogenic origin.

4.1 Nitrate Background Study Sampling Strategy

The objectives of the Nitrate Background Study will be accomplished through the collection of soil and groundwater samples in areas which are located throughout the northeastern portion of the base and upgradient from ERP sites and HAFB infrastructure (buildings, sewer, and water lines). Soil and groundwater samples collected for the nitrate background study will be analyzed for nitrate, nitrite, total Kjeldahl nitrogen, and ammonia. The background levels developed for these nitrogen compounds will be compared to the site specific data collected during the nitrate source area investigation (6 ERP sites) to determine if an anthropogenic nitrate release has occurred at these sites.

4.1.1 Background Soil Sampling

Twenty-four hollow stem auger (HSA) boreholes (NBG-SB01 through NBG-SB24) will be advanced at the locations shown on Figure 4-1. At each boring location, three soil samples will be collected (surface, subsurface, and capillary fringe interface). In addition, surface soil samples will also be collected from drainage outcrops to determine

if the natural depositional conditions present at HAFB accumulate nitrate in caliche and evaporate type deposits. Forty surface soil samples (NBG-SS01 through NBG-SS40) will be collected from outcrops located along the major drainages within the northeastern portion of the base. These drainages include the Lost River, Lost River Basin, Hay Draw, Malone Draw, Carters Draw, Ritas Draw, Dillard Draw, Gullez Draw, and Sheep Camp Draw. The 40 surface soil outcrop samples will be collected from 0 to 6 inches bgs and the locations are shown on Figure 4-2. A total of 112 primary soil samples will be collected from the 24 soil borings (3 per boring) and 40 drainage outcrop locations and each soil sample will be analyzed for nitrate, nitrite, TKN, and ammonia. The soil sampling requirements and procedures for the Nitrate Background Study are described in Section 4.4.1 of this Work Plan.

4.1.2 Background Groundwater Sampling

Twenty three of the twenty four background soil borings will be converted into permanent 2-inch diameter monitoring wells (NBG-MW01 through NBG-MW23). One round of groundwater samples will be collected from the 23 new monitoring wells and one existing monitoring well (MW-BG-02) which is located adjacent to the background soil boring NBG-SB24. The monitoring well locations for the Nitrate Background Study are also shown on Figure 4-1. A total of 24 groundwater samples will be analyzed for nitrate, nitrite, TKN, ammonia, and TDS. The requirements and procedures for monitoring well installation, development, and groundwater sampling for the Nitrate Background Study are described in Section 4.4.2 of this Work Plan.

4.2 Nitrate Source Area Investigation Sampling Strategy

The objectives of the Nitrate Source Area Investigation will be accomplished through the collection of soil and groundwater samples at six ERP sites associated with the Sled Test Track and the testing and development of guided missiles and rockets. Historical operations at these sites may have contributed to the elevated nitrate concentrations detected in previously collected groundwater samples in the central portion of HAFB.

4.2.1 OT-04 Acid Trailer Burial Site

4.2.1.1 Soil Sampling

Three HSA boreholes (NSA04-SB01 through NSA04-SB03) will be drilled and sampled to determine the horizontal and vertical distribution of nitrogen compounds present in the soil at the site (Figure 4-3). Three soil samples will be collected from each borehole at the surface, subsurface, and the capillary fringe interface. A total of nine soil samples will be collected from the three soil borings and each soil sample will be analyzed for nitrate, nitrite, TKN, and ammonia. The soil sampling requirements and the drilling and sampling procedures for the OT-04 Nitrate Source Area Investigation are described in Section 4.4.1 of this Work Plan.

4.2.1.2 Groundwater Sampling

One of the three soil borings (NSA04-SB01) will be converted into a permanent 2-inch diameter monitoring well to provide a site specific upgradient groundwater sampling location. One round of groundwater samples will be collected from the previously installed monitoring wells (MW-04-01 through MW-04-04) and the new well (NSA04-MW01). The monitoring well network for the OT-04 Nitrate Source Area Investigation is also shown on Figure 4-3. A total of five groundwater samples will be for analyzed for nitrate, nitrite, TKN, ammonia, and TDS. The requirements and procedures for monitoring well installation, development, and groundwater sampling are described in Section 4.4.2 of this Work Plan.

4.2.2 SS-36 Unconventional Fuels Area Spill Site

4.2.2.1 Soil Sampling

Three HSA boreholes (NSA36-SB01 through NSA36-SB03) will be advanced and sampled to determine the horizontal and vertical distribution of nitrogen compounds present in the soil at the site (Figure 4-4). At each boring location, three soil samples will be collected (surface, subsurface, and capillary fringe interface). A total of nine soil samples will be collected from the three soil borings and each soil sample will be analyzed for nitrate, nitrite, TKN, and ammonia. The soil sampling requirements and the drilling and sampling procedures for the SS-36 Nitrate Source Area Investigation are described in Section 4.4.1 of this Work Plan.

4.2.2.2 Groundwater Sampling

Two of the three soil borings (NSA36-SB01 and NSA36-SB02) will be converted into permanent 2-inch diameter monitoring wells to provide site specific up and downgradient groundwater sampling locations. One round of groundwater samples will be collected from the previously installed monitoring wells (MW-36-01 through MW-36-05 and 129-MW01 through 129-MW04) and the two new wells (NSA36-MW01 and NSA36-MW02). The monitoring well network for the SS-36 Nitrate Source Area Investigation is also shown on Figure 4-4. A total of 11 groundwater samples will be analyzed for nitrate, nitrite, TKN, ammonia, and TDS. The requirements and procedures for monitoring well installation, development, and groundwater sampling are described in Section 4.4.2 of this Work Plan.

4.2.3 OT-37 Early Missile Test Site

4.2.3.1 Soil Sampling

Three HSA boreholes (NSA37-SB01 through NSA37-SB03) will be drilled and sampled to determine the horizontal and vertical distribution of nitrogen compounds present in the soil at the site (Figure 4-5). Three soil samples will be collected from each borehole at the surface, subsurface, and the capillary fringe interface. A total of nine soil samples

will be collected from the three soil borings and each soil sample will be analyzed for nitrate, nitrite, TKN, and ammonia. The soil sampling requirements and the drilling and sampling procedures for the OT-37 Nitrate Source Area Investigation are described in Section 4.4.1 of this Work Plan.

4.2.3.2 Groundwater Sampling

Two of the three soil borings (NSA37-SB01 and NSA37-SB02) will be converted into permanent 2-inch diameter monitoring wells to provide site specific upgradient groundwater sampling locations. One round of groundwater samples will be collected from the previously installed monitoring wells (MW-37-01 through MW-37-06 and OT37-MW07 through OT37-MW19) and the new wells (NSA37-MW01 and NSA37-MW02). The monitoring well network for the OT-37 Nitrate Source Area Investigation is also shown on Figure 4-5. A total of 21 groundwater samples will be analyzed for nitrate, nitrite, TKN, ammonia, and TDS. The requirements and procedures for monitoring well installation, development, and groundwater sampling are described in Section 4.4.2 of this Work Plan.

4.2.4 OT-38 Test Sled Maintenance Area

4.2.4.1 Soil Sampling

Three HSA boreholes (NSA38-SB01 through NSA38-SB03) will be advanced and sampled to determine the horizontal and vertical distribution of nitrogen compounds present in the soil at the site (Figure 4-6). At each boring location, three soil samples will be collected (surface, subsurface, and capillary fringe interface). A total of nine soil samples will be collected from the three soil borings and each soil sample will be analyzed for nitrate, nitrite, TKN, and ammonia. The soil sampling requirements and the drilling and sampling procedures for the OT-38 Nitrate Source Area Investigation are described in Section 4.4.1 of this Work Plan.

4.2.4.2 Groundwater Sampling

Two of the three soil borings (NSA38-SB01 and NSA38-SB02) will be converted into permanent 2-inch diameter monitoring wells to provide site specific up and downgradient groundwater sampling locations. One round of groundwater samples will be collected from the previously installed monitoring wells (MW-38-01 through MW-38-03) and the two new wells (NSA38-MW01 and NSA38-MW02). The monitoring well network for the OT-38 Nitrate Source Area Investigation is also shown on Figure 4-6. A total of five groundwater samples will be analyzed for nitrate, nitrite, TKN, ammonia, and TDS. The requirements and procedures for monitoring well installation, development, and groundwater sampling are described in Section 4.4.2 of this Work Plan.

4.2.5 SS-39 Missile Spill Area

4.2.5.1 Soil Sampling

Three HSA boreholes (NSA39-SB01 through NSA39-SB03) will be drilled and sampled to determine the horizontal and vertical distribution of nitrogen compounds present in the soil at the site (Figure 4-7). Three soil samples will be collected from each borehole at the surface, subsurface, and the capillary fringe interface. A total of nine soil samples will be collected from the three soil borings and each soil sample will be analyzed for nitrate, nitrite, TKN, and ammonia. The soil sampling requirements and the drilling and sampling procedures for the SS-39 Nitrate Source Area Investigation are described in Section 4.4.1 of this Work Plan.

4.2.5.2 Groundwater Sampling

Two of the three soil borings (NSA39-SB01 and NSA39-SB02) will be converted into permanent 2-inch diameter monitoring wells to provide site specific up and downgradient groundwater sampling locations. One round of groundwater samples will be collected from the previously installed permanent monitoring wells (MW-39-01 through MW-39-07, MW-39-06D, and MW-39-13 through MW-39-16) and the new wells (NSA39-MW01 and NSA39-MW02). The monitoring well network for the SS-39 Nitrate Source Area Investigation is also shown on Figure 4-7. A total of 14 groundwater samples will be analyzed for nitrate, nitrite, TKN, ammonia, and TDS. The requirements and procedures for monitoring well installation, development and groundwater sampling are described in Section 4.4.2.

4.2.6 LF-58 Incinerator Landfill

4.2.6.1 Soil Sampling

Three HSA boreholes (NSA58-SB01 through NSA58-SB03) will be advanced and sampled to determine the horizontal and vertical distribution of nitrogen compounds present in the soil at the site (Figure 4-8). At each boring location, three soil samples will be collected (surface, subsurface, and capillary fringe interface). A total of nine soil samples will be collected from the three soil borings and each soil sample will be analyzed for nitrate, nitrite, TKN, and ammonia. The soil sampling requirements and the drilling and sampling procedures for the LF-58 Nitrate Source Area Investigation are described in Section 4.4.1 of this Work Plan.

4.2.6.2 Groundwater Sampling

Two of the three soil borings (NSA58-SB01 and NSA58-SB02) will be converted into permanent 2-inch diameter monitoring wells to provide site specific up and downgradient groundwater sampling locations. One round of groundwater samples will be collected from the previously installed monitoring wells (MW-58-01 through MW-58-04) and the two new wells (NSA58-MW01 and NSA58-MW02). The monitoring well

network for the LF-58 Nitrate Source Area Investigation is also shown on Figure 4-8. A total of six groundwater samples will be analyzed for nitrate, nitrite, TKN, ammonia, and TDS. The requirements and procedures for monitoring well installation, development, and groundwater sampling are described in Section 4.4.2.

4.3 Pre-investigation Requirements

Before the Nitrate Background Study and the Nitrate Source Area Investigation can begin, there are several pre-investigation documents and approval requirements to be met, including Air Force Form (AF Fm) 332 approval, Base dig permit(s) with utility clearances, site security measures, and facility manager notification of the intended operations. NationView will coordinate project requests for Base installation support services through the 49th CES/CEAN. Pertinent to the start of activities, a pre-construction meeting and site walk-through will be conducted with the USACE Resident Engineer, HAFB personnel, and NationView Site Manager, to inspect site-specific conditions for equipment access, equipment staging, and decontamination area(s), potential site hazards, and emergency evacuation routes. Also reviewed at this time will be project procedures in accordance with the schedule and planned activities.

4.3.1 AF Form 332

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

4.3.2 Dig Permit/Utility Clearances

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

4.3.3 Site Security

Site security is concerned with safety at the sampling locations during all drilling and sampling activities and will be addressed as outlined in the *Basewide Health and Safety Plan* (HASP) (Bhate, 2003b). At a minimum, the exclusion zone at each sampling location will be secured with caution tape, and traffic cones surrounding the perimeter of the location. The size of each exclusion zone will be determined by the size of the drilling and support equipment, and the prevailing sampling location conditions. Open boreholes will not be left unattended without first securing the immediate area

surrounding the borehole, and covering the opening so that it does not become a hazard.

4.4 Investigation Requirements

Field activities for the Nitrate Background Study and the Nitrate Source Area Investigation will be performed in accordance with the *Site-Specific Addendum to the Basewide Health and Safety Plan* (see Appendix A of this Work Plan), the *Quality Assurance Project Plan* [QAPP] *Addendum* (see Appendix B of this Work Plan), as well as other USACE mandated procedures for laboratories. The field work for sampling activities will be conducted in accordance with HAFB Standard Operating Procedures (SOPs) provided in the *Basewide Quality Assurance Project Plan* (Bhate, 2003a) and the *NationView Standard Operating Procedures* (NationView, 2009). These SOPs outline methodologies for soil boring advancement, soil sampling, soil sample description, groundwater sampling, sample management, equipment decontamination, and chain-of-custody procedures. Sample nomenclature will follow the ERPIMS format. The specific SOPs to be followed during this project are listed below:

- HAFB SOP-1 - Documentation, Sample Handling, Chain-of Custody, and Shipping
- HAFB SOP-2 - Sampling Equipment Decontamination
- HAFB SOP-3 - Staking, Utility Clearance, and Permitting
- HAFB SOP-5 - Soil Sampling for Chemical Analysis
- HAFB SOP-6 - Procedure for Field Screening of Volatile Organics
- HAFB SOP-7 - Lithologic Description and Geotechnical Sampling
- HAFB SOP-9 - Field Management of Investigation-Derived Waste
- HAFB SOP-10 - Borehole Abandonment and Site Restoration
- NationView SOP No. 1 - Soil Sampling and Subsurface Investigations
- NationView SOP No. 10 - Subsurface Water Investigation

The following sections describe the procedures for soil sampling, groundwater sampling, and the analyses to be performed for the Nitrate Background Study and the Nitrate Source Area Investigation.

4.4.1 Soil Sampling Requirements

The following sections present the soil sampling collection procedures and sampling and analysis requirements for the Nitrate Background Study and the Nitrate Source Area Investigation. Each drilling location will be cleared for subsurface utilities in accordance with HAFB SOP-3 (Bhate, 2003a). All soil borings will be advanced with 8-¼ inch outer diameter (O.D.) augers (4-¼ inch inner diameter [I.D.]), equipped with a 5-ft stainless steel continuous core barrel sampler in accordance with NationView SOP

No. 1 (NationView, 2009). Soil cores collected from the ERP Sites (Nitrate Source Area Investigation) will be field screened every two feet with a photoionization detector (PID) for health and safety purposes in accordance with HAFB SOP-6. In addition, surface soil (evaporate and caliche soil outcrop deposits) will be collected for the Nitrate Background Study using a disposable PVC scoop. The proposed locations of the 24 boreholes and 40 drainage outcrop soil samples for the Nitrate Background Study are shown on Figures 4-1 and 4-2 respectively. The proposed borehole locations (18) for the site specific Nitrate Source Area Investigation (ERP sites OT-04, SS-36, OT-37, OT-38, SS-39, and LF-58) are shown on Figures 4-3 through 4-8.

Three soil samples will be collected at each boring location (Nitrate Background Study and Nitrate Source Area Investigation) and sent offsite for laboratory analysis as per the following criteria:

- One soil sample will be collected from 0 to 6 inches bgs
- A second soil sample will be collected mid-point between the surface sample and the water table (saturated zone)
- The third sample will be collected from the capillary fringe interface just above the water table

In addition, as part of the Nitrate Background Study, 40 surface soil samples will also be collected from drainage outcrops from 0 to 6 inches bgs.

4.4.1.1 Soil Sampling Procedures

All soil samples will be collected in accordance with HAFB SOP-5 (Bhate, 2003a). Non-dedicated sampling equipment (e.g., drilling equipment including hollow stem augers and the 5-ft stainless steel continuous core barrel samplers) will be decontaminated prior to sample collection using appropriate decontamination procedures. Before and during sampling, all decontaminated sampling equipment and bottles will be placed on clean plastic sheeting to avoid contamination. Soil from the sampler will be placed into the sampling jars provided by the laboratory. Excess soil around the top of the sample jars will be wiped away with a clean cloth or paper towel to ensure the cap will fit tightly. When all sample jars required are filled, excess soil will be returned to the sampling site. New, disposable gloves will be worn to collect each soil sample. Residual soil from the soil sampling will be discarded in accordance with the waste management procedures established in Section 4.5 of this Work Plan, Investigation-Derived Waste (IDW) Management.

4.4.1.2 Laboratory Analyses for Soil Sampling

The analysis of all soil samples collected for this Nitrate Characterization Study Work Plan will follow the USEPA protocol. A summary of the Nitrate Background Study soil sampling and analysis (borehole and drainage outcrop surface soil sampling) and the

Nitrate Source Area Investigation (borehole soil sampling) is provided in Tables 4-1 through 4-3 respectively. The soil samples will be analyzed as follows:

- Nitrate by USEPA Method 300/9056
- Nitrite by USEPA Method 300/9056
- Total Kjeldahl Nitrogen by USEPA Method 351.2
- Ammonia by USEPA Method 350.1

Samples submitted for laboratory analysis will be labeled, handled, and prepared for shipment in accordance with HAFB SOP-1. The samples will be placed on ice and shipped under chain-of-custody to TestAmerica Laboratories, Inc., in Savannah, Georgia.

An appropriate quantity of soil is required for each analytical sample and will be collected in specific containers provided by the laboratory. Each sample will be submitted to the laboratory within the appropriate hold time. Table 4-4 provides the required sample volume, sample container, preservative, and hold times for each analysis.

4.4.1.3 Quality Control Samples

Field duplicate samples will be collected at a frequency of 10 percent and matrix spike (MS)/matrix spike duplicate (MSD) and equipment rinsate samples (for borehole soil samples) will be collected at a frequency of 5 percent. The required number of field duplicate and MS/MSD samples for the Nitrate Background and Source Area soil sampling events are included in Tables 4-1 through 4-3.

The detection reporting limits for all analytical parameters and the quality assurance sampling requirements (duplicate, MS/MSD, and equipment rinsate samples) are summarized in the QAPP Addendum provided in Appendix B of this Work Plan.

4.4.1.4 Soil Description and Classification

Each borehole (including outcrop surface soil samples) will be visually classified and lithology described in the field according to HAFB SOP-7 and the Unified Soil Classification System (USCS) (American Society for Testing and Materials [ASTM] D 2487-06 [ASTM, 2006a] and ASTM D 2488-06 [ASTM, 2006b]) by a qualified geologist. Soil boring logs will be completed in the field and presented in the Nitrate Characterization Report. In addition, the following information will be recorded in a bound field logbook for each sample collected:

- Date and time of collection,
- Sample location,
- Sample number,
- Weather conditions,

- Depth of sample collection,
- Sample type (primary, duplicate, split, as applicable),
- Visual observation of soil (color, layers, texture, etc.), and
- Sampler's name and personnel present.

4.4.1.5 Identification System

Each soil sample collected will be identified on the sample label and chain-of-custody (COC) records, regardless of type. Sample documentation, handling, and shipping will be in accordance with HAFB SOP-1. Sample collection information inclusive of the container type and quantity for the soil samples collected during this Nitrate Characterization Study will be performed in accordance with the QAPP Addendum (Appendix B). An example of the sample identification nomenclature for soil samples collected from the Nitrate Background Study boreholes will be as follows:

NBG-SB01-15-A

Investigation identifier: NBG = Nitrate Background

Sample type identifier: SB = soil boring

Sequential soil boring number: 01, 02, etc.

Ending depth of sample interval (ft bgs): 15

Quality Assurance (QA) sample identifiers: A = field duplicate, MS = matrix spike, MSD = matrix spike duplicate, R = Rinsate

An example of the sample identification nomenclature for drainage outcrop surface soil samples collected for the Nitrate Background Study will be as follows:

NBG-SS01-0.5-A

Investigation identifier: NBG = Nitrate Background

Sample type identifier: SS = surface soil

Sequential drainage outcrop location number: 01, 02, etc.

Ending depth of sample interval (ft bgs): 0.5

QA sample identifiers: A = field duplicate, MS = matrix spike, MSD = matrix spike duplicate

An example of the sample identification nomenclature for soil samples collected from the site specific Nitrate Source Area Investigation boreholes will be as follows:

NSA04-SB01-15-A

Investigation identifier: NSA = Nitrate Source Area

ERP Site number identifier: = 04 (i.e., OT-04, Acid Trailer Burial Site)

Sample type identifier: SB = soil boring

Sequential soil boring number (per site): 01, 02, 03

Ending depth of sample interval (ft bgs): 15

QA sample identifiers: A = field duplicate, MS = matrix spike, MSD = matrix spike duplicate, R = Rinsate

4.4.1.6 Surveying

Prior to leaving the sample location, a surveying stake with the location number written on it will be placed at or immediately adjacent to the actual sampling location. A qualified surveyor will locate the boreholes using a global positioning system (GPS) unit. All horizontal coordinates will be referenced to the State Plane Coordinate System, New Mexico Central and surveyed to an accuracy of +/- 1.0 foot. Vertical elevations will be referenced to North American Datum (NAD) 1983 coordinates.

4.4.2 Groundwater Sampling Requirements

The following subsections describe the groundwater assessments associated with the Nitrate Background Study and the Nitrate Source Area Investigation. The proposed locations of the 23 new monitoring wells for the Nitrate Background Study are shown on Figure 4-1. The monitoring well locations (proposed and existing) for the site specific Nitrate Source Area Investigation (ERP sites OT-04, SS-36, OT-37, OT-38, SS-39 and LF-58) are shown on Figures 4-3 through 4-8.

4.4.2.1 Monitoring Well Installation and Development

A total of 34 monitoring wells will be installed as part of the Nitrate Background Study (23 new wells) and the Nitrate Source Area Investigation (11 new wells). The 34 monitoring wells will be constructed in accordance with NationView SOP No. 10 (NationView, 2009) using HSA drilling technology. Each monitoring well will extend to a depth of 8 ft below the water table and be completed with 10 ft of 2-inch diameter 0.010-inch factory slotted Schedule 40 PVC screen in accordance with NationView SOP No. 10. The remaining borehole casing will be comprised of flush threaded 2-inch diameter Schedule 40 PVC casing.

Based on previous monitoring well installations within the north-central portion of HAFB, the 34 monitoring wells will be installed to depths between 25 to 50 ft bgs. The annular space surrounding the screen will be backfilled with 10/20 mesh Colorado silica sand capped with at least 2 ft of granular bentonite or ¼-inch diameter pellets. The bentonite will be hydrated prior to backfilling the remaining annular space with neat Portland Type I/II cement. The surface completion will consist of a lockable and tamper proof 8-inch diameter steel cover as a flush mount well completion with a 2-ft diameter concrete pad slightly arched to allow surface water runoff to flow away from the well.

The 34 new monitoring wells will be developed to remove fine particulates and improve hydraulic communication with the surrounding saturated material as per NationView SOP No. 10 (NationView, 2009). Well development will begin no sooner than 12 hours after grouting. Monitoring well development will take place by over-pumping each well until at least five well volumes have been removed, and the dissolved oxygen (DO),

turbidity, potential of hydrogen (pH), specific conductivity, and temperature have stabilized by +/- 10 percent for at least three consecutive readings.

4.4.2.2 Groundwater Sampling Procedures

One round of groundwater samples will be collected from the Nitrate Background Study monitoring well network (24 wells). In addition, a round of groundwater samples will be collected from the monitoring well networks associated with OT-04 (5 wells), SS-36 (11 wells), OT-37 (21 wells), OT-38 (5 wells), SS-39 (14 wells), and LF-58 (6 wells) for the Nitrate Source Area Investigation. Each monitoring well will be sampled in accordance with NationView SOP No. 10 (NationView, 2009). A stainless steel monsoon submersible low flow pump equipped with polyethylene tubing will be used to bring sample water to the surface where indicator field parameters will be monitored in a flow through cell. Field parameters will be measured and recorded every one well volume. Groundwater samples will not be obtained until three consecutive field parameter measurements have stabilized. Stabilization occurs when the pH measurements remain constant within 0.1 units; specific conductivity, DO, and temperature vary by no more than 10 percent; and turbidity by no more than 5 nephelometric turbidity units (NTUs). Utilizing low-flow purging and sampling techniques may require removal of a greater volume of water than three to five volumes. Once field parameters have stabilized, the groundwater samples will be collected. A new length of polyethylene tubing will be used for each well. All groundwater samples will be collected from the mid-screen interval in each monitoring well. For the 34 newly installed monitoring wells (Nitrate Background Study [23 wells] and the Nitrate Source Area Investigation [11 wells]) a minimum of 14 days will elapse between well development and sampling. Water level indicators will be decontaminated prior to use at each well.

4.4.2.3 Laboratory Analyses for Groundwater Sampling

The analysis of all groundwater samples collected for this Nitrate Characterization Study Work Plan will follow the USEPA protocol. A summary of the Nitrate Background Study and the Nitrate Source Area Investigation groundwater sampling and analysis is provided in Tables 4-5 and Table 4-6, respectively. The groundwater samples will be analyzed as follows:

- Nitrate by USEPA Method 300/9056
- Nitrite by USEPA Method 300/9056
- Total Kjeldahl Nitrogen by USEPA Method 351.2
- Ammonia by USEPA Method 350.1
- TDS by USEPA Standard Method (SM) 19 Method 2540C

Samples submitted for laboratory analysis will be labeled, handled, and prepared for shipment in accordance with HAFB SOP-1. The samples will be placed on ice and

shipped under strict chain-of-custody to TestAmerica Laboratories, Inc., in Savannah, Georgia.

An appropriate quantity of groundwater is required for each analytical sample and will be collected in specific containers with associated preservatives, provided by the laboratory. Each sample will be submitted to the laboratory within the appropriate hold time. Table 4-4 provides the required volume, sample container, preservative, and hold times for each analysis.

4.4.2.4 Quality Control Samples

Field duplicate samples will be collected at a frequency of 10 percent and MS/MSD samples will be collected at a frequency of 5 percent. The required number of field duplicate and MS/MDS samples for the Nitrate Background and Source Area soil sampling events are included in Tables 4-5 and 4-6 respectively.

The detection reporting limits for all analytical parameters and the quality assurance sampling requirements (duplicate and MS/MSD samples) are summarized in the QAPP Addendum provided in Appendix B of this Work Plan.

4.4.2.5 Identification System

Each groundwater sample collected will be identified on the sample label and COC records. Sample documentation, handling, and shipping will be in accordance with HAFB SOP-1. Sample collection information inclusive of the container type and quantity for the groundwater samples collected during this Nitrate Characterization Study will be performed in accordance with the QAPP Addendum (Appendix B). An example of the sample identification nomenclature for groundwater samples collected from the new Nitrate Background Study monitoring wells will be as follows:

NBG-MW01-A

Investigation identifier: NBG = Nitrate Background

Sample type identifier: MW = Monitoring Well

Sequential monitoring well number: 01, 02, etc.

QA sample identifiers: A = field duplicate, MS = matrix spike, MSD = matrix spike duplicate

An example of the sample identification nomenclature for groundwater samples collected from the new site specific Nitrate Source Area Investigation monitoring wells will be as follows:

NSA04-MW01-A

Investigation identifier: NSA = Nitrate Source Area

ERP Site number identifier: = 04 (i.e., OT-04, Acid Trailer Burial Site)

Sample type identifier: MW = Monitoring Well

Sequential monitoring Well number (per site): 01, 02

QA sample identifiers: A = field duplicate, MS = matrix spike, MSD = matrix spike duplicate

The sample identification nomenclature for groundwater samples collected from the existing monitoring wells (Nitrate Background Study and Nitrate Source Area Investigation) will be based on the existing well identification number (i.e. MW-04-01). QA sample identifiers will be denoted after the well identification, as necessary (i.e. MW-04-01-A).

4.4.2.6 Surveying

The monitoring well networks for the Nitrate Background Study and ERP sites OT-04, SS-36, OT-37, OT-38, SS-39, and LF-58 (Nitrate Source Area Investigation) will be surveyed by a qualified surveyor using a survey grade Trimble® Geometrics Pro XR GPS in accordance with methods described in the Basewide QAPP (Bhate, 2003a). Horizontal locations will be relative to the State Plane Coordinate System, New Mexico Central and surveyed to an accuracy of +/- 1.0 ft. Vertical elevations will be referenced to NAD 1983. The top of casing (vertical control) will be used to determine the depth and elevation of the groundwater and surveyed to an accuracy of +/-0.01 ft. All site maps will include a coordinate system (e.g., New Mexico State Plane Coordinate System, Central Zone) with the site and pertinent features.

4.4.2.7 Groundwater Elevations

During the sampling of monitoring wells under this Work Plan, groundwater elevations will be measured. The water level in each well will be gauged to the nearest 0.01 ft using an electronic water level indicator prior to sampling. The depth to water information will be used to calculate the volume of water to be purged from the well prior to sample collection. At the conclusion of the groundwater sampling event, depth to groundwater measurements will be collected from the monitoring well networks for the Nitrate Background Study and ERP sites OT-04, SS-36, OT-37, OT-38, SS-39, and LF-58 to develop current potentiometric surface maps.

4.5 Investigation-Derived Waste Management

IDW will be managed and characterized according to HAFB SOP No. 9. Whenever possible, waste minimization techniques will be used to reduce the amount of IDW. IDW generated by advancing soil borings, installing the new monitoring wells, and subsequent soil and groundwater sampling activities will be managed and characterized according to the following guidelines. Solid waste such as empty sand and bentonite bags, personal protective equipment (PPE), and used tubing, etc., will be placed in trash bags and disposed of in dumpsters on site for disposal as non-hazardous sanitary waste.

The proposed soil boring/groundwater monitoring well locations selected for the Nitrate Background Study are not considered to be contaminated. All soil generated during drilling will be used to backfill the borehole or spread on the ground at the boring. Additionally, development and purge water from the nitrate background wells will be disposed on the ground surface adjacent to the well.

Based on the analytical results of previous soil samples collected at the six ERP sites (Nitrate Source Area Investigation), it is not anticipated that soil cuttings will contain any contaminants which are above action levels, and therefore, should be suitable for spreading on the ground at each borehole location. Additionally, all soil cuttings which are generated from boreholes drilled at the six ERP sites will be field screened with a PID using headspace screening techniques for the presence of organic vapors. If PID screening of the soil indicates the presence organic vapors (above background), the soil will be contained and temporarily staged at the permitted HAFB FT-31 Landfarm pending the receipt of analytical sampling results. If analytical results indicate contaminants present at concentrations above the landfarm's acceptance levels, the soil will be properly disposed offsite. If the analytical results indicate contaminants present at levels below the landfarm's acceptance levels, the material will be land-farmed. If headspace readings are below background, the cuttings will be spread around the borehole locations as described in HAFB SOP No. 9 of the HAFB Basewide QAPP (Bhate, 2003a).

Decontamination and purge waters (from monitoring well development and purging at the six ERP sites) will be locally contained in 5-gallon pails and conveyed to a 1,000 gallon portable storage tank. The 1,000-gallon portable storage tank will be maintained by NationView until disposal through the HAFB Wastewater Treatment Plant (WWTP), pending laboratory analysis. Other liquid wastes, such as decontamination rinses will also be conveyed to the portable storage tank.

4.6 General Decontamination Procedures

Small equipment, such as sampling tools, will be decontaminated in accordance with HAFB SOP-2. Heavy equipment will be decontaminated by steam cleaning at a temporary decontamination pad. The containers and decontamination pad will be managed in a secure area and the decontamination water will be allowed to evaporate or discharged to the HAFB WWTP (pending review of the laboratory analytical data by HAFB WWTP personnel). Sediment remaining in the decontamination pad area after the water has either evaporated or been discharged to the WWTP, will be spread on the ground.

4.7 Site Restoration

Upon completion of the investigation activities, the sampling locations will be restored to their original condition. Soil boring locations not converted into monitoring wells will be

backfilled to the surface in accordance with HAFB SOP-10 (Bhate, 2003a). The areas will be canvassed for trash, debris, etc.

5 PROJECT QUALITY ASSURANCE

The field operations documentation will provide consistent procedures and formats for documentation and management of field records. Additional field operations documentation and required submittals are described within the QAPP Addendum (Appendix B) and Site Specific Addendum to the Basewide HASP (Appendix A). Appendix C of this Work Plan includes all of the field forms that will be used during the implementation of the Nitrate Characterization Study Work Plan.

5.1 Data Quality Objectives Process

To support the overall objectives for the Nitrate Background Study and the Nitrate Source Area Investigation, Data Quality Objectives (DQOs) have been established. The DQOs are qualitative and quantitative statements that specify the quality of data required to meet the goals of site characterizations, risk assessments, and remedial design. Data developed during the Nitrate Background Study will be used to support site-specific studies of potential nitrate contamination at other HAFB sites.

DQOs will be used to:

- Ensure data comparability through the use of standard methods and controlled systems to collect and analyze samples;
- Provide analytical results of known and acceptable precision and accuracy; and to provide a minimum of 95 percent data completeness for analytical results representing each matrix-method combination.

The level of analytical support to meet these goals will be both screening and definitive data. As part of the analytical reporting requirements for the definitive data, TestAmerica Laboratories, Inc. will provide the following data, in addition to the data deliverables described in Appendix C of the Basewide QAPP (Bhate 2003a):

- Sample identification numbers cross-referenced with laboratory identification numbers and Quality Control (QC) sample numbers,
- Problems with arriving samples noted on chain-of-custody,
- Each analyte reported as an actual value or less than a specified detection limit, and
- Dilution factors, preparation dates, and analysis dates.

QC sample results for laboratory blanks, surrogate spikes, MS, laboratory control samples (LCS), field duplicates, and trip blanks will be used to evaluate the reliability of the data. The data developed during the investigation will meet the chosen objectives for precision, accuracy, representativeness, completeness, comparability, and sensitivity.

5.1.1 Precision

Precision is a measure of the degree of reproducibility of an analytical value and is used as a check on the quality of the sampling and analytical procedures. Laboratory replicates, field duplicates, and duplicate analysis (such as MS/MSD and LCS/LCS duplicates [LCSD]) are used to quantify precision. Laboratory replicates measure the analytical precision, whereas field duplicate analysis provides a precision measurement that includes the sampling and the potential variability of the sample matrix.

Precision of the analytical method, at each stage is expressed in terms of a relative percent difference (RPD) between duplicate determinations. A detailed calculation of the RPD is presented in the Basewide QAPP (Bhate, 2003a). Soil sample measurements are usually less precise than water sample measurements because it is more difficult to achieve a homogeneous, representative sample. Based on this, the precision targets for soil field duplicates will be an RPD of 30 or less, while the target water matrix RPD will be 25 or less. The laboratory RPDs are presented in the QAPP Addendum in Appendix B of this Work Plan.

Field duplicates will be collected at the frequency of 1 in 10 samples collected or 1 per batch whichever is greater. MS/MSD samples will be collected at a frequency of 1 set per 20 samples.

5.1.2 Accuracy

Accuracy is the degree to which a measurement agrees with the actual value, i.e., the amount of measurement bias. Accuracy is expressed as a percent recovery (%R) of a known concentration of reference material. For the Nitrate Characterization Study, MS/MSDs will be used to determine the accuracy for a given method and sample matrix. An aliquot of a normal sample will be designated as the MS/MSD. The laboratory will spike the MS/MSD sample set as described below.

The spiked compounds will include representative compounds that are quantified during the method, and spiked during sample preparation, on a specially prepared aliquot of the sample matrix. Results of these spiked aliquots are then compared to the native concentrations of the analytes spiked, and a %R is calculated. The %R of the spiked compound is used as an assessment of analytical accuracy on the sample matrix analyzed, which is essential in identifying sample matrix interferences. The %R will be between 75 and 125 percent.

5.1.3 Representativeness

Representativeness is a qualitative parameter that expresses the degree to which sample data actually represent the matrix conditions. Requirements and procedures for sample collection and handling are designed to maximize sample representativeness. Representativeness can also be monitored by reviewing field documentation and by

performing field QA audits. The determination of the representativeness of the data will be performed by:

- Comparing actual sampling procedures and chain of custody forms to those described in the work plan,
- Identifying and eliminating non-representative data in site characterization activities, and
- Evaluating holding times and condition of samples on arrival at the laboratory.

The objective of this element is to eliminate all non-representative data.

5.1.4 Completeness

Data completeness represents the percentage of valid data collected from a sampling/analytical program or measurement system compared to the amount expected to be obtained under optimal conditions. The completeness goal for the definitive samples is 95%. The completeness results will be calculated following data validation and review.

5.1.5 Comparability

Comparability is a qualitative measure of the confidence with which one data set can be compared to another. These data sets include data generated by different laboratories, data generated by laboratories in previous investigative phases, data generated by the same laboratory over a period of several years, or data obtained using differing sampling techniques or analytical protocols. The measurement comparability objective of this work plan is to generate consistent data using standard test methods, standard field data sheets, and uniform concentration units. These data are intended to be accepted and used by other investigators who are considering specific sites within HAFB.

5.1.6 Sensitivity

Sensitivity is a general term referring to the calibration sensitivity and the analytical sensitivity of a piece of equipment, used to establish detection/quantitation/reporting limits. Several limits have been established to describe sensitivity requirements (i.e. instrument detection limits [IDLs], MDLs, practical quantitation limits [PQLs], and reporting limits [RLs]). Since IDLs and MDLs are normally based on a reagent water matrix or a purified soil matrix, published IDLs and MDLs are presumed not to be consistently achievable for environmental samples. It is because of this inconsistency and the goal to promote the generation of comparable data that the following definitions shall be used to meet the project DQOs:

- IDL – The IDL references the absolute limit of detection for a compound or analyte in a media that is free from matrix interferences at a level greater than two times the noise level of the instrument. Certain programs require the laboratory to publish

IDLs on an annual basis; however, achievement of these detection levels generally cannot be met during routine analyses.

- MDL – The MDL is the minimum concentration of an analyte that can be measured and reported with 99 percent confidence that the analyte concentration is greater than zero, and is determined from the analysis of sample in a given matrix containing the analyte. The laboratory is required to perform an MDL study during the initial setup of the analytical procedure and annually thereafter. An MDL study is also performed whenever the basic chemistry of the procedure is changed. When MDLs are reported with analytical data, they should be adjusted for sample weight, moisture content, and volumetric dilution on a per-sample basis.
- PQL - Because of the amount of error associated with results quantitated at the IDL or MDL and the fact that the MDL may not be attainable for the project matrices, the PQL is established at a factor of 5 to 10 times the MDL, but no lower than 3 times the MDL for the target analytes. The PQL represents the value at which the laboratory has demonstrated the ability to reliably quantitate target analytes within a prescribed performance criterion for the method performed. The PQL is often based on the lowest standard used in the initial calibration curve or as a low-level calibration verification standard.
- RL - The RL is the lowest concentration at which an analyte can be detected in a sample and its concentration can be reported with a reasonable degree of accuracy and precision and is established at a level between the laboratory's PQL and the level needed to meet project requirements. Positive detections below the RL (and above the MDL) are reported and qualified with a J-flag as an estimated value. The RL is usually based upon project-specific requirements including risk-based concentrations of concern, or regulatory action levels. RLs should be adjusted based on the sample matrix and any necessary sample dilutions. The RLs for this project are presented in Table 4-2 of the QAPP Addendum found in Appendix B of this Work Plan.

5.1.7 Data Validation

Data validation includes the elements of verification, in which a complete accuracy check of the laboratory hardcopies are checked against the electronic data deliverable (EDD), in order to assure agreement; however, the assessment process is designed to result in data that are of "known" accuracy and precision. Individual data that cannot be validated under established criteria for acceptance are flagged to indicate that the results are either estimated, or unusable. Validation is an alternative to adversarial review and is performed by a qualified chemist who can exercise the use of professional judgment during the qualification process.

A 100% data validation of the definitive analytical data will be conducted by the NationView Project Chemist, in order to verify compliance with Appendix C of the Basewide (Bhate, 2003a) and the QAPP Addendum (Appendix B) and the specified methodology. Data validation procedures will be based on the *USEPA Contract Laboratory Program National Functional Guidelines for Inorganic Superfund Data*

Review (USEPA, 2010). Upon completion of the data validation process, the usability of the data will be determined.

5.2 Standard Operating Procedures

Applicable SOPs for completing the field sampling activities are located in Appendix A of the Basewide QAPP (Bhate, 2003a) and applicable SOPs from the *NationView Standard Operating Procedures* Manual (NationView, 2009). All applicable SOPs and field forms will be placed in a 3-ring binder that will be kept on site during the Nitrate Characterization Study.

5.3 Sample Identification

Each environmental sample (including field QC samples) will be identified on the sample label (which will be attached to the individual sample container) and COC records. Table 4-4 provides the sample collection information inclusive of the container type, preservative, holding time, and quantity for the soil and groundwater samples that will be collected during this investigation. Sample documentation, handling, and shipping will be in accordance with HAFB SOP No. 1. Field duplicates will be submitted with other field samples. The sample identifier nomenclature will adhere to the guidelines presented in Sections 4.4.1.5 and 4.4.2.5 of this Work Plan.

5.4 Project Documentation

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

5.4.1 Daily Quality Control Reports

Daily Quality Control Reports (DQCRs) will be completed and submitted by field personnel to the USACE-Omaha Project Manager. The purpose of these reports is to provide a written log of daily activities to the Project Manager and the USACE. Information provided on the DQCRs includes:

- Project name and location
- Date
- Temperature range
- Personnel on site
- Summary of site activities
- Level of health and safety protection
- Instruments used and calibrations performed
- Instrument problems and corrective actions
- Samples collected and sample collection methods
- QC samples collected
- Additional remarks

DQCRs will be compiled on a daily basis. At the completion of site activities a copy of all reports will be reproduced and forwarded to USACE.

5.4.2 Sample Documentation

Sample documentation, identification, and tracking will adhere to the prescribed methods found in the Basewide QAPP (Bhate, 2003a). All sampling activities will include documentation of significant activities, potential environmental influences during sampling, field variances, and sample identification information. At a minimum, field logbooks will be used to record dates and times, sampling protocols, project numbers, and sampler's name. Other pertinent information will include COC numbers and air-bill tracking number. Chain-of-custody forms will be completed and included with each sample shipment; one COC per cooler.

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

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

5.4.3 Field Logbook

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

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

The following general requirements apply to field logbooks:

- The left page of the logbook will be used for auxiliary reporting such as sketches, tables, etc.

- The date will be recorded at the top of every page in the left-hand corner of the right page.
- The time of entry recordings will be in columnar form down the left-hand side of the right page.

5.4.4 Field Screening Data

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

5.4.5 Data Reporting

Data collected during the sampling of screening and definitive samples, will be reported according to the Basewide QAPP (Bhate, 2003a). The data will be provided in tabular form as well as an appendix of the original laboratory analytical report. Figures and/or graphical depictions will be generated indicating concentrations in both media. An ERPIMS submittal will be required for this project.

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6 HEALTH AND SAFETY REQUIREMENTS

Project Health and Safety practices will adhere to the *Basewide Health and Safety Plan* (Bhate, 2003b) and the Site Specific Addendum to the Basewide HASP, as included in Appendix A of this Work Plan. It is anticipated that no greater than modified level D PPE will be required to complete the project activities. This includes: Occupational Safety and Health Administration (OSHA) approved safety shoes, American National Standards Institute (ANSI) approved safety glasses (Z87.1) and hard hat (Z89.1-1997: Type I), sleeved shirt and long pants, and as required, hearing protection, leather work gloves, and nitrile gloves during sampling.

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7 PROJECT MANAGEMENT AND SCHEDULE

This section presents the project management and schedule for performing the Nitrate Characterization Study which includes a Nitrate Background Study and the Nitrate Source Area Investigation.

7.1 Management Control Structure

During the implementation of the field activities for the Nitrate Characterization Study, Mr. Jim Moore will serve as the NationView Site Manager and Field Team Leader, overseeing and directing all sampling activities. Mr. Moore will also provide on-site management of any sub-contractors for the project. Mr. Frank Gardner will serve as the NationView Project Manager. Mr. David Martin is the NationView Corporate Sponsor and will ensure required project documents, permits, contractual agreements, and other program tasks are completed. Key project personnel and their responsibilities are listed in Table 7-1. The field activities for the Nitrate Background Study and the Nitrate Source Area Investigation are anticipated to begin in mid/late 2012 (pending NMED review/approval of the work plan) and will last approximately 8 weeks.

7.2 Reporting

A variety of reporting mechanisms will be used throughout the Nitrate Characterization Study to facilitate communication between HAFB, USACE, NMED, and Contractors. These reporting mechanisms will include the standard quality control and progress reports outlined in the HAFB Basewide QAPP, as well as the Draft and Final Nitrate Characterization Study Reports.

Each of these reports will be instrumental in maintaining and documenting the continuing communication between various entities involved in the project.

A Draft Nitrate Characterization Study Report will be prepared and undergo a series of internal reviews prior to submission to the HAFB 49th CES/CEAN and the USACE Omaha District, as the agency service provider, prior to revision and submission of the Final version to the NMED Hazardous Waste Bureau for review. Upon receipt of NMED comments, the Final Report will be revised accordingly. As needed, a meeting may be requested to address any issues of significance that are not readily resolved through standard revision-level processes. The NationView Team will be responsible for resolving any issues that rise to that level of discourse.

Specifically, the Nitrate Characterization Study Report(s) will include the following elements:

- Introduction
- Environmental Setting

- Nitrate Source Area Characterization (ERP sites: OT-04, SS-36, OT-37, OT-38, SS-39, and LF-58)
- Sampling and Analysis Results
- Data Quality Assurance/Data Quality Control Review
- Conclusions
- Recommendations

In order to streamline the Nitrate Characterization Study Report, the Nitrate Background Study will be a separate report and will be included as an Appendix.

7.3 Records Management

Project files will contain the following information:

- Correspondence
    a. External and internal correspondence
    b. Personnel, organization, and responsibilities
    c. Planning and scheduling
    d. QA auditing and inspection reports
- All Field Generated Data
- Contractual Documentation
    a. Prime Contract
    b. Delivery Orders / Task Orders
    c. Change Orders
    d. Subcontracts
    e. Competitive bid evaluations
- Laboratory Analytical Data
- Submittals/Reports
- Miscellaneous project information as required

Project files will be maintained by Project Management and Quality Assurance personnel, as supported by designated document control personnel.

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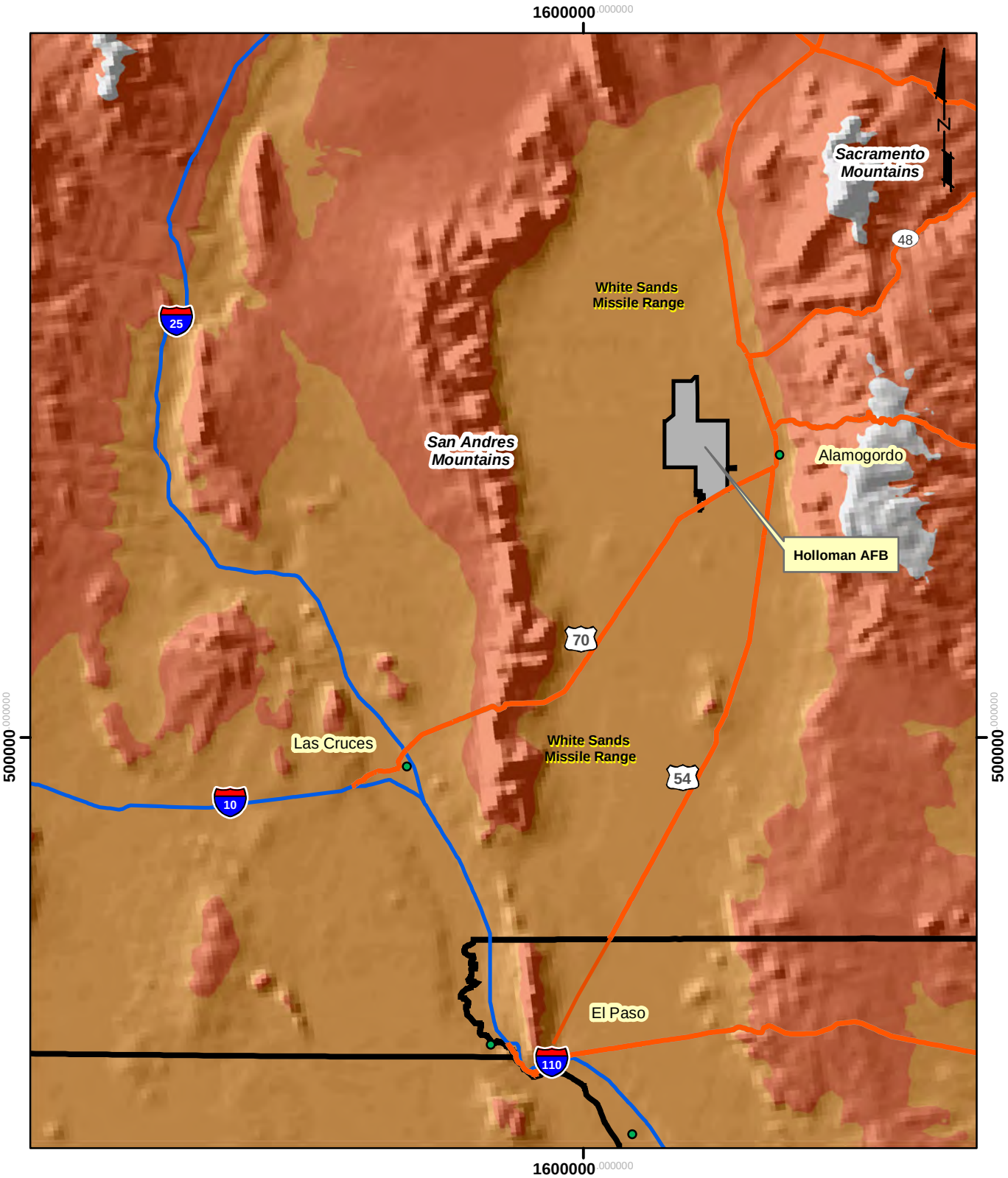
FIGURES



0 4.5 9 18 27 36 Miles

Note: Projection-New Mexico State Plane Coordinate System, Central Zone, North American Horizontal Datum 1983 (feet)

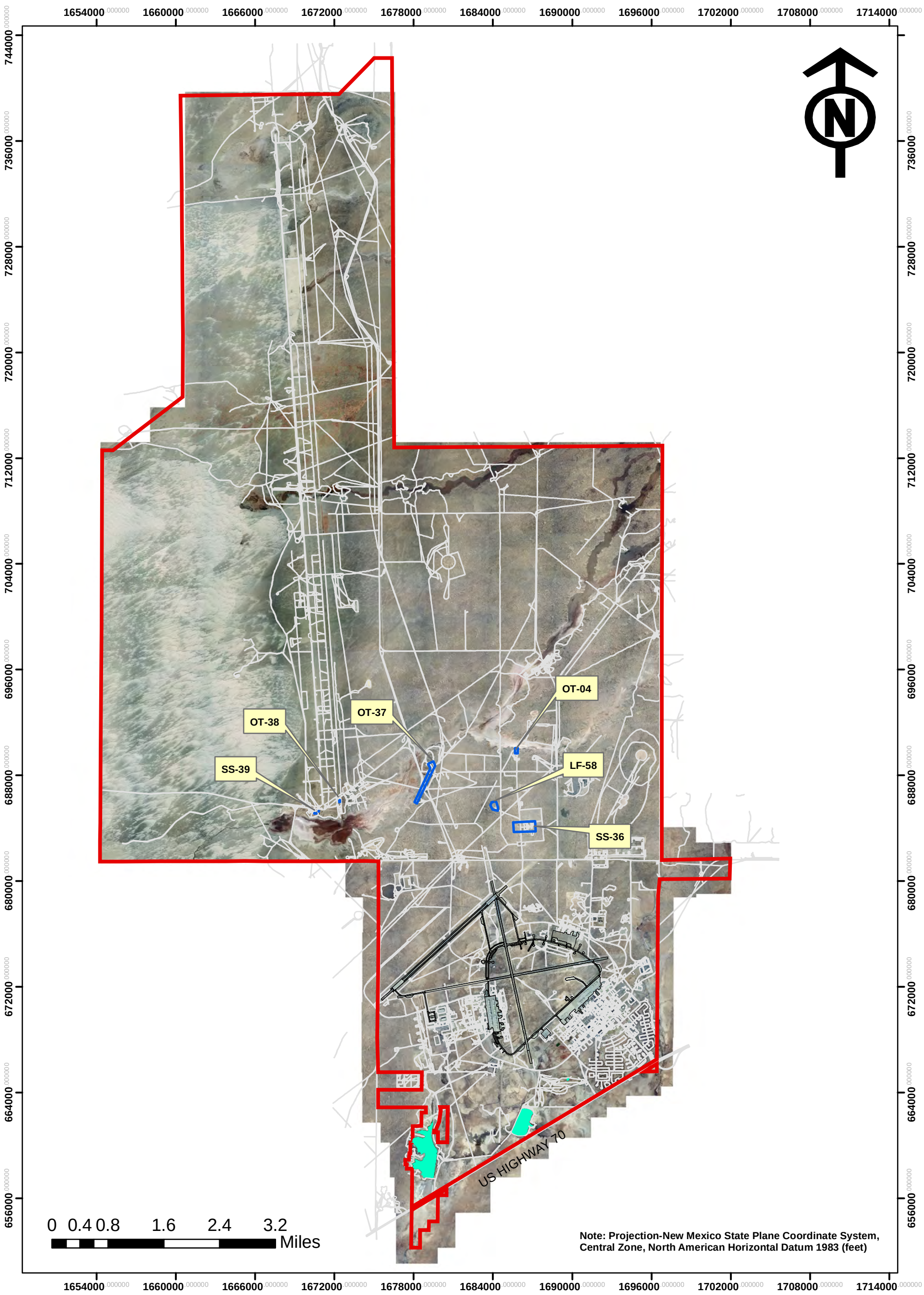
NATIONVIEW

Holloman AFB, New Mexico Location Map

PROJECT NO.	SCALE	DATE	DRAWN BY:
11-0017	1"=18 Miles	11/2/11	cm
			DRAWING NO: Figure 1-1

Nitrate Characterization Study Work Plan
Holloman AFB, New Mexico

Figure 1-1



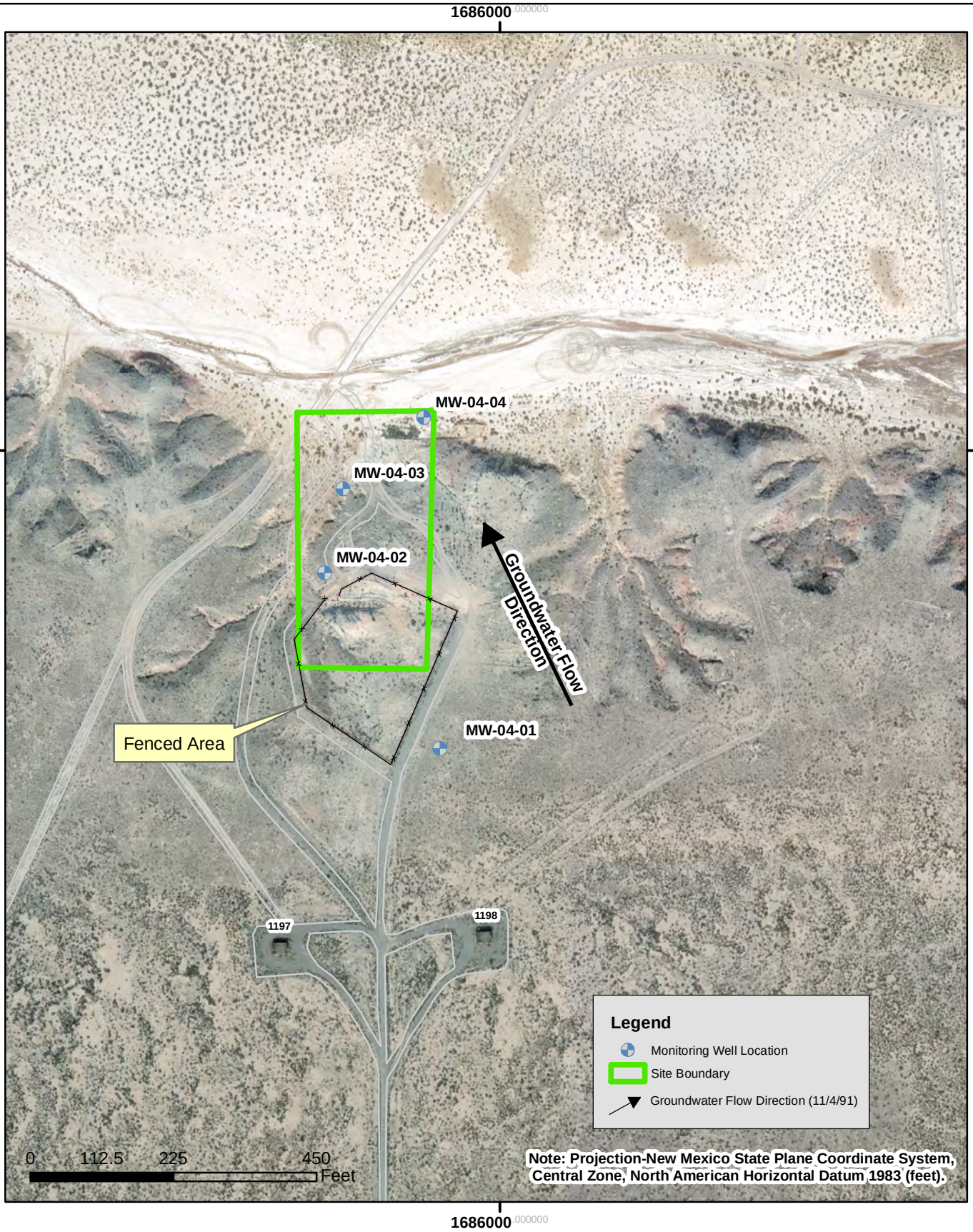
NATIONVIEW

Selected ERP Sites with Elevated Nitrate Groundwater Concentrations

PROJECT NO.	SCALE	DATE	DRAWN BY:
11-0017	1"=8000'	9/27/11	cm
			DRAWING NO: Figure 1-2

Nitrate Characterization Study Work Plan
Holloman AFB, New Mexico

Figure 1-2



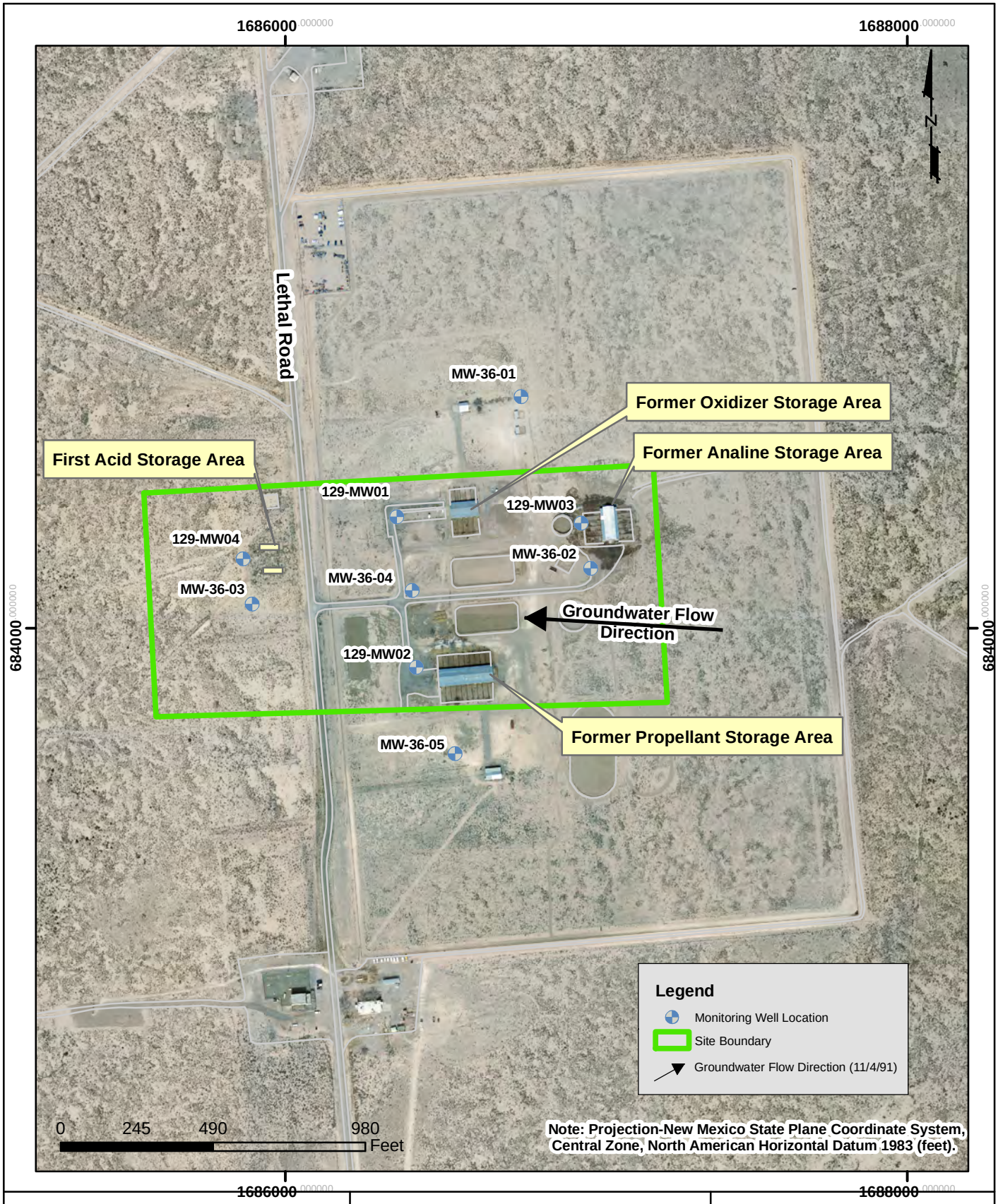
NATIONVIEW

OT-04 Acid Trailer Burial Site
Site Map Showing
Existing Monitoring Well Network

PROJECT NO.	SCALE	DATE	DRAWN BY: cm
11-0017	1"=200'	1/2/12	DRAWING NO: Figure 1-3

Nitrate Characterization Study Work Plan
Holloman AFB, New Mexico

Figure 1-3



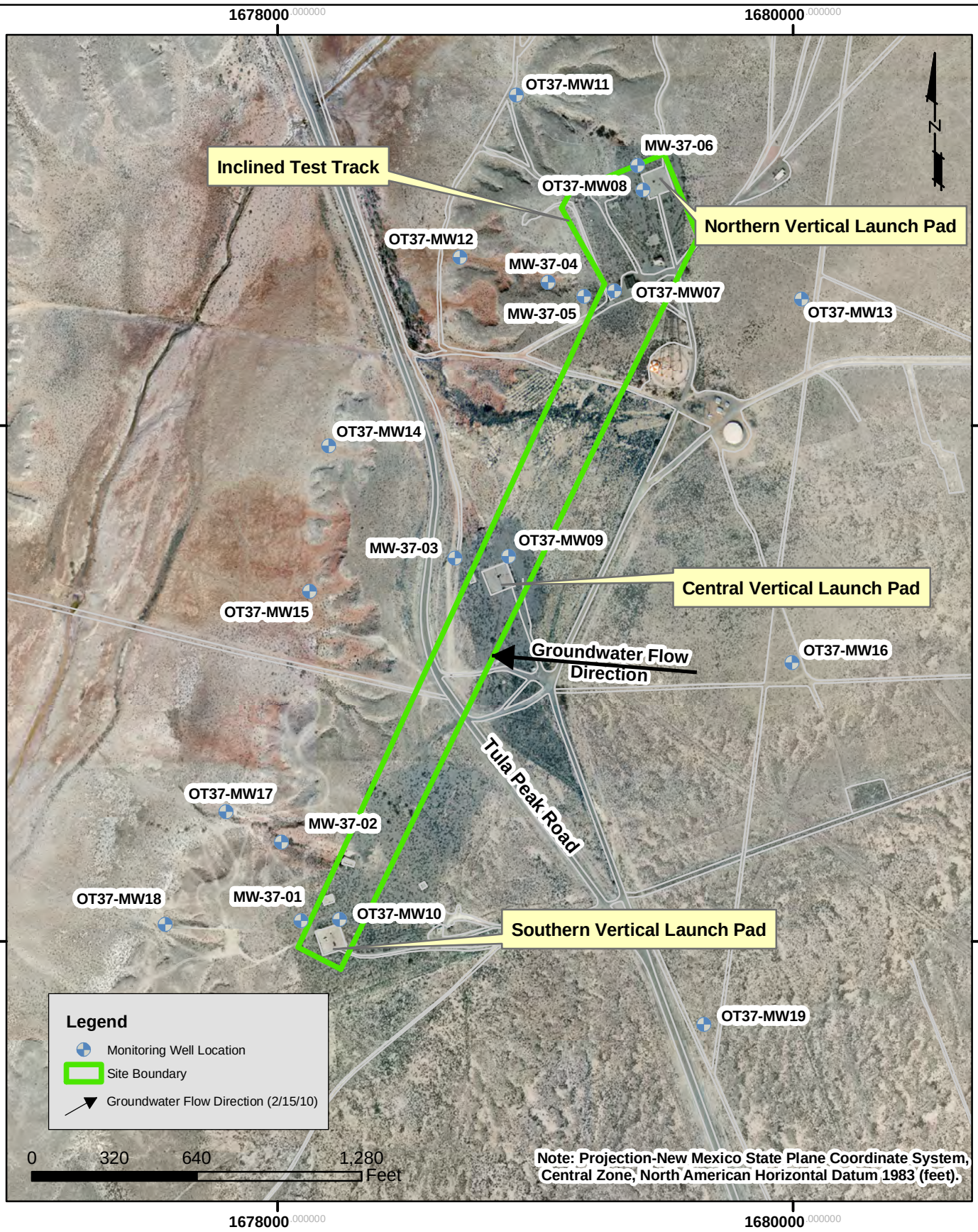
NATIONVIEW

SS-36 Unconventional Fuels Area Spill Site
Site Map Showing
Existing Monitoring Well Network

PROJECT NO.	SCALE	DATE	DRAWN BY:
11-0017	1"=400'	1/2/12	cm
			DRAWING NO: Figure 1-4

Nitrate Characterization Study Work Plan
Holloman AFB, New Mexico

Figure 1-4



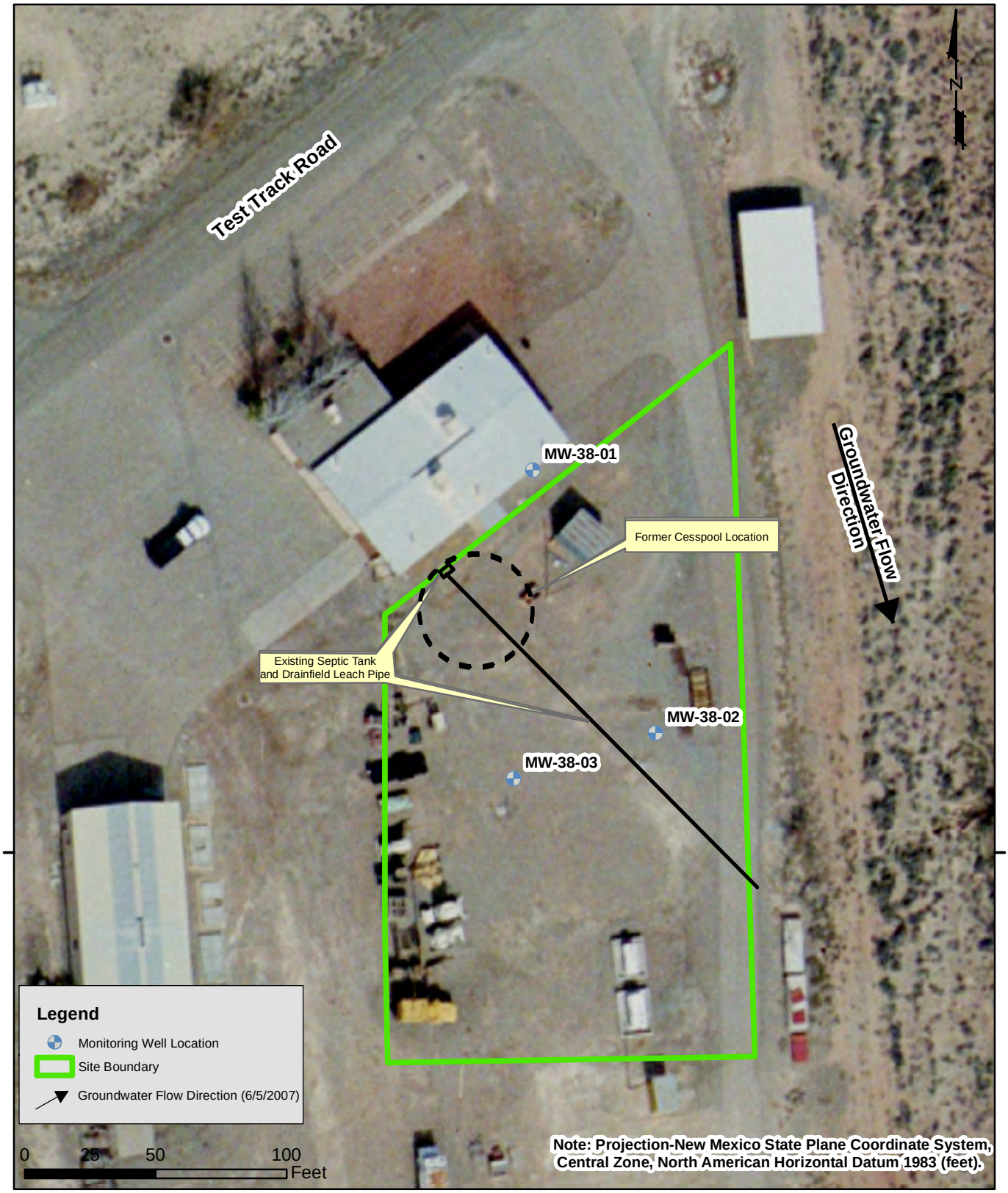
NATIONVIEW

OT-37 Early Missile Test Site
Site Map Showing
Existing Monitoring Well Network

PROJECT NO.	SCALE	DATE	DRAWN BY: cm
11-0017	1"=500'	1/2/12	DRAWING NO: Figure 1-5

Nitrate Characterization Study Work Plan
Holloman AFB, New Mexico

Figure 1-5



NATIONVIEW

OT-38 Test Sled Maintenance Area
Site Map Showing
Existing Monitoring Well Network

PROJECT NO.	SCALE	DATE	DRAWN BY: cm
11-0017	1"=40'	1/2/12	DRAWING NO: Figure 1-6

Nitrate Characterization Study Work Plan
Holloman AFB, New Mexico

Figure 1-6

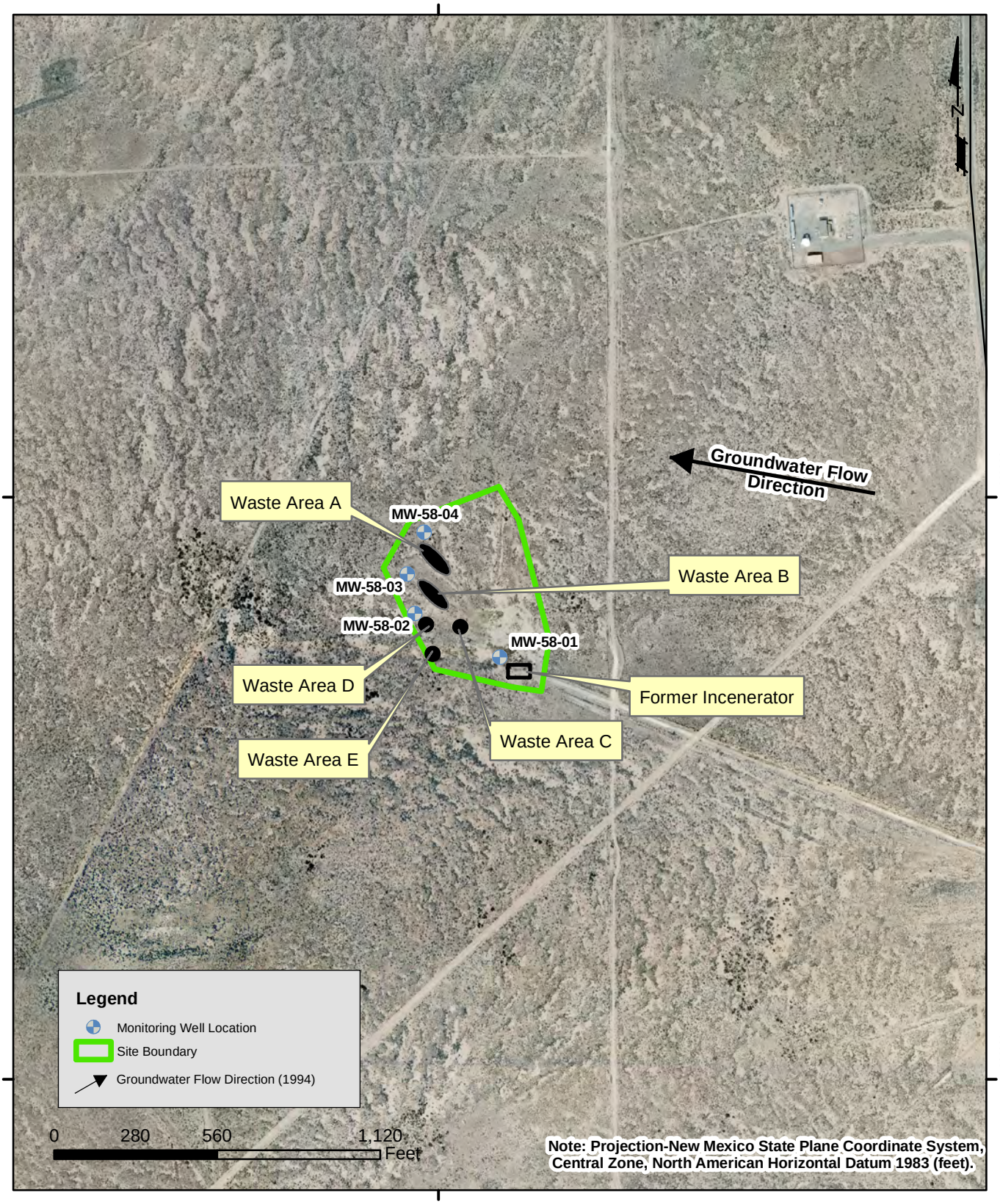
NATIONVIEW

SS-39 Missile Spill Area
Site Map Showing
Existing Monitoring Well Network

PROJECT NO.	SCALE	DATE	DRAWN BY: cm
11-0017	1"=250'	1/2/12	DRAWING NO: Figure 1-7

Nitrate Characterization Study Work Plan
Holloman AFB, New Mexico

Figure 1-7



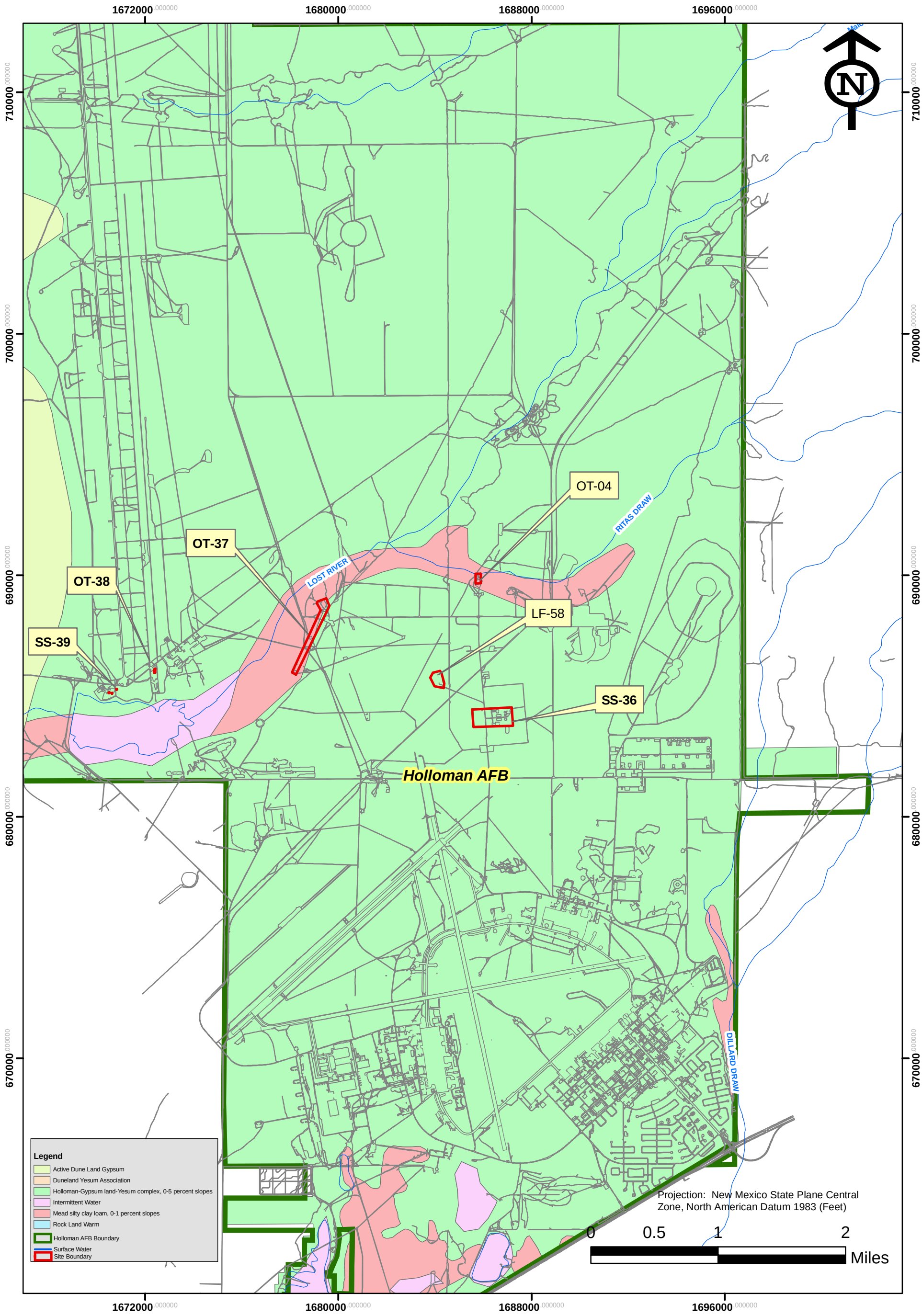
NATIONVIEW

LF-58 Incinerator Landfill
Site Map Showing
Existing Monitoring Well Network

PROJECT NO.	SCALE	DATE	DRAWN BY: cm
11-0017	1"=200'	1/2/12	DRAWING NO: Figure 1-8

Nitrate Characterization Study Work Plan
Holloman AFB, New Mexico

Figure 1-8



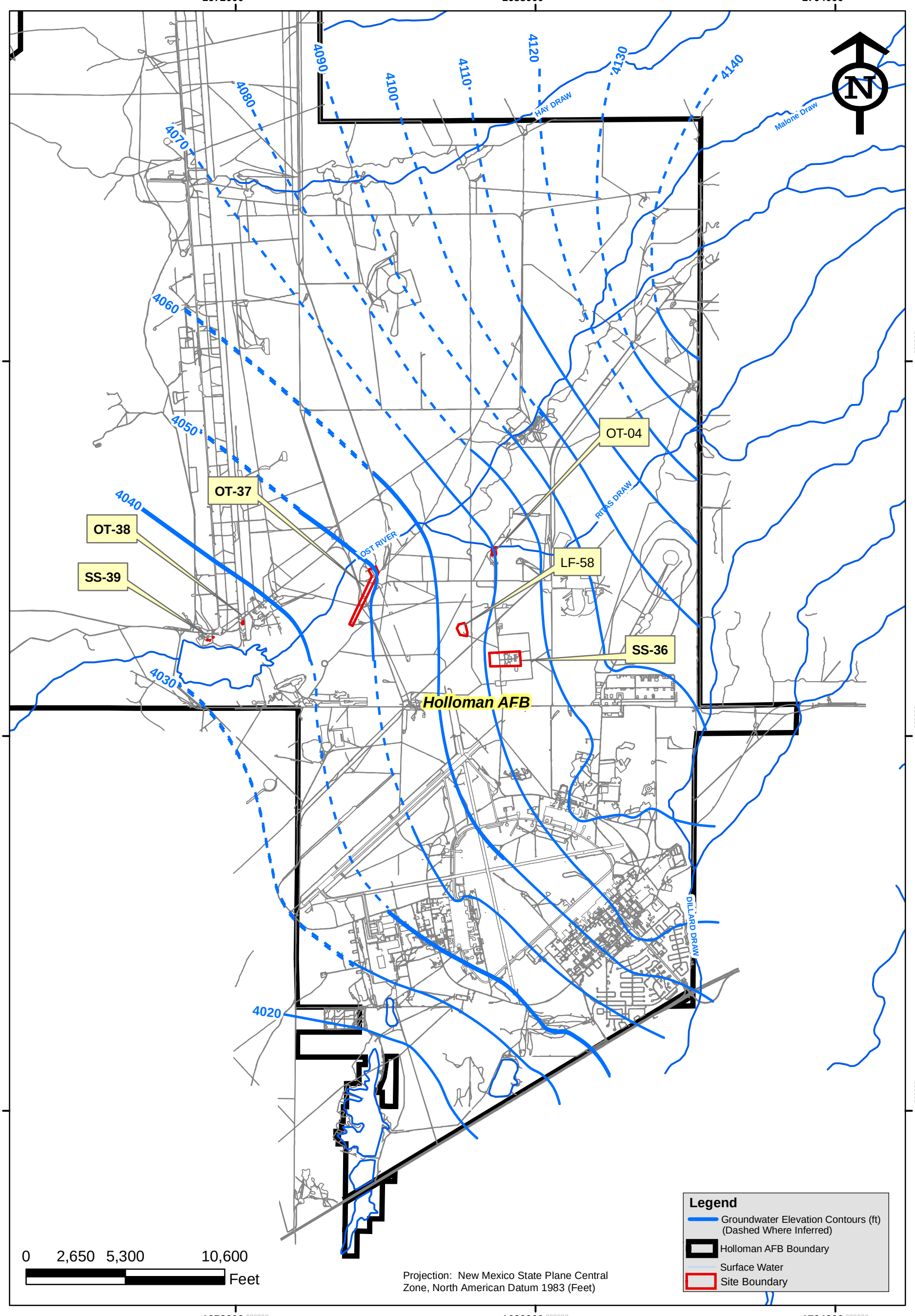
NATIONVIEW

Soil Map
Holloman AFB, New Mexico

PROJECT NO.	SCALE	DATE	DRAWN BY:
11-0017	Shown	9/29/11	cm
			DRAWING NO: fig 2-1

Nitrate Characterization Study Work Plan
Holloman AFB, New Mexico

Figure 2-1



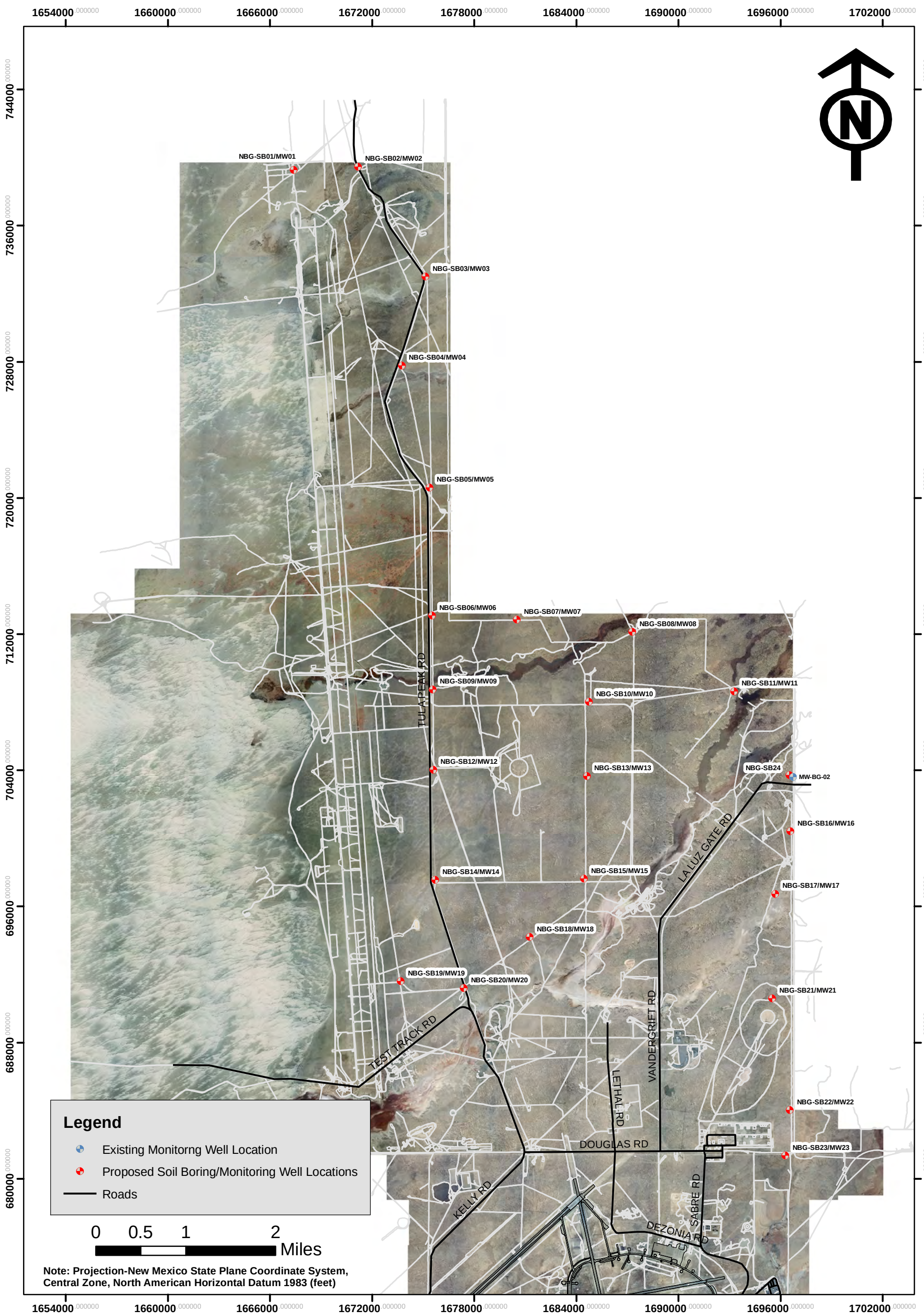
NATIONVIEW

Groundwater Contour Map
Holloman AFB

Nitrate Characterization Study Work Plan
Holloman AFB, New Mexico

Figure 2-2

PROJECT NO.	SCALE	DATE	DRAWN BY:
11-0017	1"=5000'	9/29/11	cm
			DRAWING NO: figure 2-2



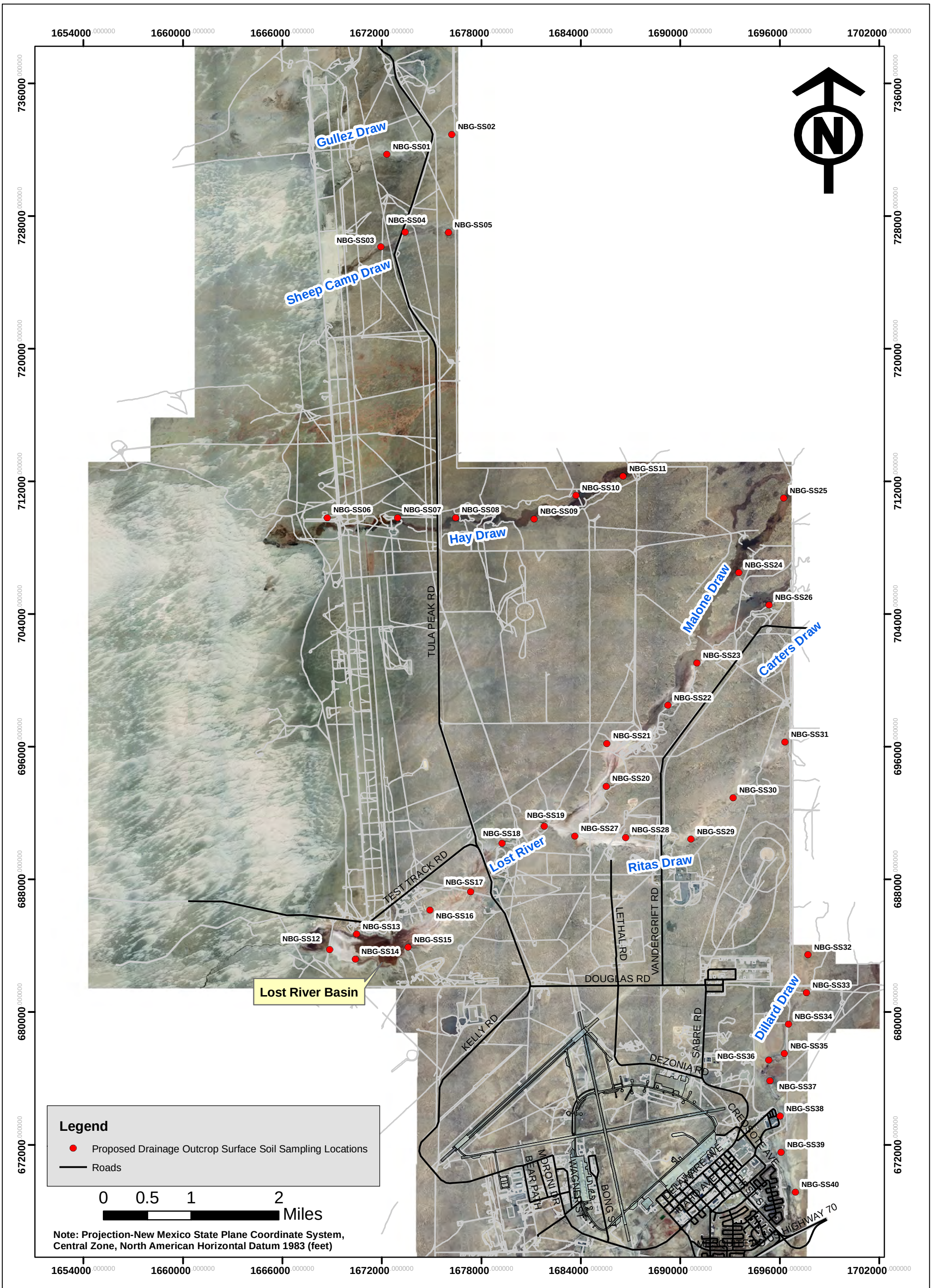
NATIONVIEW

Proposed Soil and Groundwater Sampling Locations, Nitrate Background Study

PROJECT NO.	SCALE	DATE	DRAWN BY:
11-0017	Shown	9/27/11	cm
			DRAWING NO: Figure 4-1

Nitrate Characterization Study Work Plan
Holloman AFB, New Mexico

Figure 4-1



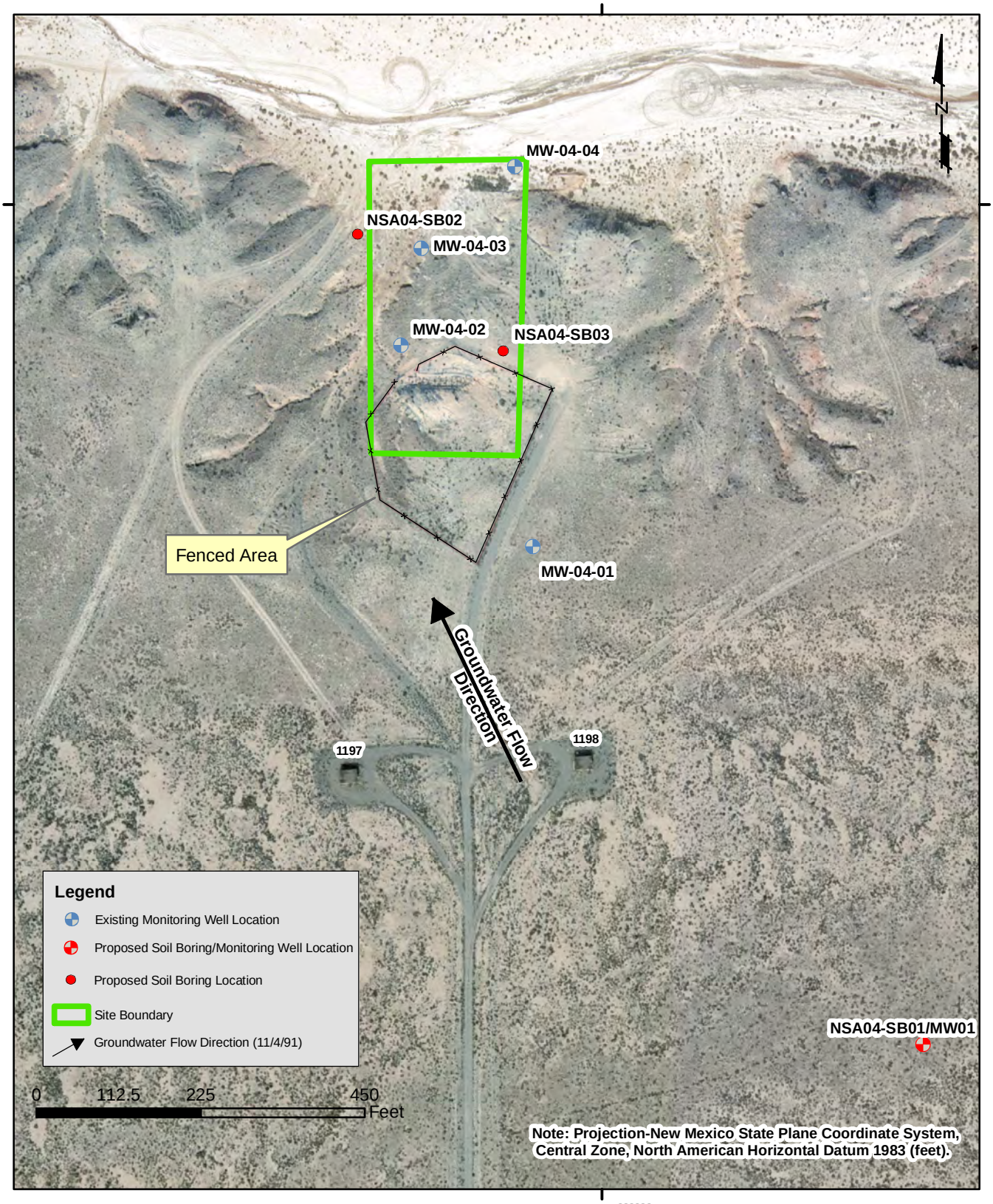
NATIONVIEW

Proposed Drainage Outcrop Surface Soil Sampling Locations Nitrate Background Study

PROJECT NO.	SCALE	DATE	DRAWN BY:
11-0017	Shown	9/27/11	cm
			DRAWING NO: Figure 4-2

Nitrate Characterization Study Work Plan
Holloman AFB, New Mexico

Figure 4-2



NATIONVIEW

OT-04 Acid Trailer Burial Site
Proposed Soil and Groundwater
Sampling Locations,
Nitrate Source Area Investigation

PROJECT NO.	SCALE	DATE	DRAWN BY: cm
11-0017	1"=175'	1/2/12	DRAWING NO: Figure 4-3

Nitrate Characterization Study Work Plan
Holloman AFB, New Mexico

Figure 4-3

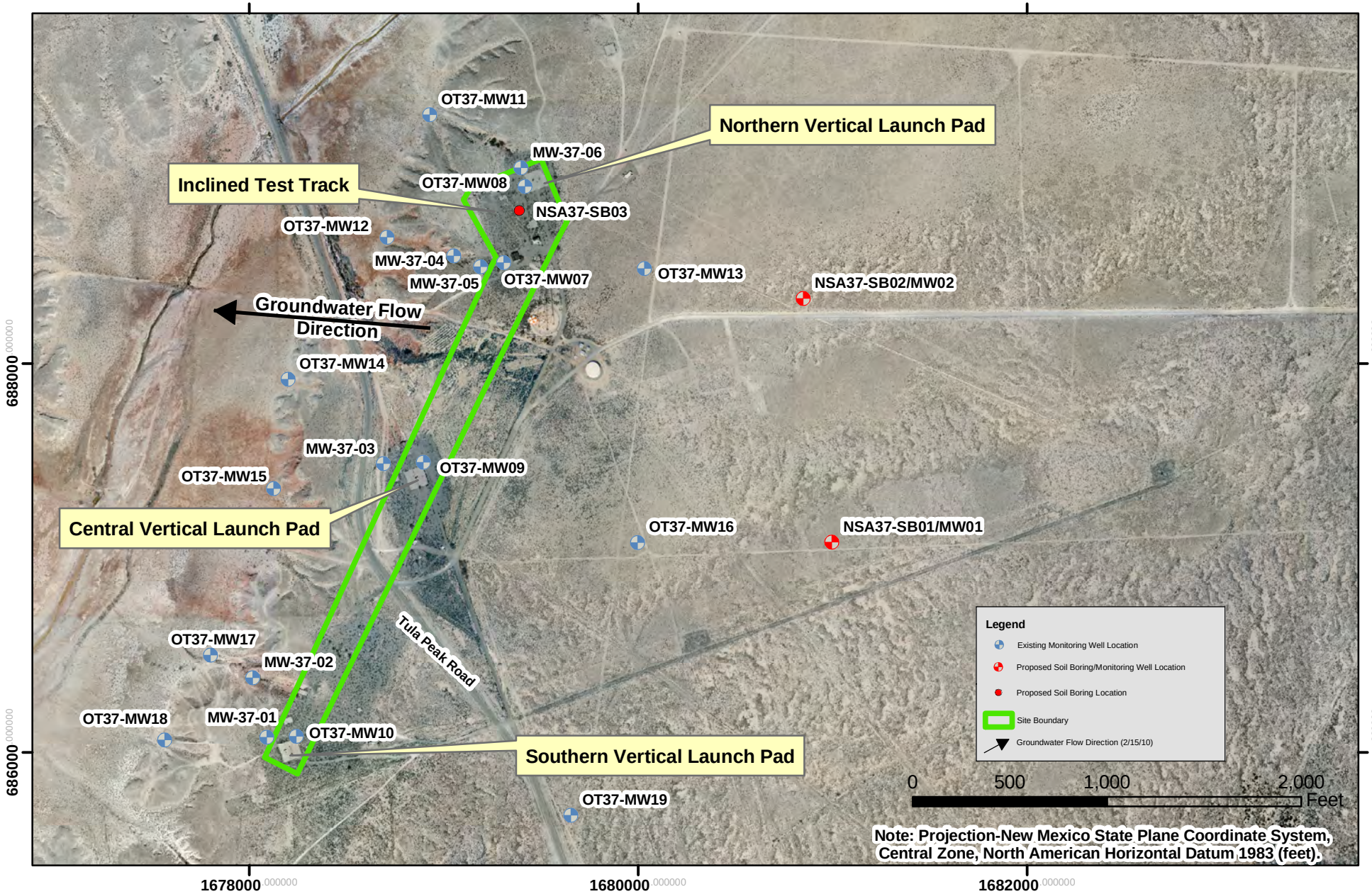
NATIONVIEW

SS-36 Unconventional Fuels Area Spill Site
Proposed Soil and Groundwater
Sampling Locations,
Nitrate Source Area Investigation

PROJECT NO.	SCALE	DATE	DRAWN BY: cm
11-0017	1"=500'	1/2/12	DRAWING NO: Figure 4-4

Nitrate Characterization Study Work Plan
Holloman AFB, New Mexico

Figure 4-4



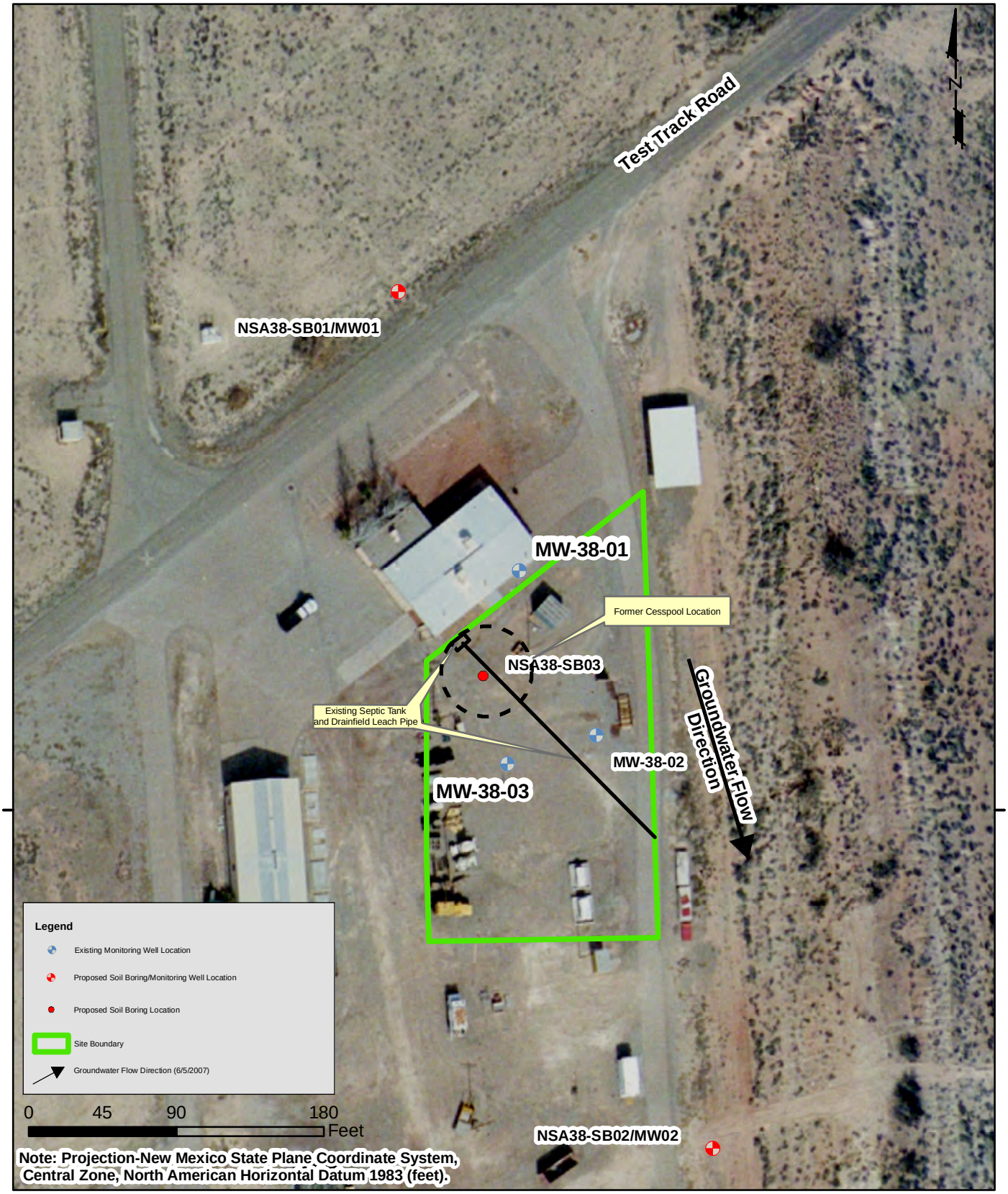
NATIONVIEW

OT-37 Early Missile Test Site
Proposed Soil and Groundwater Sampling Locations,
Nitrate Source Area Investigation

PROJECT NO.	SCALE	DATE	DRAWN BY:
11-0017	1"=700'	9/22/11	cm
			DRAWING NO: Figure 4-5

Nitrate Characterization Study Work Plan
Holloman AFB, New Mexico

Figure 4-5



NATIONVIEW

OT-38 Test Sled Maintenance Area
Proposed Soil and Groundwater
Sampling Locations,
Nitrate Source Area Investigation

PROJECT NO.	SCALE	DATE	DRAWN BY: cm
11-0017	1"=80'	12/9/11	DRAWING NO: Figure 4-6

Nitrate Characterization Study Work Plan
Holloman AFB, New Mexico

Figure 4-6

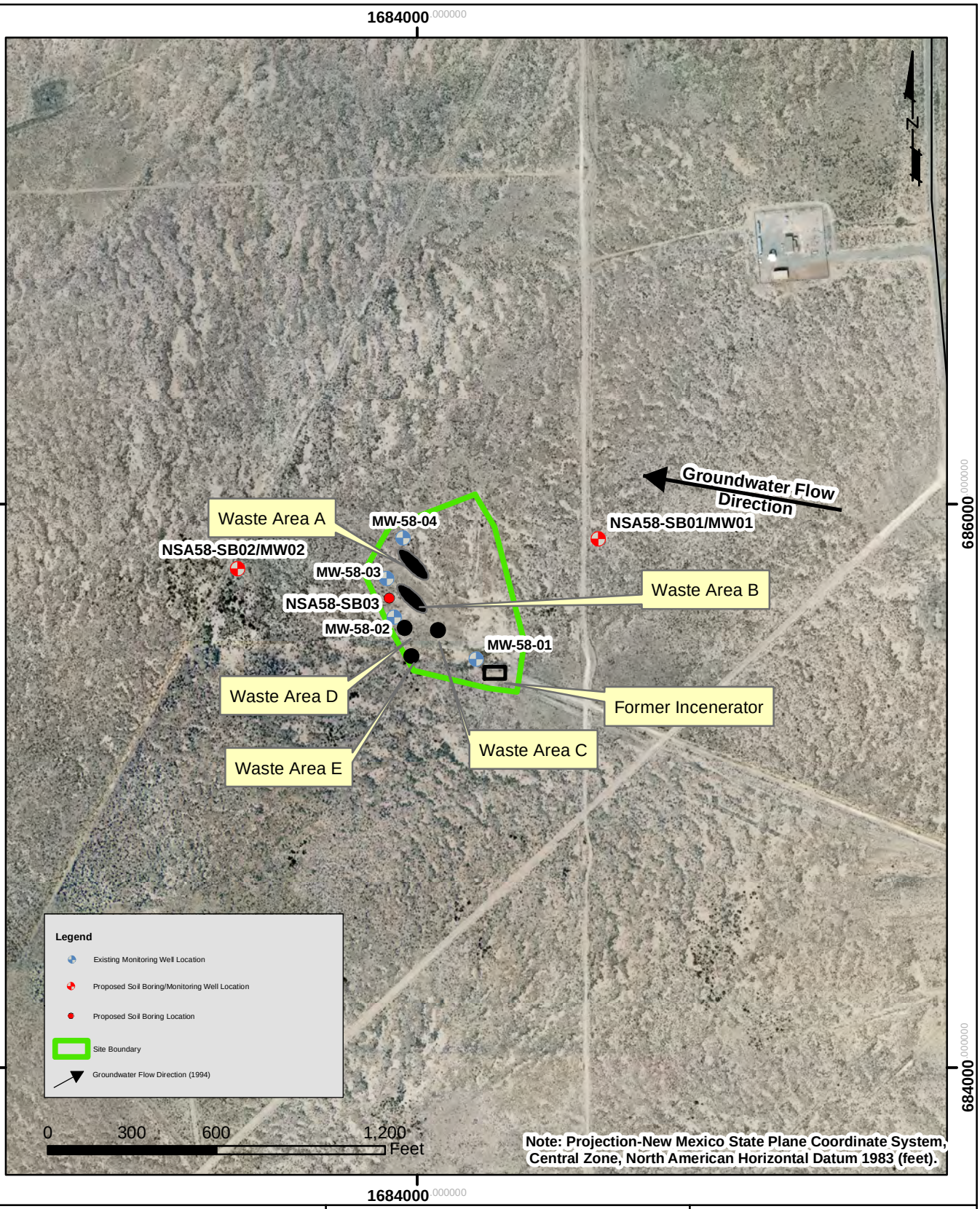
NATIONVIEW

SS-39 Missile Spill Area
Proposed Soil and Groundwater
Sampling Locations,
Nitrate Source Area Investigaiton

PROJECT NO.	SCALE	DATE	DRAWN BY: cm
11-0017	1"=250'	1/2/12	DRAWING NO: Figure 4-7

Nitrate Characterization Study Work Plan
Holloman AFB, New Mexico

Figure 4-7



NATIONVIEW

LF-58 Incinerator Landfill
Proposed Soil and Groundwater Sampling Locations,
Nitrate Source Area Investigation

PROJECT NO.	SCALE	DATE	DRAWN BY: cm
11-0017	1"=200'	1/2/12	DRAWING NO: Figure 4-8

Nitrate Characterization Study Work Plan
Holloman AFB, New Mexico

Figure 4-8

TABLES

Table 1-1
OT-04 Historical Nitrate Groundwater Analytical Data
Nitrate Characterization Study Work Plan
Holloman AFB, New Mexico
NationView Project No. 11-0017

Monitoring Well Identification:	**Groundwater Screening Levels**		**MW-04-01 [3]**	**MW-04-01 [4]**	**MW-04-02 [3]**	**MW-04-03 [3]**	**MW-04-04 [3]**
Sample Identification:	**NMWQCC[1]**	**USEPA MCL [2]**	**04-01-01**	**MW-04-01**	**04-02-01**	**04-03-01**	**04-04-01**
Year Sampled:			**1991**	**2008**	**1991**	**1991**	**1991**
Analyte			**Result**	**Result**	**Result**	**Result**	**Result**
	mg/L	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**
Nitrate-Nitrite (USEPA 353.1)	10	10	**23**	NS	**46**	9.4	4.5
Nitrate (USEPA 353.2)	10	10	NS	**17**	NS	NS	NS

Notes:
NMWQCC = New Mexico Water Quality Control Commission
USEPA = United States Environmental Protection Agency
MCL = Maximum Contaminant Level
mg/L = milligrams per liter
NS = Not Sampled
[1] Standards for Groundwater, if 10,000 mg/L Total Dissolved Solids (TDS) Concentration or Less, New Mexico Administrative Code 20.6.2.3103
[2] USEPA National Primary Drinking Water Regulations MCLs (816-F-09-004, May 2009)
[3] Remedial Investigation, Study and Recommendation for 29 Waste Sites, Radian 1992
[4] Basewide Background Study, Holloman Air Force Base, New Mexico (NationView/Bhate JV III, 2011)
Bold value indicates analytes above the New Mexico Groundwater Quality Standard or the USEPA MCL

Table 1-2
SS-36 Historical Nitrate Groundwater Analytical Data
Nitrate Characterization Study Work Plan
Holloman AFB, New Mexico
NationView Project No. 11-0017

Monitoring Well Identification:	**Groundwater Screening Levels**		**MW-36-01 [3]**	**MW-36-02 [3]**	**MW-36-03 [3]**	**MW-36-04 [3]**	**MW-36-05 [3]**
Sample Identification:	**NMWQCC[1]**	**USEPA MCL [2]**	**36-01-01**	**36-02-01**	**36-03-01**	**36-04-01**	**36-05-01**
Year Sampled:			**1991**	**1991**	**1991**	**1991**	**1991**
Analyte			**Result**	**Result**	**Result**	**Result**	**Result**
	mg/L	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**
Nitrate-Nitrite (USEPA 353.1)	10	10	**32**	**29**	**68**	**97**	**59**
Nitrate (USEPA 353.2)	10	10	NS	NS	NS	NS	NS

Notes:
NMWQCC = New Mexico Water Quality Control Commission
USEPA = United States Environmental Protection Agency
MCL = Maximum Contaminant Level
mg/L = milligrams per liter
NS = Not Sampled
TDS = Total Dissolved Solids

[1] Standards for Groundwater, if 10,000 mg/L TDS Concentration or Less, New Mexico Administrative Code 20.6.2.3103
[2] USEPA National Primary Drinking Water Regulations MCLs (816-F-09-004, May 2009)
[3] Remedial Investigation, Study and Recommendation for 29 Waste Sites, Radian 1992
[4] Phase I RCRA Facility Investigation, Table 2 Solid Waste Management Units, Radian 1994
Bold value indicates analytes above the New Mexico Groundwater Quality Standard or the USEPA MCL

Table 1-2
SS-36 Historical Nitrate Groundwater Analytical Data
Nitrate Characterization Study Work Plan
Holloman AFB, New Mexico
NationView Project No. 11-0017

Monitoring Well Identification:	**Groundwater Screening Levels**		**129-MW01 [4]**	**129-MW02 [4]**	**129-MW03 [4]**	**129-MW04 [4]**
Sample Identification:	**NMWQCC[1]**	**USEPA MCL [2]**	**129-MW01-01-01**	**129-MW02-01-01**	**129-MW03-01-01**	**129-MW04-01-01**
Year Sampled:			**1993**	**1993**	**1993**	**1993**
Analyte			**Result**	**Result**	**Result**	**Result**
	mg/L	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**
Nitrate-Nitrite (USEPA 353.1)	10	10	**31.9**	**3.7**	**29.2**	**0.345**
Nitrate (USEPA 353.2)	10	10	NS	NS	NS	NS

Notes:
NMWQCC = New Mexico Water Quality Control Commission
USEPA = United States Environmental Protection Agency
MCL = Maximum Contaminant Level
mg/L = milligrams per liter
NS = Not Sampled
TDS = Total Dissolved Solids

[1] Standards for Groundwater, if 10,000 mg/L TDS Concentration or Less, New Mexico Administrative Code 20.6.2.3103
[2] USEPA National Primary Drinking Water Regulations MCLs (816-F-09-004, May 2009)
[3] Remedial Investigation, Study and Recommendation for 29 Waste Sites, Radian 1992
[4] Phase I RCRA Facility Investigation, Table 2 Solid Waste Management Units, Radian 1994
Bold value indicates analytes above the New Mexico Groundwater Quality Standard or the USEPA MCL

Table 1-3
OT-37 Historical Nitrate Groundwater Analytical Data
Nitrate Characterization Study Work Plan
Holloman AFB, New Mexico
NationView Project No. 11-0017

Monitoring Well Identification:	**Groundwater Screening Levels**		**MW-37-01** [3]	**MW-37-01** [5]	**MW-37-01** [5]	**MW-37-02** [3]	**MW-37-03** [3]	**MW-37-03** [5]	**MW-37-04** [3]
Sample Identification:	**NMWQCC**[1]	**USEPA MCL** [2]	**37-01-01**	**OT37-MW01**	**OT37-MW01-A**	**37-02-01**	**37-03-01**	**OT37-MW03**	**37-04-01**
Year Sampled:			**1991**	**2010**	**2010**	**1991**	**1991**	**2010**	**1991**
Analyte			**Result**	**Result**	**Result**	**Result**	**Result**	**Result**	**Result**
	mg/L	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**
Nitrate-Nitrite (USEPA 353.1)	10	10	**48**	NS	NS	**66**	**48**	NS	**75**
Nitrate (USEPA 353.2)	10	10	NS	NS	NS	NS	NS	NS	NS
Nitrogen, Nitrate (USEPA 9056)	10	10	NS	**42**	**54.2**	NS	NS	**19.1**	NS

Notes:

NMWQCC = New Mexico Water Quality Control Commission
USEPA = United States Environmental Protection Agency
MCL = Maximum Contaminant Level
mg/L = milligrams per liter
NS = Not Sampled
TDS = Total Dissolved Solids

[1] Standards for Groundwater, if 10,000 mg/L TDS Concentration or Less, New Mexico Administrative Code 20.6.2.3103
[2] USEPA National Primary Drinking Water Regulations MCLs (816-F-09-004, May 2009)
[3] Remedial Investigation, Study and Recommendation for 29 Waste Sites, Radian 1992
[4] Basewide Background Study, Holloman Air Force Base, New Mexico (NationView/Bhate JV III, 2011)
[5] OT-37 Accelerated Corrective Measures Addendum Investigation (NationView, 2010)
Bold value indicates analytes above the New Mexico Groundwater Quality Standard or the USEPA MCL

Table 1-3
OT-37 Historical Nitrate Groundwater Analytical Data
Nitrate Characterization Study Work Plan
Holloman AFB, New Mexico
NationView Project No. 11-0017

Monitoring Well Identification:	**Groundwater Screening Levels**		**MW-37-04 [5]**	**MW-37-05 [3]**	**MW-37-05 [5]**	**MW-37-06 [3]**	**MW-37-06 [4]**	**MW-37-06 [5]**	**MW-37-06 [5]**
Sample Identification:	**NMWQCC[1]**	**USEPA MCL [2]**	**OT37-MW04**	**37-05-01**	**OT37-MW05**	**37-06-01**	**MW-37-06**	**OT37-MW06**	**OT37-MW06-A**
Year Sampled:			**2010**	**1991**	**2010**	**1991**	**2008**	**2010**	**2010**
Analyte			**Result**	**Result**	**Result**	**Result**	**Result**	**Result**	**Result**
	mg/L	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**
Nitrate-Nitrite (USEPA 353.1)	10	10	NS	**75**	NS	**74**	NS	NS	NS
Nitrate (USEPA 353.2)	10	10	NS	NS	NS	NS	**42**	NS	NS
Nitrogen, Nitrate (USEPA 9056)	10	10	**43.8**	NS	**25.7**	NS	NS	**37.1**	**36**

Notes:

NMWQCC = New Mexico Water Quality Control Commission
USEPA = United States Environmental Protection Agency
MCL = Maximum Contaminant Level
mg/L = milligrams per liter
NS = Not Sampled
TDS = Total Dissolved Solids

[1] Standards for Groundwater, if 10,000 mg/l TDS Concentration or Less, New Mexico Administrative Code 20.6.2.3103
[2] USEPA National Primary Drinking Water Regulations MCLs (816-F-09-004, May 2009)
[3] Remedial Investigation, Study and Recommendation for 29 Waste Sites, Radian 1992.
[4] Basewide Background Study, Holloman Air Force Base, New Mexico (NationView/Bhate JV III, 2011)
[5] OT-37 Accelerated Corrective Measures Addendum Investigation (NationView, 2010)
Bold value indicates analytes above the New Mexico Groundwater Quality Standards or the USEPA MCLs

Table 1-3
OT-37 Historical Nitrate Groundwater Analytical Data
Nitrate Characterization Study Work Plan
Holloman AFB, New Mexico
NationView Project No. 11-0017

Monitoring Well Identification:	**Groundwater Screening Levels**		**OT37-MW07 [5]**	**OT37-MW08 [5]**	**OT37-MW09 [5]**	**OT37-MW10 [5]**	**OT37-MW11 [5]**	**OT37-MW12 [5]**	**OT37-MW13 [5]**
Sample Identification:	**NMWQCC[1]**	**USEPA MCL [2]**	**OT37-MW07**	**OT37-MW08**	**OT37-MW09**	**OT37-MW10**	**OT37-MW11**	**OT37-MW12**	**OT37-MW13**
Year Sampled:			**2010**	**2010**	**2010**	**2010**	**2010**	**2010**	**2010**
Analyte			**Result**	**Result**	**Result**	**Result**	**Result**	**Result**	**Result**
	mg/L	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**
Nitrate-Nitrite (USEPA 353.1)	10	10	NS	NS	NS	NS	NS	NS	NS
Nitrate (USEPA 353.2)	10	10	NS	NS	NS	NS	NS	NS	NS
Nitrogen, Nitrate (USEPA 9056)	10	10	**16.8**	**36.5**	**12.8**	**62.1**	**47.1**	**74.7**	**22.1**

Notes:

NMWQCC = New Mexico Water Quality Control Commission
USEPA = United States Environmental Protection Agency
MCL = Maximum Contaminant Level
mg/L = milligrams per liter
NS = Not Sampled
TDS = Total Dissolved Solids

[1] Standards for Groundwater, if 10,000 mg/L TDS Concentration or Less, New Mexico Administrative Code 20.6.2.3103
[2] USEPA National Primary Drinking Water Regulations MCLs (816-F-09-004, May 2009)
[3] Remedial Investigation, Study and Recommendation for 29 Waste Sites, Radian 1992
[4] Basewide Background Study, Holloman Air Force Base, New Mexico (NationView/Bhate JV III, 2011)
[5] OT-37 Accelerated Corrective Measures Addendum Investigation (NationView, 2010)
Bold value indicates analytes above the New Mexico Groundwater Quality Standards or the USEPA MCLs

Table 1-3
OT-37 Historical Nitrate Groundwater Analytical Data
Nitrate Characterization Study Work Plan
Holloman AFB, New Mexico
NationView Project No. 11-0017

Monitoring Well Identification:	**Groundwater Screening Levels**		**OT37-MW14 [5]**	**OT37-MW15 [5]**	**OT37-MW16 [5]**	**OT37-MW17 [5]**	**OT37-MW18 [5]**	**OT37-MW19 [5]**
Sample Identification:	**NMWQCC[1]**	**USEPA MCL [2]**	**OT37-MW14**	**OT37-MW15**	**OT37-MW16**	**OT37-MW17**	**OT37-MW18**	**OT37-MW19**
Year Sampled:			**2010**	**2010**	**2010**	**2010**	**2010**	**2010**
Analyte			**Result**	**Result**	**Result**	**Result**	**Result**	**Result**
	mg/L	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**
Nitrate-Nitrite (USEPA 353.1)	10	10	NS	NS	NS	NS	NS	NS
Nitrate (USEPA 353.2)	10	10	NS	NS	NS	NS	NS	NS
Nitrogen, Nitrate (USEPA 9056)	10	10	**24.3**	**72.8**	**143**	**50.7**	**26.7**	5.6

Notes:

NMWQCC = New Mexico Water Quality Control Commission
USEPA = United States Environmental Protection Agency
MCL = Maximum Contaminant Level
mg/L = milligrams per liter
NS = Not Sampled
TDS = Total Dissolved Solids

[1] Standards for Groundwater, if 10,000 mg/L TDS Concentration or Less, New Mexico Administrative Code 20.6.2.3103
[2] USEPA National Primary Drinking Water Regulations MCLs (816-F-09-004, May 2009)
[3] Remedial Investigation, Study and Recommendation for 29 Waste Sites, Radian 1992
[4] Basewide Background Study, Holloman Air Force Base, New Mexico (NationView/Bhate JV III, 2011)
[5] OT-37 Accelerated Corrective Measures Addendum Investigation (NationView, 2010)
Bold value indicates analytes above the New Mexico Groundwater Quality Standards or the USEPA MCLs

Table 1-4
OT-38 Historical Nitrate Groundwater Analytical Data
Nitrate Characterization Study Work Plan
Holloman AFB, New Mexico
NationView Project No. 11-0017

Monitoring Well Identification:	**Groundwater Screening Levels**		**MW-38-01 [3]**	**MW-38-01 [4]**	**MW-38-02 [3]**	**MW-38-03 [3]**
Sample Identification:	**NMWQCC[1]**	**USEPA MCL [2]**	**36-01-01**	**MW-38-01**	**36-02-01**	**36-03-01**
Year Sampled:			**1991**	**2008**	**1991**	**1991**
Analyte			**Result**	**Result**	**Result**	**Result**
	mg/L	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**
Nitrate-Nitrite (USEPA 353.1)	10	10	**110**	NS	**130**	**110**
Nitrate (USEPA 353.2)	10	10	NS	**28**	NS	NS

Notes:
NMWQCC = New Mexico Water Quality Control Commission
USEPA = United States Environmental Protection Agency
MCL = Maximum Contaminant Level
mg/L = milligrams per liter
NS = Not Sampled
TDS = Total Dissolved Solids
[1] Standards for Groundwater, if 10,000 mg/L TDS Concentration or Less, New Mexico Administrative Code 20.6.2.3103
[2] USEPA National Primary Drinking Water Regulations MCLs (816-F-09-004, May 2009)
[3] Remedial Investigation, Study and Recommendation for 29 Waste Sites, Radian 1992
[4] Basewide Background Study, Holloman Air Force Base, New Mexico (NationView/Bhate JV III, 2011)
Bold value indicates analytes above the New Mexico Groundwater Quality Standard or the USEPA MCL

Table 1-5
SS-39 Historical Nitrate Groundwater Analytical Data
Nitrate Characterization Study Work Plan
Holloman AFB, New Mexico
NationView Project No. 11-0017

Monitoring Well Identification:	**Groundwater Screening Levels**		**MW-39-01** [3]	**MW-39-02** [3]	**MW-39-03** [3]	**MW-39-03** [4]	**MW-39-04** [3]
Sample Identification:	**NMWQCC**[1]	**USEPA MCL** [2]	**39-01-01**	**39-02-01**	**39-03-01**	**179-MW3903**	**39-04-01**
Year Sampled:			**1991**	**1991**	**1991**	**2008**	**1991**
Analyte			**Result**	**Result**	**Result**	**Result**	**Result**
	mg/L	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**
Nitrate-Nitrite (USEPA 353.1)	10	10	**48**	**87**	**49**	NS	0.52
Nitrate (USEPA 353.2)	10	10	NS	NS	NS	**31**	NS

Notes:
NMWQCC = New Mexico Water Quality Control Commission
USEPA = United States Environmental Protection Agency
MCL = Maximum Contaminant Level
mg/L = milligrams per liter
NS = Not Sampled
TDS = Total Dissolved Solids
[1] Standards for Groundwater, if 10,000 mg/L TDS Concentration or Less, New Mexico Administrative Code 20.6.2.3103
[2] USEPA National Primary Drinking Water Regulations MCLs (816-F-09-004, May 2009)
[3] Remedial Investigation, Study and Recommendation for 29 Waste Sites, Radian 1992
[4] Basewide Background Study, Holloman Air Force Base, New Mexico (NationView/Bhate JV III, 2011)
Bold value indicates analytes above the New Mexico Groundwater Quality Standard or the USEPA MCL

Table 1-6
LF-58 Historical Nitrate Groundwater Analytical Data
Nitrate Characterization Study Work Plan
Holloman AFB, New Mexico
NationView Project No. 11-0017

Monitoring Well Identification:	**Groundwater Screening Levels**		**MW-58-03** [3]
Sample Identification:	**NMWQCC**[1]	**USEPA MCL** [2]	**MW-58-03**
Year Sampled:			**2008**
Analyte			**Result**
	mg/L	**mg/L**	**mg/L**
Nitrate (USEPA 353.2)	10	10	**56**

Notes:
NMWQCC = New Mexico Water Quality Control Commission
USEPA = United States Environmental Protection Agency
MCL = Maximum Contaminant Level
mg/L = milligrams per liter
[1] Standards for Groundwater, if 10,000 mg/L Total Dissolved Solids (TDS) Concentration or Less, New Mexico Administrative Code 20.6.2.3103
[2] USEPA National Primary Drinking Water Regulations MCLs (816-F-09-004, May 2009)
[3] Basewide Background Study, Holloman Air Force Base, New Mexico (NationView/Bhate JV III, 2011)
Bold value indicates analytes above the New Mexico Groundwater Quality Standards or the USEPA MCLs

Table 4-1
Soil Sampling and Analysis Nitrate Background Study
Nitrate Characterization Study Work Plan
Holloman AFB, New Mexico
NationView Project No. 11-0017

Soil Boring Identification Number	Number of Samples Per Boring [1]	Nitrate (USEPA Method 300/9056)	Nitrite (USEPA Method 300/9056)	TKN (USEPA Method 351.2)	Ammonia (USEPA Method 350.1)
NBG-SB01	3	3	3	3	3
NBG-SB02	3	3	3	3	3
NBG-SB03	3	3	3	3	3
NBG-SB04	3	3	3	3	3
NBG-SB05	3	3	3	3	3
NBG-SB06	3	3	3	3	3
NBG-SB07	3	3	3	3	3
NBG-SB08	3	3	3	3	3
NBG-SB09	3	3	3	3	3
NBG-SB10	3	3	3	3	3
NBG-SB11	3	3	3	3	3
NBG-SB12	3	3	3	3	3
NBG-SB13	3	3	3	3	3
NBG-SB14	3	3	3	3	3
NBG-SB15	3	3	3	3	3
NBG-SB16	3	3	3	3	3
NBG-SB17	3	3	3	3	3
NBG-SB18	3	3	3	3	3
NBG-SB19	3	3	3	3	3
NBG-SB20	3	3	3	3	3
NBG-SB21	3	3	3	3	3
NBG-SB22	3	3	3	3	3
NBG-SB23	3	3	3	3	3
NBG-SB24	3	3	3	3	3
Subtotal	72	72	72	72	72
Quality Assurance/ Quality Control Samples Required					
Field Duplicates	NA	8	8	8	8
Matrix Spike (MS)	NA	4	4	4	4
Matrix Spike Duplicate (MSD)	NA	4	4	4	4
Rinsate Blanks	NA	4	4	4	4
Total Number of Samples	**NA**	**92**	**92**	**92**	**92**

Notes:
USEPA = U.S. Environmental Protection Agency
TKN = Total Kjeldahl Nitrogen
NBG = Nitrate Background
SB = Soil Boring
NA = Not applicable
[1] Three soil samples will be collected from each boring. One surface soil sample will be collected from a depth of 0 to 6 inches below ground surface (bgs). The second soil sample will be collected mid point between the surface sample and the water table (saturated zone). And the third soil sample will be collected from the capillary fringe interface just above the saturated zone.

Table 4-2
Drainage Outcrop Surface Soil Sampling and Analysis Nitrate Background Study
Nitrate Characterization Study Work Plan
Holloman AFB, New Mexico
NationView Project No. 11-0017

Surface Soil Identification Number	Number of Samples Per Location[1]	Nitrate (USEPA Method 300/9056)	Nitrite (USEPA Method 300/9056)	TKN (USEPA Method 351.2)	Ammonia (USEPA Method 350.1)
NBG-SS01	1	1	1	1	1
NBG-SS02	1	1	1	1	1
NBG-SS03	1	1	1	1	1
NBG-SS04	1	1	1	1	1
NBG-SS05	1	1	1	1	1
NBG-SS06	1	1	1	1	1
NBG-SS07	1	1	1	1	1
NBG-SS08	1	1	1	1	1
NBG-SS09	1	1	1	1	1
NBG-SS10	1	1	1	1	1
NBG-SS11	1	1	1	1	1
NBG-SS12	1	1	1	1	1
NBG-SS13	1	1	1	1	1
NBG-SS14	1	1	1	1	1
NBG-SS15	1	1	1	1	1
NBG-SS16	1	1	1	1	1
NBG-SS17	1	1	1	1	1
NBG-SS18	1	1	1	1	1
NBG-SS19	1	1	1	1	1
NBG-SS20	1	1	1	1	1
NBG-SS21	1	1	1	1	1
NBG-SS22	1	1	1	1	1
NBG-SS23	1	1	1	1	1
NBG-SS24	1	1	1	1	1
NBG-SS25	1	1	1	1	1
NBG-SS26	1	1	1	1	1
NBG-SS27	1	1	1	1	1
NBG-SS28	1	1	1	1	1
NBG-SS29	1	1	1	1	1
NBG-SS30	1	1	1	1	1
NBG-SS31	1	1	1	1	1
NBG-SS32	1	1	1	1	1
NBG-SS33	1	1	1	1	1
NBG-SS34	1	1	1	1	1
NBG-SS35	1	1	1	1	1
NBG-SS36	1	1	1	1	1
NBG-SS37	1	1	1	1	1
NBG-SS38	1	1	1	1	1
NBG-SS39	1	1	1	1	1
NBG-SS40	1	1	1	1	1
Subtotal	40	40	40	40	40
Quality Assurance/ Quality Control Samples Required					
Field Duplicates	NA	4	4	4	4
Matrix Spike (MS)	NA	2	2	2	2
Matrix Spike Duplicate (MSD)	NA	2	2	2	2
Total Number of Samples	**NA**	**48**	**48**	**48**	**48**

Notes:
USEPA = U.S. Environmental Protection Agency
TKN = Total Kjeldahl Nitrogen
NBG = Nitrate Background
SS = Surface Soil (Sample)
NA = Not Applicable
[1] Surface soil samples will be collected from a depth of 0 to 6 inches below ground surface

Table 4-3
Soil Sampling and Analysis Nitrate Source Area Investigation
Nitrate Characterization Study Work Plan
Holloman AFB, New Mexico
NationView Project No. 11-0017

ERP Site Name	Soil Boring Identification Number	Number of Samples Per Boring[2]	Nitrate (USEPA Method 300/9056)	Nitrite (USEPA Method 300/9056)	TKN (USEPA Method 351.2)	Ammonia (USEPA Method 350.1)
OT-04 Acid Trailer Burial Site	NSA04-SB01	3	3	3	3	3
	NSA04-SB02	3	3	3	3	3
	NSA04-SB03	3	3	3	3	3
SS-36 Unconventional Fuels Area Spill Site	NSA36-SB01	3	3	3	3	3
	NSA36-SB02	3	3	3	3	3
	NSA36-SB03	3	3	3	3	3
OT-37 Early Missile Test Site	NSA37-SB01	3	3	3	3	3
	NSA37-SB02	3	3	3	3	3
	NSA37-SB03	3	3	3	3	3
OT-38 Test Sled Maintenance Area	NSA38-SB01	3	3	3	3	3
	NSA38-SB02	3	3	3	3	3
	NSA38-SB03	3	3	3	3	3
SS-39 Missile Fuel Spill Area	NSA39-SB01	3	3	3	3	3
	NSA39-SB02	3	3	3	3	3
	NSA39-SB03	3	3	3	3	3
LF-58 Incinerator Landfill	NSA58-SB01	3	3	3	3	3
	NSA58-SB02	3	3	3	3	3
	NSA58-SB03	3	3	3	3	3
	Subtotal	54	54	54	54	54
Quality Assurance/ Quality Control Samples Required						
Field Duplicates [1]		NA	6	6	6	6
Matrix Spike (MS)		NA	3	3	3	3
Matrix Spike Duplicate (MSD)		NA	3	3	3	3
Rinsate Blanks		NA	3	3	3	3
Total Number of Samples		**NA**	**69**	**69**	**69**	**69**

Notes:
USEPA = U.S. Environmental Protection Agency
TKN = Total Kjeldahl Nitrogen
NSA = Nitrate Source Area
SB = Soil Boring
NA = Not Applicable
[1] One Field Duplicate will be collected at each site.
[2] Three soil samples will be collected from each boring. One surface soil sample will be collected from a depth of 0 to 6 inches below ground surface (bgs). The second soil sample will be collected mid point between the surface sample and the water table (saturated zone). And the third soil sample will be collected from the capillary fringe interface just above the saturated zone.

Table 4-4
Sample Containers and Holding Times by Sample Media
Nitrate Charaterization Study Work Plan
Holloman AFB, New Mexico
NationView Project No. 11-0017

Media	Sample Collection Information	Analyte Group (Method)				
		Nitrate (USEPA Method 300/9056)	Nitrite (USEPA Method 300/9056)	TKN (USEPA Method 351.2)	Ammonia (USEPA Method 350.1)	TDS (USEPA SM19 Method 2540C)
Soil	Container Type	8 oz glass jar	8 oz glass jar	8 oz glass jar	8 oz glass jar	NA
	Container Quantity	1 (All soil can be combined into 1 jar)	1 (All soil can be combined into 1 jar)	1 (All soil can be combined into 1 jar)	1 (All soil can be combined into 1 jar)	NA
	Holding Time	28 days	28 days	28 days	28 days	NA
Groundwater	Container Type	125-mL Poly	125-mL Poly	250 mL Poly	250 mL-Poly	500-mL Poly
	Preservative	H_2SO_4	NA	H_2SO_4	H_2SO_4	NA
	Container Quantity	1	1	1 (Can be combined with Ammonia)	1 (Can be combined with TKN)	1
	Holding Time	48 hours	48 hours	28 days	28 days	7 days

Notes:
TKN = Total Kjeldahl Nitrogen
USEPA = U.S. Environmental Protection Agency
SM = Standard Methods for the Examination of Water and Wastewater
TDS = Total Dissolved Solids
H_2SO_4 = Sulfuric Acid
NA = Not Applicable
oz = ounce
mL = milliliter
Poly = Polyethylene

Table 4-5
Groundwater Sampling and Analysis Nitrate Background Study
Nitrate Characterization Study Work plan
Holloman AFB, New Mexico
NationVie Project No. 11-0017

Monitoring Well Identification Number	Number of Samples Per Well	Nitrate (USEPA Method 300/9056)	Nitrite (USEPA Method 300/9056)	TKN (USEPA Method 351.2)	Ammonia (USEPA Method 350.1)	TDS (USEPA SM19 2540C)
NBG-MW01	1	1	1	1	1	1
NBG-MW02	1	1	1	1	1	1
NBG-MW03	1	1	1	1	1	1
NBG-MW04	1	1	1	1	1	1
NBG-MW05	1	1	1	1	1	1
NBG-MW06	1	1	1	1	1	1
NBG-MW07	1	1	1	1	1	1
NBG-MW08	1	1	1	1	1	1
NBG-MW09	1	1	1	1	1	1
NBG-MW10	1	1	1	1	1	1
NBG-MW11	1	1	1	1	1	1
NBG-MW12	1	1	1	1	1	1
NBG-MW13	1	1	1	1	1	1
NBG-MW14	1	1	1	1	1	1
NBG-MW15	1	1	1	1	1	1
NBG-MW16	1	1	1	1	1	1
NBG-MW17	1	1	1	1	1	1
NBG-MW18	1	1	1	1	1	1
NBG-MW19	1	1	1	1	1	1
NBG-MW20	1	1	1	1	1	1
NBG-MW21	1	1	1	1	1	1
NBG-MW22	1	1	1	1	1	1
NBG-MW23	1	1	1	1	1	1
MWBG-02	1	1	1	1	1	1
Subtotal	24	24	24	24	24	24
Quality Assurance/Quality Control Samples Required						
Field Duplicates	NA	3	3	3	3	3
Matrix Spike (MS)	NA	2	2	2	2	2
Matrix Spike Duplicate (MSD)	NA	2	2	2	2	2
Total Number of Samples	**NA**	**31**	**31**	**31**	**31**	**31**

Notes:
USEPA = U.S. Environmental Protection Agency
TKN = Total Kjeldahl Nitrogen
NBG = Nitrate Background
MW = Monitoring Well
NA = Not Applicable
SM = Standard Methods

Table 4-6
Groundwater Sampling and Analysis Nitrate Source Area Investigation
Nitrate Characterization Study Work Plan
Holloman AFB, New Mexico
NationView Project No. 11-0017

ERP Site Name	Monitoring Well Identification Number	Number of Samples Per Well	Nitrate (USEPA Method 300/9056)	Nitrite (USEPA Method 300/9056)	TKN (USEPA Method 351.2)	Ammonia (USEPA Method 350.1)	TDS (USEPA SM19 2540C)
OT-04 Acid Trailer Burial Site (5 wells)	MW-04-01	1	1	1	1	1	1
	MW-04-02	1	1	1	1	1	1
	MW-04-03	1	1	1	1	1	1
	MW-04-04	1	1	1	1	1	1
	NSA04-MW01	1	1	1	1	1	1
SS-36 Unconventional Fuels Area Spill Site (11 wells)	MW-36-01	1	1	1	1	1	1
	MW-36-02	1	1	1	1	1	1
	MW-36-03	1	1	1	1	1	1
	MW-36-04	1	1	1	1	1	1
	MW-36-05	1	1	1	1	1	1
	129-MW01	1	1	1	1	1	1
	129-MW02	1	1	1	1	1	1
	129-MW03	1	1	1	1	1	1
	129-MW04	1	1	1	1	1	1
	NSA36-MW01	1	1	1	1	1	1
	NSA36-MW02	1	1	1	1	1	1
OT-37 Early Missile Test Site (21 wells)	MW-37-01	1	1	1	1	1	1
	MW-37-02	1	1	1	1	1	1
	MW-37-03	1	1	1	1	1	1
	MW-37-04	1	1	1	1	1	1
	MW-37-05	1	1	1	1	1	1
	MW-37-06	1	1	1	1	1	1
	OT37-MW07	1	1	1	1	1	1
	OT37-MW08	1	1	1	1	1	1
	OT37-MW09	1	1	1	1	1	1
	OT37-MW10	1	1	1	1	1	1
	OT37-MW11	1	1	1	1	1	1
	OT37-MW12	1	1	1	1	1	1
	OT37-MW13	1	1	1	1	1	1
	OT37-MW14	1	1	1	1	1	1
	OT37-MW15	1	1	1	1	1	1
	OT37-MW16	1	1	1	1	1	1
	OT37-MW17	1	1	1	1	1	1
	OT37-MW18	1	1	1	1	1	1
	OT37-MW19	1	1	1	1	1	1
	NSA37-MW01	1	1	1	1	1	1
	NSA37-MW02	1	1	1	1	1	1
OT-38 Test Sled Maintenance Area (5 wells)	MW-38-01	1	1	1	1	1	1
	MW-38-02	1	1	1	1	1	1
	MW-38-03	1	1	1	1	1	1
	NSA38-MW01	1	1	1	1	1	1
	NSA38-MW02	1	1	1	1	1	1
SS-39 Missile Fuel Spill Area (14 wells)	MW-39-01	1	1	1	1	1	1
	MW-39-02	1	1	1	1	1	1
	MW-39-03	1	1	1	1	1	1
	MW-39-04	1	1	1	1	1	1
	MW-39-05	1	1	1	1	1	1
	MW-39-06	1	1	1	1	1	1
	MW-39-06D	1	1	1	1	1	1
	MW-39-07	1	1	1	1	1	1
	MW-39-13	1	1	1	1	1	1
	MW-39-14	1	1	1	1	1	1
	MW-39-15	1	1	1	1	1	1
	MW-39-16	1	1	1	1	1	1
	NSA39-MW01	1	1	1	1	1	1
	NSA39-MW02	1	1	1	1	1	1
LF-58 Incinerator Landfill (6 wells)	MW-58-01	1	1	1	1	1	1
	MW-58-02	1	1	1	1	1	1
	MW-58-03	1	1	1	1	1	1
	MW-58-04	1	1	1	1	1	1
	NSA58-MW01	1	1	1	1	1	1
	NSA58-MW02	1	1	1	1	1	1
	Subtotal	62	62	62	62	62	62
Quality Assurance/ Quality Control Samples Required							
Field Duplicates [1]		NA	7	7	7	7	7
Matrix Spike (MS)		NA	4	4	4	4	4
Matrix Spike Duplicate (MSD)		NA	4	4	4	4	4
Total Number of Samples		**NA**	**77**	**77**	**77**	**77**	**77**

Notes:
USEPA = U.S. Environmental Protection Agency
TKN = Total Kjeldahl Nitrogen
TDS = Total Dissolved Solids
NSA = Nitrate Source Area
MW = Monitoring Well
NA = Not Applicable
[1] One field duplicate will be collected from each site.

Table 7-1

Key Personnel and Responsibilities

Nitrate Characterization Study Work Plan
Holloman AFB, New Mexico
NationView Project No. 11-0017

Name	Project Title/Assigned Role	Phone Numbers
Mr. David Martin	Corporate Sponsor	Cell: (205) 908-0731
Mr. Frank Gardner, P.G.	Program Manager	Cell: (303) 386-6454
Mr. Jim Moore, P.G.	Field Team Leader/Sr. Geologist	Cell: (303) 929-4840
Mr. Dustin McNeil, P.G.	Project Geologist	Cell: (303) 895-1963
Mr. Zackary Beck, P.G.	Project Geologist	Cell: (575) 921-1736
Ms. Marcia Olive	Project Chemist	Office: (303) 597-2450
Mr. John Hymer	SSHO/Emergency Task Manager	Cell: (575) 491-9171
Ms. Sally Smith, MHS, CIH, CSP, CPEA, CHMM	Health and Safety Manager	Office: (205) 918-4032 Cell: (205) 983-4150

Notes:
P.G. = Professional Geologist
SSHO = Site Safety and Health Officer
CIH = Certified Industrial Hygienist
CHMM = Certified Hazardous Materials Manager
CSP = Certified Safety Professional
CPEA = Certified Professional Environmental Auditor
MHS = Masters of Health Sciences

ATTACHMENT 1

NMED CORRESPONDENCE

NEW MEXICO ENVIRONMENT DEPARTMENT

Hazardous Waste Bureau

BILL RICHARDSON
Governor

DIANE DENISH
Lieutenant Governor

2905 Rodeo Park Drive East, Building 1
Santa Fe, New Mexico 87505-6303
Phone (505) 476-6000 Fax (505) 476-6030
www.nmenv.state.nm.us

RON CURRY
Secretary

SARAH COTTRELL
Deputy Secretary

CERTIFIED MAIL - RETURN RECEIPT REQUESTED

October 28, 2010

Mr. David Scruggs, Chief
Environmental Restoration Program
49 CES/CEVR
550 Tabosa Ave.
Holloman AFB, NM 88330-8458

SUBJECT: NOTICE OF DISAPPROVAL
BASEWIDE BACKGROUND STUDY REPORT DECEMBER 7, 2009
REVISION
HOLLOMAN AIR FORCE BASE, EPA ID# NM6572124422
HWB-HAFB-09-004

Dear Mr. Scruggs:

The New Mexico Environment Department (NMED) has reviewed the United States Air Force's (Permittee) December 7, 2009, response to the May 4, 2009, Notice of Disapproval (NOD) of the *Basewide Background Study Report* for Holloman Air Force Base (Report).
This NOD is organized into two major parts. Part 1 includes comments that apply to all constituents and media. Part 2 includes additional comments on radiochemical constituents. A compliance schedule follows Part 2. The Permittee must submit a response to each comment of each Part by the deadlines indicated and in accordance with the compliance schedule.

PART 1
COMMENTS ON ALL CONSTITUENTS AND MEDIA

1. Section 5.5 of the subject Report states, in part, "While nitrate and nitrogen are a part of the natural ecosystem at HAFB, the present quantities, distributions, and historical conditions at HAFB are not natural." Additionally, background levels and statistical descriptors for nitrate, nitrite, and ammonia are proposed in Tables 5-5, 5-15, and 5-18.
NMED does not approve the proposed background levels in the Report for nitrate, nitrite, or

ammonia because some of the groundwater samples acquired as part of the background study are contaminated by one or more of these compounds, and thus are not representative of natural conditions. The Permittee is therefore required to conduct an investigation of nitrate and the other nitrogen-bearing compounds in groundwater to establish true and reliable background conditions for them, and to determine the source, extent, and rate of migration of these compounds where they are known or suspected to be a contaminant of anthropogenic origin. The Permittee must submit to the NMED for its review and approval a plan to investigate background conditions and known or suspected sites of contamination with respect to nitrate, nitrite, and ammonia by the deadline indicated in the compliance schedule at the end of this letter. This investigation of nitrate, nitrite, and ammonia will be considered by the NMED as a separate action from the subject background study because of the pressing need to establish background levels for other naturally occurring constituents.

The investigation plan shall include the sampling requirements and statistical methods to be employed for the purpose of establishing background conditions for nitrate, nitrite, and ammonia. The plan shall also provide construction details and the locations and anticipated depths of groundwater monitoring wells to be installed to determine background conditions and the nature and extent of contamination, geology, hydrology, groundwater flow direction and velocity at each site where contamination of the groundwater by nitrate, nitrite, or ammonia is known or suspected to occur. The plan shall also present details on field procedures, sampling and analysis of the groundwater and related quality control, and discuss the historical use of sites that have groundwater contamination to the extent that such use is known. The plan shall also contain a summary of the results to be reported after the investigation phase is completed, and a schedule for implementation of the work, including monitoring.

2. The sixth paragraph of Section 5.6.3 reads: "As required by comment No. 5 in NMED correspondence dated May 4, 2009 (provided in attachment 2 of this report), if 100% of the measurements in the data set are non-detects, then the UTL value was arbitrarily set at the lowest DL in the data set. This practice is not in agreement with current USEPA guidance but was determined to be non-negotiable after significant discussion with NMED. See note below."

According to Tables 5-13 through 5-16 and 5-18, some background levels were set by the Permittee at two times the Method Detection Limit (MDL) (MDL is referred to in the quote from the Report as DL).

The referenced comment (No. 5) does not require that an Upper Tolerance Limit (UTL) be set at the lowest MDL in all cases where 100% of the data are non-detect values, as the Permittee was given the opportunity to justify setting background levels to twice the MDL in such cases. Contrary to the Permittee's assertion, NMED has not rejected setting background levels to twice the MDL where it can be justified. But, as noted previously in the May 4, 2009 NOD, for some constituents all or nearly all samples (more than 100) were found to be less than the MDL. However, NMED continues to believe that it would be difficult to justify setting a background level to two times the MDL when 100% of a large sample population was found to be less than one times the MDL.

The use of data greater than the MDL, but less than the Practical Quantification Limit (PQL), is acceptable for use in a background study. The purpose of the background study is to provide an estimate of background conditions for soil and groundwater at the Facility. Data for any given constituent that are greater than the MDL but less than the PQL indicate that the analyte is present at a high level of confidence, but with respect to accuracy are considered to be estimated values only. However, NMED notes that its data in many cases closely matches facility data, suggesting that the accuracy of these estimated values are likely within an acceptable range. Statistical analyses applied to data sets for establishing background conditions help eliminate bias from exceptionally inaccurate data, provided such data do not make up a considerable majority of the data in a data set.

A PQL is typically five times greater than the MDL. Data at or exceeding the PQL are considered accurate at a high level of confidence. Setting a background level for a data set that consists of all non-detects to twice the MDL, instead of at the MDL, will still result in establishing a background level that is less than the PQL. Another disadvantage of setting a background level to twice the MDL instead of at the MDL is that lower levels of potential contamination could escape recognition. Finally, setting a background level to no more than one times the MDL is conservative with respect to carrying contaminant levels forward into risk assessments.

The NMED will consider any reasoned argument made on a case-by-case basis that values set at two times the MDL in Tables 5-13 through 5-16 and 5-18 should be approved as representative of background levels for the constituents/media involved. Any such argument should consider the above discussion.

3. The note below the sixth paragraph of Section 5.6.3, the subject Report states: "Therefore, the use of the term "UTL" is inappropriate to describe a value arbitrarily set at the DL." While the NMED agrees with this statement, it used the term "UTL" in the May 4, 2009, NOD, to remain consistent with the terminology used in the original version of the Report. Both versions of the Report list and refer to background levels as "UTLs" whether or not they are true UTLs or some other statistic chosen as representative of background levels.

Because the proposed background levels are sometimes UTLs and sometimes other statistical descriptors, the NMED prefers to denote them simply as "background levels." Background levels are the values that will be used for simple comparisons to environmental samples to screen for potential contamination. Ideally, background levels would be UTLs based on a 95% coverage and a 95% confidence level. However, UTLs can not always be calculated for some constituents, especially those with censored data sets.

Although background levels are important as a screening tool, the other statistical descriptors (e.g., mean, standard deviation, ranges) have value. For example, such descriptors may be considered when making a determination that low level contamination is present, but is not obvious, or in comparing verification samples to background conditions after a site remediation is completed.

Re-label the columns in Tables 5-12 to 5-18, as appropriate, to read "background levels" instead of UTLs.

4. The User's Guide for ProUCL was provided in Appendix D. However, it does not appear that any of the input/output files from use of ProUCL were provided in the Report. The Permittee must submit all the input/output files for review.

5. Data Validation Reports: (DVRs) – Several problematic issues were identified in the review of the DVRs. The samples, analyses, and resulting data were the subject of 25 separate nonconformance reports by the laboratory. These primarily document a number of matrix effects. Some of the nonconformance reports are redundant, some were resolved, and some were not resolved. The samples seemed to present significant difficulty for the laboratory; this both complicates the DVRs as well as impacts data quality. A general finding of NMED's review is that the matrix effects and their impact on data usability were not properly identified in the DVR and conveyed to the data users. The DVRs should discuss what steps, such as contacting the laboratory to obtain clarification of the many issues, were applied to obtain resolution of these issues.

Also, the DVRs provide an assessment section which includes the statement: "Overall, the data is suitable for the intended data usage." Typically this type of statement is reserved for a data quality assessment and not included in a DVR. If a DVR is going to include such conclusions, the intended use must be fully described (including data quality objectives (DQOs) and measurement quality objectives (MQOs)), and the data reconciled against those criteria.

Furthermore, on future DVRs, a column titled "Reason for Qualifier" should be added to all the tables currently titled "Summary of Qualified Data." This column should be used to describe why the particular data validation qualifier is being assigned (e.g., due to method blank contamination, LCS recoveries outside acceptable limits) As the DVRs are currently written, it is difficult to tell exactly why a validation qualifier was applied without looking at the raw data package Quality Control forms. Adding this "Reason for Qualifier" column will greatly enhance the clarity of the validation qualifiers for any reviewer or reader, and will significantly reduce the time spent on any technical review of DVRs.

Because of these issues, as well as the more specific data validation issues identified in Part 2 of this letter, the Permittee must submit to the NMED the Permittee's data validation plan for the HAFB Facility. NMED intends to review the plan with the goal of determining if the plan should be revised and improved for future application to assess and validate environmental data.

6. Method Blanks were positive for a number of analytes and samples. A statistical evaluation of significance in accordance with the *Evaluation of Radiochemical Data Usability* (U. S. Department of Energy, April 1997) (ERDU)) to determine flagging status was applied. This procedure is appropriate and adequate. However, it was not possible to determine if the procedure was applied properly from the data supplied as nearly all positive results were already

qualified for being below the reporting limit, and no data qualifier reason codes were provided. Provide clarification of this issue.

7. Section 6 – The Permittee must clarify for each constituent/medium what final distribution was assigned to the data set for the constituent/medium, and if the data set was censored, if Cohen's or some other method was applied to the data set. When ProUCL was used for censored data sets, indicate what specific method under ProUCL was used to calculate the statistical descriptors (such as mean and standard deviation) listed in the Report for each of these data sets.

8. A quality control (QC) review was conducted to verify the accuracy of the data validator's comments and qualifiers documented in the DVRs. For SDG #D8I060136, Method 6010B, Sample BWBG-SB03-30, the results noted on the DVR for total copper and total magnesium do not match the results given in the data package. Clarify and/or correct as needed.

9. Table 5-18 – The April 2009 NMED Soil Screening Levels (SSLs) were applied in the data tables. The SSLs were updated in December 2009. A review against the December 2009 SSLs was conducted. The only difference is the SSL for arsenic, which is now 3.9 milligrams per kilogram (mg/kg). Revise Table 5-18 accordingly.

10. Table 5-18 –The SSL for hexavalent chromium was applied for comparison purposes. However, the analytical results are representative of total chromium. Revise Table 5-18 accordingly.

11. Tables 5-12 through 5-17 – These tables contain transformed data. Revise the tables to list the data in their original form. For example, if the transformed data are the natural logs of the original data, revise and report the data in the tables as the anti-natural logs of the transformed data. Revise the titles in the tables to reflect the changes in data form.

PART 2
ADDITIONAL COMMENTS ON RADIOCHEMICAL CONSTITUENTS

1. In several cases, the laboratory used "truncation" to limit the effect of poor carrier or tracer recovery. A detailed explanation of this procedure describing its effects and supporting references for its use must be provided as part of the validation corrective action process. Provide an explanation that includes details on the extent to which this technique corrects for poor recoveries and the conditions or uncertainties introduced by poor recoveries which are not corrected by truncation. Explain any truncation effects.

2. Matrix spikes (MS) were not reviewed in accordance with the ERDU, which provides for the statistical evaluation of the significance of anomalous MS results. The review standard applied is not clearly stated nor does it appear to conform with the National Functional Guidelines. For instance, in aqueous samples the carbon-14 (C-14) MS was recovered below the lower acceptance limit, and the precision for the MS/MS Duplicate (MSD) pair was also out of

limits. The laboratory notes in non-conformance No. 06-0120707 that the cause is "possible matrix effects" and that no corrective action was taken in the laboratory. Application of the "Test for matrix-induced bias" found at Section 5 E 5 (page 32 of 41) of ERDU for sample SS61-MW01 as part of this review produced a result of 3.6, which under ERDU would result in consideration of the "R" flag. Considering the low recovery of the spike, the failure of the relative percent difference (RPD), and the non-detect status of the associated results, at a minimum the "UJ" data qualifier was required, and the "R" qualifier should, at a minimum, have been discussed and either applied, or a rationale for non-application presented. The DVR indicates that the issue was noted, but states that because the Laboratory Control Sample (LCS) was in control no data qualification was necessary. The normal interpretation of this situation is that the data identify a matrix effect, as the laboratory concluded. Provide additional information to include: 1) a clearly stated and developed MS/MSD review standard; 2) a reassessment of all results associated with an MS or MSD result outside of laboratory limits; and 3) a scientifically defensible rationale for the use of data associated with out of control MS, MSD or RPD.

3. There were several matrix issues noted for lead-210 (Pb-210) aqueous samples. A series of non-conformance reports in the laboratory report indicated that undissolved matter remained in sample preparations and that carrier recoveries were low. The laboratory effected corrective actions by repeating the preparation of the samples using reduced sample volume. For some samples this was effective, and for others the preparations were repeated again using even less sample. The amount of sample used is not documented. In the end, the laboratory indicates that a matrix effect is still present, even after repeat analysis, and that it may be causing a low bias. The laboratory "truncated yields at 100%" to minimize or eliminate the low bias (stated as "minimize" in one non-conformance and as "eliminate" in another non-conformance). The DVR deals with the resulting increase in minimum detectable activity (MDA), but does not address the potential for low bias or the validity and impact of the "truncation" procedure, noting only that "Sample results were corrected for carrier recovery and/or re-extracted and compared to LCS recoveries. Therefore, no qualification was required." Additionally, for some samples, the LCS was out of control as well (high). This is noted properly in the DVR (typically a high bias with non-detect sample results is a valid result), but there is no consideration of the combined impact of multiple data quality indicator failures anywhere in the DVR. Ultimately, no reasonable rationale for acceptance of the data subject to matrix-effect is presented. This situation leaves the question of whether this method is suitable for the subject samples, and whether there are serious issues of laboratory performance that have gone unanswered. Discuss these issues and provide an assessment of their impact on the results and data usability. A scientifically defensible rationale for the use of these data must be presented.

4. Numerous issues affected Pb-210 analysis in soils, resulting in several non-conformance reports with limited corrective action in the laboratory. Affected samples vary, but the following issues were noted:

a. For one sample, BWBG-SB20-40, the LCS was high, and the MS was high. The DVR properly identified this sample and reasonably determined that since bias was high and the sample was a non-detect, no qualification was necessary.

b. For 13 samples, the MS and MSD were low and the laboratory noted, "physical evidence of matrix interference."
c. For 17 samples, the laboratory noted that the carrier recovery was high which could lead to low bias, and "physical evidence of matrix interference" was present. Yields were truncated.
d. For 13 samples the LCS carrier yield was out of limits.

These conditions are noted to some extent in the matrix spike section and the reporting limits section of the DVR, but in each case it was concluded that because the LCS was within limits, no data qualification was necessary. There was no detailed identification of the issues, no consideration of their magnitude, no consideration of the effect of multiple failures on the same samples, and "Physical evidence of matrix interference" was not acknowledged in the DVR. The DVR does not engage in any meaningful evaluation or discussion, and provides no meaningful rationale for acceptance of these data nor were the data assessed in accordance with ERDU. The overall result of the review is that matrix interference was clearly and unambiguously established for this method and matrix, resulting in a low bias for many samples; the DVR failed to account for this problem. Provide a discussion of these issues.

5. Matrix issues were noted for the radium-226 (Ra-226) soil samples. For sample BWBG-SB20-20, repeated efforts at the laboratory resulted in failure of the sample preparation. The laboratory indicated that the sample would not precipitate. This method failure was not mentioned in the DVR. The laboratory reported this as a non-detect. However, no result should have been reported at all. Unless a scientifically defensible rationale for the use of this datum is provided, this result must be qualified "R" and the completeness description and the statistics for Ra-226 in the Report revised.

6. For eight additional soil samples for Ra-226, the carrier recovery was less than the acceptable lower limit, and for six of these samples, yields were truncated. The laboratory concluded that there was "physical evidence of matrix interference." For 18 samples the MS/MSD RPD was out of limits. The DVR notes carrier and RPD conditions and states that because results "were cross referenced with their LCSs" no qualification was required, and that "Sample results were corrected for carrier recovery and/or re-extracted and compared to LCS recoveries. Therefore, no qualification was required." This treatment is not adequate and does not meaningfully address the issues. Provide a more detailed examination of the Ra-226 results with specific description of their handling and specific assessment of the impacts of analytical anomalies on data usability. Provide a scientifically defensible rationale for the use of these Ra-226 results in spite of clear evidence of matrix interference.

7. Ra-228 soil samples experienced similar issues as those noted above for Ra-226 in soil. Six samples exhibited unacceptable carrier recovery; also, yields were truncated. The RPD for the MS/MSD pair was out of limits for 20 samples. The DVR makes no mention of these matters. Re-assess the Ra-228 results and discuss data usability.

8. Two matrix spikes exhibited low recovery affecting 13 samples. The DVR notes this in a very generic and cursory manner: "The MS and/or MSD percent recoveries (%Rs) for Lead-210 were outside QC limits associated with the soil samples as well as Carbon 14 MS %Rs." However, the LCS results used to conclude that no qualification is necessary. Either the procedure for testing the significance of MS results from ERDU should be applied, or another approach proposed. The appropriate conclusion when an LCS is well-controlled and an MS fails is that there is suspect matrix interference. Passage of the LCS cannot be a rationale for acceptance of failed spike results. Revise the Report to include at a minimum a scientifically defensible rationale for data acceptance, or appropriately qualify the results.

9. Several matrix issues were noted for isotopic thorium (Th) aqueous samples. Non-conformance reports document that thorium was re-extracted using reduced sample volume due to severe matrix effects. It appears that this procedure was effective in eliminating the matrix effect. The issue is noted to some extent in the DVR under the reporting limit heading, as the ultimate effect on the data is an elevated MDA. However, this should be addressed in both the matrix and reporting sections of the report, and not primarily the reporting limit section. The DVR states that "The LCS tracer recovery for Thorium 229 was outside QC limits for all aqueous samples." An LCS was reported for Th-230, but Th-229 was not an analyte. It is assumed that Th-229 is a typographic error and that Th-230 was intended. It appears that the statement refers to the initial analysis of thorium, and not the reported final analysis. The closing statement of the reporting limits section of the DVR seems to support this, as does the laboratory report. However, this statement appears in the reporting limits section along with the summary of matrix effects and re-extractions; its significance is not explained. Overall, this mixing of matrix assessment, reporting limit and LCS is confusing, not informative, and awkward. Submit additional information on the following:

a. A discussion of matrix effects with matrix spikes.
b. A discussion of the LCS.
c. A discussion of the overall combined impacts of matrix spikes and LCS.
d. A scientifically defensible rationale for acceptance or qualification of the data when anomalies exist.

COMPLIANCE SCHEDULE

The Permittee must respond to the comments in Part 1 of this letter by no later than **December 18, 2010,** and to the comments in Part 2 of this letter by no later than **January 18, 2011** (Table 1). The Permittee must submit the groundwater investigation plan for nitrate, nitrite, and ammonia (see general comment #1 in Part 1 of this letter) by no later than **February 15, 2011** (Table 1).

Table 1 – Compliance Schedule	
Submittal	**Due Date**
Response to Part 1	December 18, 2010
Response to Part 2	January 18, 2011
Investigation Plan for Nitrate, Nitrite, and Ammonia	February 15, 2011

Contact William Moats of my staff at (505) 222-9551 should you have any questions.

Sincerely,

James P. Bearzi
Chief
Hazardous Waste Bureau

cc: J. Kieling, NMED HWB
W. Moats, NMED HWB
C. Amindyas, NMED HWB
D. Strasser, NMED HWB
L. King, EPA, Region 6 (6PD-F)
File: HAFB 2010 and Reading

APPENDIX A

SITE-SPECIFIC ADDENDUM TO BASEWIDE HEALTH AND SAFETY PLAN

SITE-SPECIFIC ADDENDUM TO THE BASEWIDE HEALTH AND SAFETY PLAN

NITRATE CHARACTERIZATION STUDY HOLLOMAN AIR FORCE BASE, NEW MEXICO

Prepared for:

49 CES/CEAN
Holloman Air Force Base
New Mexico

Under Contract to:

U.S. Army Corps of Engineers
Omaha District
1616 Capitol Avenue
Omaha Nebraska 68102-1618

Prepared by:

NationView, LLC
1608 13th Avenue South, Suite 160
Birmingham, Alabama 35205
NationView Project No. 11-0017

Contract No. W9128F-11-D-0029
Task Order No. 0001

January 2012

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SITE-SPECIFIC ADDENDUM TO THE BASEWIDE HEALTH AND SAFETY PLAN

NITRATE CHARACTERIZATION STUDY HOLLOMAN AIR FORCE BASE, NEW MEXICO

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A Activity Hazards Analysis

B Primary Contaminants of Concern

C USACE Accident Investigation Report (Form 3394 [Ver. 2] Mar. 1999)

D Reporting Civilian Employee Injuries and Illnesses

ACRONYMS AND ABBREVIATIONS

ACGIH	American Conference of Governmental Industrial Hygienists
AF Fm	Air Force Form
AHA	Activity Hazard Analysis
ANSI	American National Standards Institute
Bhate	Bhate Environmental Associates, Inc.
CES/CEAN	Civil Engineering Squadron/Civil Engineering Asset Management Flight
CFR	Code of Federal Regulations
CHMM	Certified Hazardous Materials Manager
CIH	Certified Industrial Hygienist
CPEA	Certified Professional Environmental Auditor
CPR	Cardiopulmonary Resuscitation
CRZ	Contamination Reduction Zone
CSP	Certified Safety Professional
dBA	Decibels A-weighted
DOT	Department of Transportation
EM	Engineering Manual
ERP	Environmental Restoration Program
eV	Electron Volt
EZ	Exclusion Zone
ºF	Degrees Fahrenheit
HAFB	Holloman Air Force Base
HASP	Health and Safety Plan
HEPA	High Efficiency Particulate Air
HSA	Hollow Stem Auger
HSM	Health and Safety Manager
IDW	Investigation Derived Waste
IP	Ionization Potential
kV	Kilovolt
L	Liter(s)
LEL	Lower explosive limit
LF-58	Incinerator Landfill
mg/m^3	Milligrams per cubic meter
MHS	Masters of Health Science
mL	Milliliter(s)
mm Hg	Millimeters of Mercury
MSDS	Material Safety Data Sheet
MUTCD	Manual on Uniform Traffic Control Devices
NIOSH	National Institute of Occupational Safety and Health
NRR	Noise Reduction Rating
OT-04	Acid Trailer Burial Site
OT-37	Early Missile Test Site
OT-38	Test Sled Maintenance Area

ACRONYMS AND ABBREVIATIONS (CONTINUED)

OV	Organic Vapor
PAPR	Powered Air Purifying Respirator
PEL	Permissible exposure limit
%	Percent
P.G.	Professional Geologist
PID	Photoionization Detector
PM	Project Manager
PPE	Personal protective equipment
ppm	Parts per million
SPF	Sun protection factor
SS-36	Unconventional Fuels Area Spill Site
SS-39	Missile Fuel Spill Area
SSA	Site-Specific Addendum
SSHO	Site Safety and Health Officer
SZ	Support Zone
TLV	Threshold Limit Value
TWA	Time weighted average
USACE	U.S. Army Corps of Engineers
VOC	Volatile Organic Compound
VP	Vapor Pressure

1 PROJECT SAFETY COORDINATION

The NationView, LLC (NationView) personnel who are responsible for safety and health issues during the Nitrate Characterization Study field effort are identified in Table 1-1. The respective personnel shall have reviewed and approved this Site-Specific Addendum (SSA) to the Basewide Health and Safety Plan (HASP) submitted by NationView for implementation on this scope of work prior to the start of field operations. The requirements of this site-specific addendum are applicable to NationView employees, their subcontractors, and site visitors.

Table 1-1. Project Team Members with Project Health and Safety Responsibilities

Title	Name	Telephone
Corporate Sponsor	Mr. David D. Martin	(205) 908-0731
Program Manager	Mr. Frank Gardner, P.G.	(303) 386-6454
Field Team Leader/Sr. Geologist	Mr. Jim Moore, P.G.	(303) 929-4840
Project Geologist	Mr. Dustin McNeil, P.G.	(303) 895-1963
Project Geologist	Mr. Zachary Beck, P.G.	(575) 921-1736
Environmental Specialist	Mr. Tony Lucero	(575) 921-1899
Site Safety and Health Officer (SSHO)/Emergency Task Manager	Mr. John Hymer	(575) 491-9171
Health and Safety Manager (HSM)	Ms. Sally S. Smith, MHS, CIH, CHMM, CSP, CPEA	(205) 918-4032

Notes:
P.G. = Professional Geologist
MHS = Masters of Health Science
CIH = Certified Industrial Hygienist
CHMM = Certified Hazardous Materials Manager
CSP = Certified Safety Professional
CPEA = Certified Professional Environmental Auditor

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2 PROJECT BACKGROUND AND SCOPE

The primary objectives of the Nitrate Characterization Study are twofold; first to conduct a basewide background investigation of nitrate and other nitrogen-bearing compounds in groundwater and soil to establish reliable background levels (Nitrate Background Study) and secondly to conduct a Nitrate Source Area Investigation at Environmental Restoration Program (ERP) sites where nitrate is a suspected groundwater contaminant of anthropogenic origin (e.g., ERP sites which were utilized for manufacturing, storing, or disposing liquid or solid rocket fuel propellants which contained nitrogen compounds).

For the Nitrate Source Area Investigation, six ERP sites have been identified which were historically associated with the testing and development of guided missiles and rockets. These include the Acid Trailer Burial Site (OT-04), Unconventional Fuels Area Spill Site (SS-36), Early Missile Test Site (OT-37), Test Sled Maintenance Area (OT-38), Missile Fuel Spill Area (SS-39), and the Incinerator Landfill (LF-58). Previous investigations have identified a number of contaminants of concern that have impacted the soil and groundwater at these ERP sites including the Volatile Organic Compounds (VOCs) trichloroethene and 1,1-dichloroethene; metals including arsenic, chromium, and lead; and perchlorate. See the *Nitrate Characterization Study Work Plan, Holloman Air Force Base, New Mexico* (NationView, 2011) for additional information on Holloman Air Force Base (HAFB) and the suspected nitrate source area ERP sites.

The anticipated activities for this project include:

- Mobilization and demobilization of equipment
- Hollow Stem Auger (HSA) soil boring and monitoring well installation
- Soil and groundwater sampling

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3 HAZARD ASSESSMENT AND CONTROLS

3.1 Task Hazard(s) Summary

The potential health and safety hazards of this task are summarized below in Table 3-1. The potential for encountering these hazards is ranked (high, moderate, or low) based on the work to be performed and the hazard control measures to be used. All tasks and their control measures are addressed in Task Specific Activity Hazard Analyses (AHAs) in Attachment A of this SSA.

Table 3-1. Task Hazards Summary

Summary	**Hazard potential** [High, Moderate, or Low]	Description of potential hazards
__√__**Safety**(i.e. Walking and working surfaces, traffic, falls, power and hand tools, materials handling, etc.)	• Moderate	• Walking and surfaces • Heavy equipment and vehicular traffic • Materials handling • Slips, trips, and falls
__√__**Utilities**	• Moderate	• Buried • Overhead • Building Although these hazards should not be associated with this particular scope of work, it is necessary to verify that the hazards can be controlled.
__√__**Chemical**	• Moderate	• VOCs (associated with potential nitrate source areas only) • Metals (associated with potential nitrate source areas only) • Perchlorate (associated with potential nitrate source areas only) • Nitrate (see Attachment B of this SSA) • Sample preservatives (acids) • Sand, bentonite, Portland cement (when installing monitoring wells)
__√__**Physical**	• Moderate	• Thermal stressors • Equipment noise
__√__**Biological** (i.e. Plants, animals, insects, spiders, infectious waste)	• Low	• Insect stings and bites, poisonous snakes/reptiles, and plants (potential for contact should be minimal)

3.2 Hazard Control Measures

General safe work practices and control measures are identified and summarized in the *Basewide Health and Safety Plan* (Basewide HASP) (Bhate Environmental Associates, Inc. [Bhate], 2003). This HASP Addendum has been tailored to be consistent with the practices described in the *U.S. Army Corps of Engineers Safety and Health Requirements Manual, EM 385-1-1,* September 2008. Additional task-specific hazards and control measures are identified for non-routine tasks as part of the AHA process. AHAs have been developed for each of the following activities and are included in Attachment A of this SSA:

- General site activities/mobilization and demobilization
- Soil boring, monitoring well installation/development, soil/ groundwater sampling, and investigation derived waste (IDW) handling

3.3 Written Safety Procedures and Programs

Table 3-2 provides a summary of the existing safety procedures and programs that will be used for this task. Copies of applicable procedures and programs are included in the Basewide HASP, as indicated.

Table 3-2. Written Safety Procedures and Programs

Reference Procedure or Program	Applicable Section(s)
Hazard Communication Program	All (Refer to Basewide HASP)
Respiratory Protection Program	All (Refer to Basewide HASP)
Hearing Conservation Program	All (Refer to Basewide HASP)
Incident Reporting and Investigation Program	All (Refer to Basewide HASP)
General Work and Safety Rules	All (Refer to Basewide HASP)
Site Health and Safety Inspections	All (Refer to Basewide HASP)
Environmental Monitoring	All (Refer to Basewide HASP)
Personal Protective Equipment Program	All (Refer to Basewide HASP)
Thermal Stressors Program	All (Refer to Basewide HASP)
Materials Handling Program	All (Refer to Basewide HASP)
Housekeeping Program	All (Refer to Basewide HASP)
Fire Prevention/Protection/Response Plans Program	All (Refer to Basewide HASP)
Utilities Program	All (Refer to Basewide HASP)
Electrical Safety Program	All (Refer to Basewide HASP)
Emergency Procedures Program	All (Refer to Basewide HASP)
Hand and Power Tools Program	All (Refer to Basewide HASP)

3.4 Permits

Before project activities can begin, there are several pre-construction documents and approval requirements to be met, including Air Force Form (AF Fm) 332 approval, Base dig permit with utility clearances, site security measures, and facility manager notification of the intended operations. NationView will coordinate project requests for Base installation support services through the 49th Civil Engineering Squadron/Civil Engineering Asset Management Flight (CES/CEAN). Pertinent to the start of activities, a pre-construction meeting and site walk-through will be conducted with the U.S. Army Corps of Engineers (USACE) Resident Engineer, HAFB personnel, and the NationView Site Manager to inspect site conditions for site/equipment access, equipment staging, and decontamination area(s), potential site hazards and emergency evacuation routes. Also reviewed at this time will be project procedures in accordance with the schedule and planned activities.

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4 PERSONAL PROTECTIVE EQUIPMENT

4.1 Purpose

The purpose of this program is to ensure that personal protective equipment (PPE) is selected in accordance with 29 Code of Federal Regulations (CFR) §1910.132, properly used and maintained, and that NationView personnel are properly trained in the inspection, use, and maintenance of PPE.

4.2 Scope

This program applies to all NationView operations including the subcontractors on NationView managed projects. The following PPE as presented in Table 4-1 will be used for the identified activities based on the best available information about the work requirements and anticipated hazards.

Table 4-1. Personal Protective Equipment by Activity

Activity	Head/Face	Foot	Hands	Respiratory	Clothing
Mobilization / Demobilization	Hard Hat[1] (for overhead hazards), Safety Glasses[2] with rigid side shields	Steel toed boots	Leather gloves as needed	None[3, 4]	Minimum of long pants and shirts with a minimum 4-inch sleeve
General Site Labor (outside of exclusion zone)	Hard Hat[1] (for overhead hazards), Safety Glasses[2] with rigid side shields. Goggles if windy or dusty conditions exist. Hearing protection (ear muffs or ear plugs) if sound levels exceed 85 decibels A-weighted (dBA).	Steel toed boots Boot covers as needed	Leather gloves as needed Chemical resistant gloves (nitrile) if contact with contaminants is possible	None[3, 4]	Minimum of long pants and shirts with a minimum 4-inch sleeve American National Standards Institute (ANSI) Class II high visibility vests around equipment operation or traffic
Equipment Operation (Drilling) and/or general work inside the exclusion zone	Hard Hat[1] (for overhead hazards), Safety Glasses[2] with rigid side shields. Goggles if windy or dusty conditions exist. Hearing protection (ear muffs or ear plugs) if sound levels exceed 85 dBA.	Steel toed boots Boot covers as needed	Leather gloves as needed Chemical resistant gloves (nitrile) if contact with contaminants is possible	None[3, 4] Full face Air Purifying Respirator with Organic vapor (OV) and P100 combination cartridges or Powered Air Purifying Respirator (PAPR) with P100/OV cartridges based on monitoring results	Minimum of long pants and shirts with a minimum 4-inch sleeve. ANSI Class II high visibility vests around equipment operation or traffic. Tyvek coveralls may be worn where splashing is possible and as recommended by the SSHO.

Activity	Head/Face	Foot	Hands	Respiratory	Clothing
Equipment Decontamination	Hard Hat[1] with face shield, Safety Glasses[2] with rigid side shields. Goggles if windy or dusty conditions exist. Hearing protection (ear muffs or ear plugs) if sound levels exceed 85 dBA.	Steel toed boots Boot covers	Chemical resistant gloves (nitrile inner and outer)	None[3, 4] Full face Air Purifying Respirator with OV and P100 combination cartridges or with P100/OV cartridges based on monitoring results	Minimum of long pants and shirts with a minimum 4-inch sleeve. Tyvek coveralls may be worn where splashing is possible and as recommended by the SSHO. ANSI Class II high visibility vests around equipment operation or traffic.
Soil and Groundwater Sampling/ Screening Handling IDW	Hard Hat[1] (for overhead hazards), Safety Glasses[2] with rigid side shields. Goggles if windy or dusty conditions exist. Hearing protection (ear muffs or ear plugs) if sound levels exceed 85 dBA.	Steel toed boots Boot covers as needed	Chemical resistant gloves (nitrile inner and outer)	None[3, 4] Full Face Air Purifying Respirator with OV and P100 combination cartridges or PAPR with P100/OV cartridges based on monitoring results	Minimum of long pants and shirts with a minimum 4-inch sleeve. Tyvek coveralls may be worn where splashing is possible and as recommended by the SSHO. ANSI Class II high visibility vests around equipment operation or traffic.
Supervision of work	Hard Hat[1] (for overhead hazards), Safety Glasses[2] with rigid side shields. Goggles if windy or dusty conditions exist. Hearing protection (ear muffs or ear plugs) if sound levels exceed 85 dBA.	Steel toed boots Boot covers as needed	Leather gloves as needed Chemical resistant gloves (nitrile) if contact with contaminants is possible	None[3, 4] Full Face Air Purifying Respirator with OV and P100 combination cartridges or PAPR with P100/OV cartridges based on monitoring results	Minimum of long pants and shirts with a minimum 4-inch sleeve. Tyvek coveralls may be worn where splashing is possible and as recommended by the SSHO. ANSI Class II high visibility vests around equipment operation or traffic.

Notes:

[1] Hard hats are not required inside fully enclosed equipment cabs.

[2] Safety glasses with rigid side shields approved by ANSI Z-87 required at all times.

[3] Voluntary use of respirators is authorized for comfort from nuisance dusts and odors, provided they are issued and used in accordance with established respiratory protection program procedures; respiratory protection may be required based on real time air monitoring results and action levels listed in Table 5-1.

[4] Cartridge change out will occur at the following conditions:

- Damage to cartridge
- Cartridge is wet, restriction in breathing, unusual odors
- Cartridge is visibly clogged with dust, restriction in breathing
- After each day of use with no continuous exposures over the established Permissible Exposure Limits (PELs) per. 29 CFR §1910.1028(g)(3)(i) (benzene standard) and the cartridge manufacturer's change out calculations based on anticipated concentrations.
- Changes that may be otherwise identified in 29 CFR §1910.120.

The following qualified person certifies that the selection of PPE is based on best available information about the work requirements and anticipated hazards.

Printed name:	**Signature:**	**Date:**
Sally S. Smith, MHS, CIH, CHMM, CSP, CPEA **Health and Safety Manager**	Sally S. Smith	**1-6-12**

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5 SITE MONITORING

Site monitoring will be conducted using direct-reading instruments primarily in the workers' breathing zone. To the extent feasible, field operations will be conducted and modified as needed to ensure that personnel are situated upwind of the any intrusive activities. Initial upwind background and work-zone readings will be obtained before the initiation of activities at a given site. Readings of breathing zones (unless location is otherwise specified) will be taken periodically during all activities. The SSHO has the authority to modify the level of protection required for work at each site as well as halt operations as deemed necessary to control personal exposures, after conferring with the HSM. Monitoring results will be recorded on an Atmospheric Monitoring Log Field Health and Safety form maintained by the SSHO. Monitoring, calibrating, and maintaining instruments are the responsibility of the SSHO. Table 5-1 summarizes the site monitoring parameters and action levels applicable for direct reading exposure monitoring.

Table 5-1. Direct Reading Exposure Monitoring

Activity(s)	Compound / Instrument	Action Level(s) and Frequency	Actions
Soil boring and well installation, soil and groundwater sampling	Total VOCs / Photoionization Detector (PID)	0 - 5 parts per million (ppm) Every 15 minutes during intrusive activities	Continue work in required PPE and continue monitoring.
		> 5 ppm to < 10 ppm (Sustained for more than 5 minutes)	Ensure personnel are upwind, notify the Project Manager (PM). SSHO will upgrade PPE to Level C respiratory protection with organic vapor and High Efficiency Particulate Air (HEPA) cartridge, as necessary. Implement appropriate controls such as ventilation.
		> 10 ppm (Sustained for more than 5 minutes)	Stop work, ensure employees are upwind. Notify PM and HSM for additional control measures.
	Particulates / Personal DataRam or similar particulate monitor	0 – 1.5 milligrams per cubic meter (mg/m^3) (respirable) 1-5 mg/m^3 (inhalable/total) Every 15 minutes during intrusive activities	Continue work in required PPE and continue monitoring.
		>1.5 mg/m^3 - < 3 mg/m^3 (respirable) >5 mg/m^3 - < 10 mg/m^3 (inhalable/total) (Sustained for more than 5 minutes)	Cease work and ensure personnel are upwind, notify the Site Manager. SSHO shall upgrade PPE to air purifying respiratory protection with HEPA cartridges. Perform personnel exposure monitoring using integrated time weighted average (TWA) monitoring.
		>3 - < 30 mg/m^3 (respirable) >10 - <100 mg/m^3 (total inhalable) (Sustained for more than 5 minutes)	Cease work and ensure personnel are upwind, notify the Site Manager. SSHO shall upgrade PPE to powered air purifying respiratory protection with HEPA cartridges. Perform personnel exposure monitoring using integrated TWA monitoring.

Table 5-1. Direct Reading Exposure Monitoring (continued)

Activity(s)	Compound / Instrument	Action Level(s) and Frequency	Actions
Soil boring and well installation, soil and groundwater sampling	Noise	< 85 dBA	Continue work in required PPE and continue monitoring.
		> 85 dBA to < 110 dBA	Ear plugs or ear muffs must be worn with a Noise Reduction Rating (NRR) of at least 26 dBA.
All site activities	Noise	< 85 dBA	Continue work in required PPE and continue monitoring.
		> 85 dBA to < 110 dBA	Ear plugs or ear muffs must be worn with a NRR of at least 26 dBA.
		> 110 dBA to < 130 dBA	Ear plugs and ear muffs must be worn together each with a NRR of at least 26 dBA.
		> 130 dBA	Cease work and ensure personnel leave work area. Notify the PM.

6 SITE CONTROL

6.1 Site Activities

Site-specific site control measures will be used to control access to the work area at each individual site. Tables 6-1 and 6-2 summarize the site control requirements applicable for both general work areas and work areas with potentially contaminated media, respectively.

Table 6-1. Site Control for General Work Area(s)

Location	Site Control Procedure (discuss important elements such as signs, barricades, fencing, briefings, sign-in/out logs, etc.)
General Work Area	Due to the location of the project site, access will be coordinated with the Site Manager and HAFB Operations. Access will be made via a specified route. The SSHO will be responsible for the accountability for all onsite personnel using appropriate sign in / sign out procedures as needed. The SSHO shall be responsible for maintaining adequate site control in order to limit hazards to site workers and site visitors. To the extent feasible, immediate work areas shall be cordoned off through the use of devices such as traffic cones, caution tape, or construction fencing along with appropriate signage such as "Danger – Construction Area, Authorized Personnel Only" and "Hard Hat, Safety Glasses, and Safety Boots Required in this Area". All site workers shall be aware of surroundings and prevent unauthorized personnel as well as vehicle traffic from entering the work area. In areas where traffic control is required, all traffic control devices and methodologies will comply with the U.S. Department of Transportation (DOT) Manual on Uniform Traffic Control Devices (MUTCD, http://mutcd.fhwa.dot.gov) including the use of appropriate roadway markings, ANSI Class II high visibility safety vests, and flagmen as needed.

Table 6-2. Site Control for Potentially Contaminated Area(s)

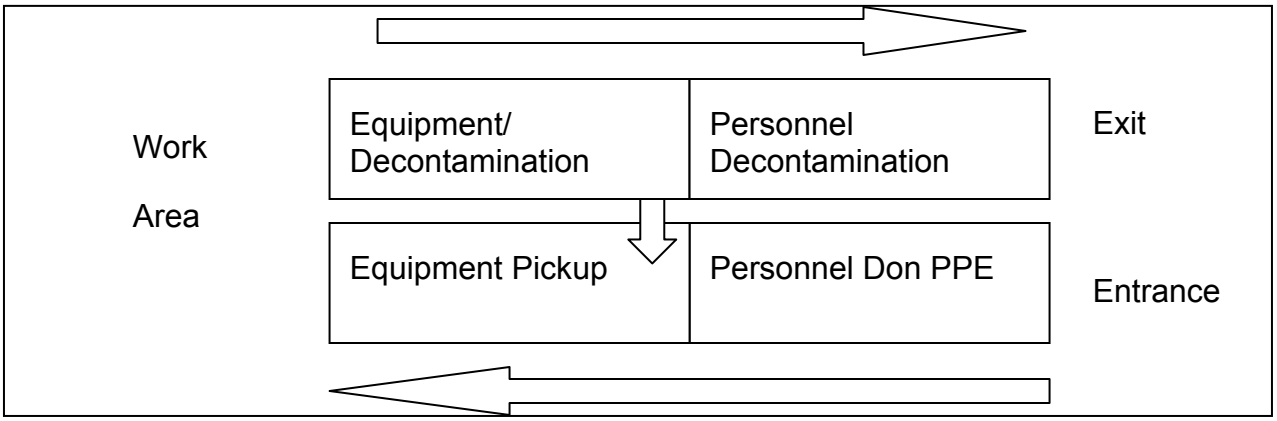
Location	Site Control Procedure (discuss important elements such as signs, barricades, briefings, qualifications, required supplies and equipment, sign-in/out logs, etc.)
Support Zone (SZ)	Located outside of contaminated areas, access will be from clean areas or from the Exclusion Zone through the Contamination Reduction Zone.
Contamination Reduction Zone (CRZ)	The Contamination Reduction Zone will be demarcated with caution tape or temporary construction fencing. Decontamination stations will be located here.
Exclusion Zone (EZ)	Exclusion Zone work areas will be clearly demarcated with caution tape or temporary construction fencing. All access to this area will require the use of a sign-in/out log.

6.2 Decontamination

Required decontamination procedures are described below in Table 6-3.

Table 6-3. Decontamination Procedures by Location

Type of Decontamination	Decontamination Methods
Personnel decontamination	Personal hygiene will be the responsibility of each individual worker. Eating, drinking, chewing tobacco or gum, smoking, and any other practice that may increase the possibility of hand-to-mouth contact is prohibited in the work area. Personnel will be required to thoroughly wash hands and face prior to eating, drinking, or smoking. Any disposable PPE used will be collected following use in the work area for proper disposal. All disposable PPE will be removed and disposed of in a labeled, pre-designated receptacle prior to leaving the work area to prevent the spread of contaminants. Upon return, new and/or cleaned PPE will be provided for use. In the case of excessive soiling or splattering, the PPE shall be changed out more frequently to reduce the spread of contamination and reduce the potential for contaminant breakthrough. Reusable PPE shall be cleaned with soap and water after each use. Respirator filter cartridges (if used) shall be changed out on a daily basis. The decontamination area will be divided into two general areas (equipment area and personnel decontamination area). When exiting the work area, workers will leave all equipment in the equipment area. Workers will then remove PPE. Gloves will be turned inside out so as to not come into contact with potentially contaminated material. Respirators if used will then be removed and set aside for cleaning. Workers will then proceed to the personnel decontamination area and don clean gloves for use with soap and water to wash respirators, any other reusable PPE and tools. A small wash area will be provided so workers can then wash their face and hands. Clean paper towels and/or rags will be used to dry hands and face. Spent PPE and towels/rags will then be placed in a 55-gallon drum for proper disposal at the end of the project. Running water or Portable hand wash station required when using Portland cement. The drawing below depicts a typical decontamination sequence.
Equipment decontamination	Work efforts will be made to minimize equipment contact with contaminated materials. Prior to leaving the work area following sampling, equipment (vehicle tires and hand tools) will be dry decontaminated. Soils from the dry decontamination process will be disposed with the excavated materials. Decontamination tools may include brooms and shovels. Hollow stem augers and drilling rods will be decontaminated using a portable decontamination trailer equipped with a high pressure steam cleaner. The operator will don heavy duty rubber gloves and a hard hat equipped with a face shield during all auger and drilling equipment decontamination operations.



7 COMMUNICATIONS

Cellular telephones will be available to summon emergency services as required. Refer to Sections 10, 11, and 12 of this SSA to the HASP for site specific guidance on emergency situations and appropriate actions. Site communication amongst workers shall be a combination of verbal and line of sight hand communications. Visual signals include:

1. Hand gripping throat = Can't breathe,
2. Grip partner's wrist or both hands at waist = Leave area immediately,
3. Hands on top of head = Need assistance,
4. Thumbs up = OK, I'm all right, I understand,
5. Thumbs down = No, Negative

Cellular telephone use is not permitted while operating equipment. However, in the event of an emergency, the support zone may contact operators of heavy equipment (Hollow Stem Auger Drill Rig) with hand held radios or cellular phones.

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8 MEDICAL SURVEILLANCE AND TRAINING

The medical surveillance and training requirements for NationView's on-site personnel working on the soil boring, soil sampling, well installation, and groundwater sampling activities will follow the requirements outlined in the Basewide HASP Sections 7.4 and 7.5, respectively.

All personnel performing on-site work activities, wherein they may be exposed to hazards resulting from field activities, will have completed applicable training in compliance with 29 CFR Part 1910/29 CFR Part 1926 and Engineering Manual (EM) 385-1-1. Table 8-1 provides a summary of the minimum training requirements for site project personnel.

Table 8-1. Required Worker Training and Site-Specific Training

Required worker training	Site-specific training requirements
√ 40-hour Hazwoper General Site Worker (All) √ 8-hour Hazwoper Supervisor (SSHO) √ 8-hour Hazwoper Refresher (as applicable) √ 30-hr for Construction (SSHO) No retraining requirements are anticipated during the project	All personnel working on site shall attend site-specific orientation/training prior to starting onsite project work. This training will be facilitated by the SSHO.

Additionally, at a minimum the SSHO or the designated representative and one other person will be certified in First Aid and Cardiopulmonary Resuscitation (CPR), and will be continuously present during site operations.

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9 HAZARDOUS CHEMICALS

Hazardous chemicals (as defined in 29 CFR §1910.1200) to be brought or used on-site are identified below. This chemical inventory and associated Material Safety Data Sheet (MSDSs) will be maintained by the SSHO.

Table 9-1. Hazardous Chemicals Brought On-Site

Chemical Name	Amount	Location	Purpose
Assorted fuels, lubricants, coolants, etc. necessary for equipment operation	No storage planned. Quantities limited to immediate use requirements of on-site equipment.	No storage planned. Materials to be brought on-site by vendor's maintenance vehicle.	Equipment Servicing and Operation
Calibration gases for air monitoring equipment, if required for instruments in use	One small aluminum cylinder of each required gas. (Each contains approximately 35 liters [L] of gas mixture).	Storage with monitoring equipment in field office	Calibration of monitoring equipment
Groundwater sample preservative (nitric acid and sulfuric acid)	2 milliliter (mL)/bottle	Minimal quantities will be required for groundwater sampling	Groundwater Sampling
Sand, bentonite, Portland cement	Small bags	At monitoring well installation	Installation of monitoring Wells

Hazardous materials anticipated to be brought on site include preservatives for groundwater samples, calibration gases for air monitoring equipment, and possible fuel, lubricants, or coolants for drill rigs and accessory vehicles. No other hazardous materials are anticipated to be brought on site by NationView or any potential subcontractor for use on site under this scope of work.

A copy of the NationView Hazard Communication Program is included in the Basewide HASP. A MSDS must be maintained on site for any hazardous materials stored or used. A MSDS must be submitted to the HSM and approvals obtained prior to bringing any hazardous materials on the job site. The MSDSs for all hazardous materials will be reviewed with all onsite personnel by the SSHO as a part of chemical specific hazard communication training.

Additionally, all personnel onsite will have appropriate general hazard communication training per 29 CFR §1910.1200 and 29 CFR §1910.120. All containers used to store hazardous materials or IDW will be properly labeled with the identity and hazards associated with the contents. All IDW water will be contained in 55-gallon U.S. DOT approved drums. An inventory of the number of drums will be maintained by the SSHO.

The labeling will be weatherproof and fade proof for a minimum of 1 year. An IDW holding area will be designated at or near the subject site. Groundwater sampling results will be used to characterize the IDW.

10 EMERGENCY ACTION AND RESPONSE

Personnel responsible for coordinating emergency response actions during the Nitrate Characterization Study HSA soil boring, well installation, and soil and groundwater sampling activities are identified below in Table 10-1. A map showing directions from HAFB to the authorized medical facility are included in Section 12.

Table 10-1. Emergency Coordinator and Alternate

Responsibility	Name	Phone Number(s)
Task Emergency Coordinator	Mr. John Hymer	Office (575) 201-4261 Cell (575) 491-9171
Alternate Emergency Coordinator	Mr. Dave Rizzuto	Office (575) 674-2012 Cell (575) 430-3965

If an emergency situation develops which requires evacuation of the work area, the evacuation procedures in Table 10-2 shall be followed.

Table 10-2. Evacuation Procedures

Evacuation Step	Methods and comments:
Notify affected workers	Use of site communication methods as applicable
Evacuate to safe location	Assemble at the primary evacuation site (support area outside of the exclusion zone)
Assemble and account for workers	Emergency Coordinator shall account for personnel using site Sign in/Sign out sheet
Notify Fire and Emergency Services	Notification as needed
Complete incident report and USACE 3394 Form (Attachment C), as applicable	Follow the *Reporting Civilian Employee Injuries and Illnesses* procedures (included in Attachment D); follow USACE 3394 Form instructions

Table 10-3 summarizes potential emergency situations and response actions that are applicable for the Nitrate Characterization Study project.

Table 10-3. Potential Emergency Situations

In case of	Response actions
Injury or illness	Treat injury with applicable First Aid. All work related injuries beyond first aid will result in notification of Emergency Services and notification of the employee supervisor. Any employee requiring advanced medical treatment will be accompanied by a knowledgeable company employee that can answer potential questions on job duties and hazards. Make notifications in accordance with the Incident Reporting and Investigation Procedure (found in Section 10.2.2 of the *Basewide Health and Safety Plan*, Bhate, 2003) and *USACE EM 385 1-1*, Sept. 2008.
Chemical exposure	First Aid shall be provided such as but not limited to: move victim to fresh air, remove contaminated clothing, flush affected skin with cool running water for at least 15 minutes, and seek medical attention.
Fire or explosion	Notify emergency services immediately. All personnel shall evacuate the immediate area of the fire and move to an upwind location. Personnel shall not engage in fire fighting activities with use of fire extinguisher unless trained to do so and only in the incipient stages of fire.
Adverse weather	Tornados, lightning, or other threatening weather conditions will result in an immediate shut down of operations and evacuation of personnel. Lightning proximity will be determined by measuring the time interval between the visually observed lightning flash and the subsequent sound of thunder. An interval less than 30 seconds will prompt the shut down. Operations will be shut down for the period of the storm passing plus an additional 20 minutes.
Material spill or release	Vehicles and equipment will be maintained and inspected so as to prevent fluid leaks. Should any vehicle fluid leaks occur, the equipment will be taken out of service to make necessary repairs and any contaminated material will be cleaned-up and disposed of properly. Spill kits will be available to facilitate prompt containment and clean-up of spills. Notification will be made in accordance with the Incident Reporting and Investigation Procedure. Storage areas will be designed to have secondary containment as required, and work plans will be executed to accommodate stormwater runoff and minimize the potential for contamination spread.

11 EMERGENCY CONTACTS

In the event of an emergency, the following contacts should be made, as appropriate:

HAFB Emergency Number (using HAFB phone system) 911
Operators will assist with Medical, Fire, and Police emergencies

HAFB Security Force.....(575) 572-5037

HAFB Fire Protection .....(575) 572-1117

HAFB Hospital – 49th Medical Group (Main switchboard) .....(575) 572-2778

Civilian Hospital (Alamogordo)
Gerald Champion Regional Medical Center. .....(575) 439-6100

HAFB Fire Protection (Non-emergency) ……....……..(575) 572-7228

Range Control (for Heat Index and Category) ……...(575) 678-2222

SSHO/Emergency Coordinator - John Hymer Office (575) 201-4261
Cell (575) 491-9171

Alternate Emergency Coordinator - Dave Rizzuto Office (575) 674-2012
Cell (575) 430-3965

Health and Safety Director -Sally Smith Office (205) 918-4032
Cell (205) 983-4150

After initial contacts have been made and the situation has stabilized, notify the Site Manager SSHO, Senior Project Manager, and/or HSM, as appropriate. An Incident Report will be completed within 24 hours and an Incident Investigation Report will be completed within 5 days of an incident. The USACE Form 3394 (Attachment C) will also be completed, as needed.

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12 HOSPITAL DIRECTIONS

In the event of a true medical emergency ("life or limb"), HAFB Emergency Services should be used. Notification of any injury must be made to HAFB Emergency Services. NationView personnel and subcontractors should not transport injured personnel to the HAFB Hospital without prior authorization from HAFB Emergency Services.

Other injuries should be treated as necessary at Gerald Champion Regional Medical Center at 2669 Scenic Drive, Alamogordo, NM 88330.

Directions from HAFB are as follows:

1.) Exit the Main Gate and proceed east on US-70,

2.) From US-70, get onto US-54,

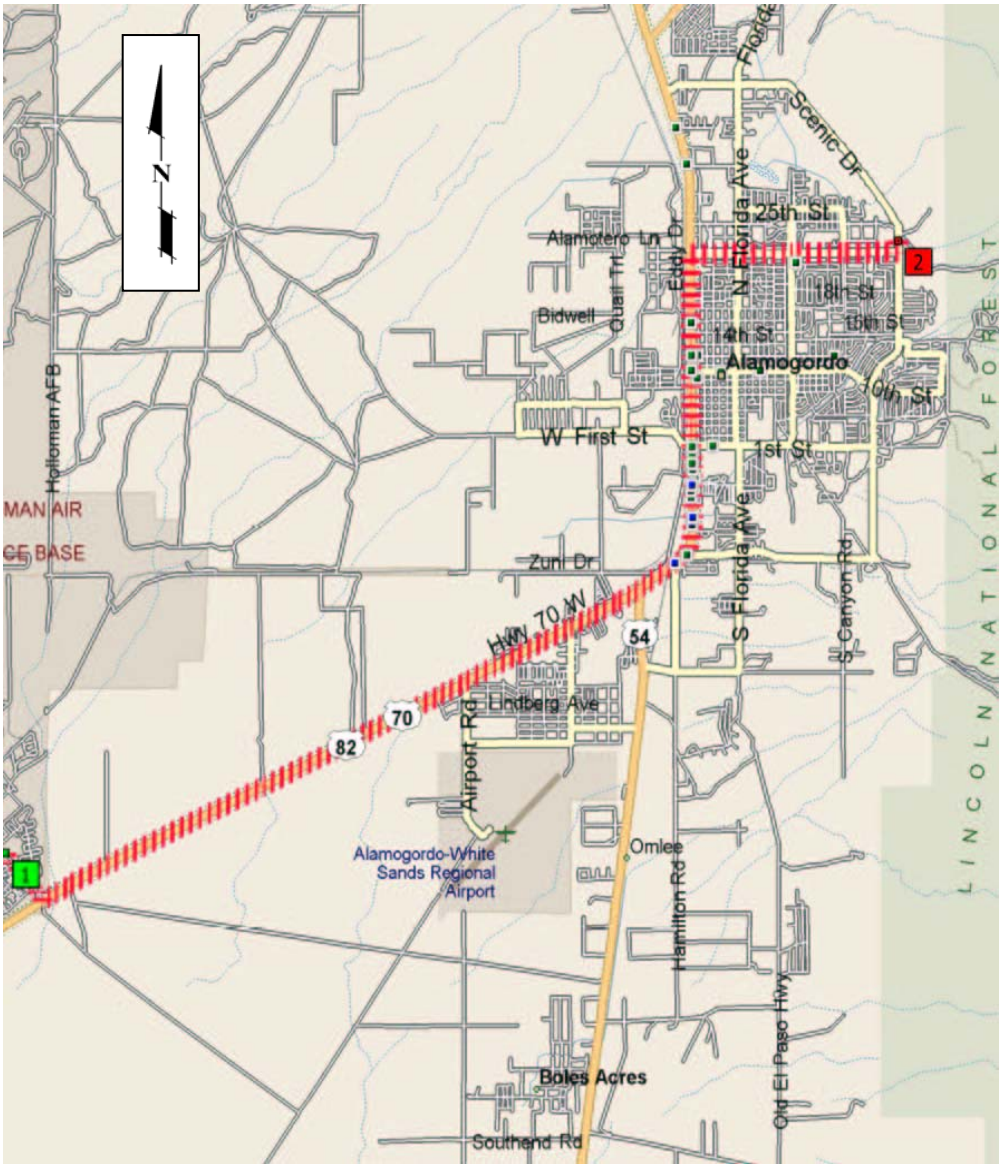
3.) Continue north on US-54 to Indian Wells Road, turn right onto Indian Wells Rd. (heading east),

4.) Continue on Indian Wells drive to Scenic Drive, turn left onto Scenic Dr.,

5.) Proceed on Scenic to the medical center. Gerald Champion Hospital is at 2669 Scenic Drive. Hospital phone: (575) 439-6100

A map to this hospital is presented as Figure 12-1.

Figure 12-1. Hospital Route Map



NATIONVIEW	HOSPITAL ROUTE MAP Holloman Air Force Base to Gerald Champion Regional Hospital Phone (575) 439-6100 Source: Microsoft Expedia Street Maps	Nitrate Characterization Study Work Plan Holloman AFB SSA to the HASP Figure 12-1
	Not to Scale / Date January 2012	

13 REFERENCES

American Conference of Governmental Industrial Hygienists (ACGIH), *Threshold Limit Values for Chemical Substances and Physical Agents and Biological Exposure Indices*.

Bhate. December 2003. *Final Basewide Health and Safety Plan, Holloman Air Force Base, Alamogordo, New Mexico.*

NationView. November 2011. *Nitrate Characterization Study Work Plan, Holloman Air Force Base, New Mexico.*

U.S. Army Corps of Engineers. September 2008. *EM 385-1-1 U.S. Army Corps of Engineers Safety and Health Requirements Manual*.

U.S. Army Corps of Engineers. 30 March 1990. *USACE Supplement 1 to AR 385-40, Reporting Civilian Employee Injuries and Illnesses.*

U.S. Department of Labor, Title 29 Code of Federal Regulations Part 1910.

U.S. Department of Labor, Title 29 Code of Federal Regulations Part 1926.

U.S. Department of Health and Human Services, National Institute of Occupational Safety and Health (NIOSH), *Pocket Guide to Chemical Hazards*.

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ATTACHMENT A

ACTIVITY HAZARD ANALYSES

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Activity Hazard Analysis (AHA) – 01

Task: Nitrate Characterization Study- General Site Activities	NationView Project Number: 11-0017	
Minimum Personal Protective Equipment (PPE): Level D PPE (Long pants, shirts with minimum 4" sleeve, steel toe boots, safety glasses with rigid side shields, hard hat for overhead hazards, leather work gloves, and hearing protection, as required)	Location: Holloman Air Force Base, New Mexico	
	Analysis Approved by: Sally S. Smith, MHS, CIH, CSP, CHMM, CPEA	Date: January 2012

Activity	Potential Hazards	Recommended Controls
General Site Activities including Mobilization / Demobilization and Site Preparation Note: Each workday shall begin with a mandatory daily safety meeting for all on-site workers	Slips, trips, or falls on walking and working surfaces	• Determine the best access route prior to transporting equipment and tools • Continuously inspect the work area for slip, trip, and fall hazards • Pay attention; ensure safe and secure footing • Maintain clean work areas by following good housekeeping procedures • Be alert for uneven and variable terrain • Wear slip resistant footwear when walking/working on slippery surfaces or slopes
	Site Traffic	• Be aware of potential vehicle traffic while on site • Follow posted warnings and rules for travel around site • All personnel to wear ANSI Class II high visibility safety vests
	Eye injury	• Use approved safety glasses with rigid side shields
	Overhead hazards	• Personnel will be required to wear hard hats that meet ANSI Standard Z89.1 in all areas with overhead hazards
	Cuts, punctures, and abrasions	• Wear leather work gloves when handling materials or using tools
	Dropped objects	• Steel toe boots meeting ANSI Standard Z41 will be worn
	Thermal Stressors (i.e. heat stress, cold stress)	• Employees will have appropriate clothing for variable weather • Use of long sleeves or application of sunscreen with a high sun protection factor (SPF) on exposed skin encouraged • Employees will take breaks and drink plenty of fluids to prevent heat stress • Warming breaks will be permitted as necessary to prevent cold stress
	Back Injury from Materials Handling	• Use proper lifting techniques • Loads greater than 50 pounds require assistance or mechanical equipment • Prior to lifting, check the load for jagged or sharp edges • Avoid torso twisting motions while handling or moving loads

AHA – 01 (Continued)

Activity	Potential Hazards	Recommended Controls
Mobilization/Demobilization and Site Preparation (continued)	Inclement weather (Thunderstorms and tornadoes)	• Halt activities immediately and take cover during thunderstorm or tornado warnings, shelter in a building if possible, stay away from windows • If outdoors, stay close to the ground • Listen to radio or television announcements for pending weather information • Do not try to outrun a tornado on foot or in a vehicle
	Biological hazards (spiders, snakes, etc.)	• Workers will inspect the work area carefully and avoid placing hands and feet into concealed areas • Look in direction of travel for biological hazards to avoid
Safety Equipment Used	**Inspection Requirements**	**Training Requirements**
Level D PPE Fire Extinguisher First Aid Kit Eyewash	Weekly inspections will be performed on fire extinguishers. Weekly inspections will be performed on first aid kits. Portable eye wash will be inspected weekly. Informal daily work area inspections to be conducted by the SSHO. Formal weekly inspections to be conducted by the SSHO using the Site Safety and Health Inspection Form.	Site personnel have read and understand the SSA Site personnel possess all of the required training as specified in the SSA Site personnel received site specific safety indoctrination Site personnel have reviewed all applicable MSDSs and Chemical Safety Cards At least two individuals on-site will have current CPR and First Aid training

Activity Hazard Analysis (AHA) – 02

Task: Nitrate Characterization Study-Soil Boring, Monitoring Well Installation/Development, Soil/Groundwater Sampling, IDW Handling	NationView Project Number: 11-0017	
Minimum Personal Protective Equipment (PPE): Level D PPE (Long pants, shirts with minimum 4" sleeve, steel toe boots, safety glasses with rigid side shields, hard hat for overhead hazards, leather work gloves, chemical gloves [nitrile inner and neoprene outer], and hearing protection, as required)	Location: Holloman Air Force Base, New Mexico	
	Analysis Approved by: Sally S. Smith, MHS, CIH, CSP, CHMM, CPEA	Date: January 2012

Activity	Potential Hazards	Recommended Controls
Soil Boring/Sampling and Handling IDW Hazards and recommended controls from AHA – 01 apply	Hand Auger Sampling Hazards Including but not limited to: Intensive labor, pinch points, uneven rough terrain, etc.	• Hand Auger equipment and tooling is to be inspected, operated, and maintained properly • To the extent possible, site ingress and egress should be limited to level terrain • Work areas should be inspected, and to the extent possible level terrain should be selected for work, prior to initiating hand auger soil boring and sampling activities • Wear required PPE (hard hat, safety glasses, work gloves, ear muffs or plugs, steel toe work boots), ensure loose clothing, jewelry, and/or hair is secured • Maintain good housekeeping on and around each sampling site
	Drill Rig Hazards Including but not limited to: Flying debris, falling objects, noise, hydraulic failures, unguarded machinery, equipment rollover, movement of large, heavy drilling tools, etc.	• Drill rig is to be operated and maintained by qualified operators • A Drill Rig Inspection Checklist should be completed daily to ensure that the rig is operating properly • The inspection will include fittings, cables, pins, connections, lubrication points, controls, emergency stops, etc. • To the extent possible, the terrain should be level and the condition of the ground such that unexpected movement of the rig is unlikely • Stabilize the rig prior to boring • Wear required PPE (hard hat, safety glasses, work gloves, ear muffs or plugs, steel toe work boots), ensure loose clothing is secured • Maintain good housekeeping on and around drill rig
	Exposure to soil contaminants	• To the extent feasible, limit contact with subsurface materials • Wear required PPE when conducting intrusive activities • SSHO shall conduct breathing zone monitoring for VOCs with a PID and particulates in accordance with requirements for site monitoring • SSHO may require an upgrade in PPE or modification to work based on monitoring results • Wear appropriate PPE including chemical resistant gloves (nitrile inner and neoprene outer) and Tyvek coveralls to minimize potential contact with soil, as appropriate • Use appropriate decontamination methods

AHA – 02 (Continued)

Activity	Potential Hazards	Recommended Controls
Soil Boring/ Sampling and Handling IDW (continued) Hazards and recommended controls from AHA – 01 apply	Overhead/buried utilities	• Conduct a utility locate to identify the location of underground utilities in boring locations and complete any required dig permits • Overhead utilities should be considered live until determined otherwise • Maintain the following minimum distances from overhead utilities to employees <u>Nominal Voltage (Minimum Clearance)</u> 0 – 50 kilovolt (kV) (10 feet) 51 – 200 kV (15 feet) 201 – 350 kV (20 feet) 351 – 500 kV (25 feet) 501 – 650 kV (30 feet) 651 – 800 kV (35 feet) 801 – 950 kV (40 feet) 951 – 1100 kV (45 feet) [IAW Table 11-1 of EM385 1-1 (USACE, 2008)] • All underground utilities must be clearly marked before beginning work • No borings shall be made within a 4-foot "Buffer Zone" of any utility marking
Monitoring Well Installation	Pinch points	• Utilize appropriate PPE (leather gloves) when handling well casings and tools
	Dust	• Use care when installing well materials (sand, bentonite, Portland cement) into monitoring well to prevent dust generation • Position body in an upwind location • Suppress dust generation using wet methods and careful handling • Running water or Portable hand wash station required when using Portland cement
Well Development / Groundwater depth measurement / Groundwater sampling Handling IDW	Exposure to groundwater contaminants	• Position body upwind from monitoring well prior to opening cap • Wear appropriate PPE including chemical resistant gloves (nitrile inner and neoprene outer) and Tyvek coveralls to minimize potential contact with groundwater, as appropriate • Conduct work activities in a manner that minimizes potential contact with groundwater • Collect all PPE and disposable sampling equipment and dispose of IDW properly • Wash hands and face prior to eating, drinking, or smoking

AHA – 02 (Continued)

Safety Equipment Used	Inspection Requirements	Training Requirements
Level D PPE Fire Extinguisher First Aid Kit Eyewash Portable hand wash station when using Portland cement	Weekly inspections will be performed on fire extinguishers. Weekly inspections will be performed on first aid kits. Portable eye wash will be inspected weekly. Informal daily work area inspections to be conducted by the SSHO. Formal weekly inspections to be conducted by the SSHO using the Site Safety and Health Inspection Form.	Site personnel have read and understand the SSA Site personnel possess all of the required training as specified in the SSA Site personnel received site specific safety indoctrination Site personnel have reviewed all applicable MSDSs and Chemical Safety Cards At least two individuals on-site will have current CPR and First Aid training

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ATTACHMENT B
PRIMARY CONTAMINANTS OF CONCERN

Properties of the Primary Contaminants of Concern

Contaminant	PEL	TLV	Route(s) of Exposure	Signs and Symptoms of Exposure		Target Organs	IP (eV)	Specific Gravity	VP (mm Hg)	Flash Point (°F)	LEL %	UEL %
				Acute	Chronic							
1,1-Dichloroethene	None	5 ppm	Inhalation, skin absorption, ingestion, dermal and/or eye contact	Irritation eyes, skin, throat; dizziness, headache, nausea, dyspnea (breathing difficulty); liver, kidney disturbance; pneumonitis; [potential occupational carcinogen]	Repeated or prolonged contact with skin may cause dermatitis. The substance may have effects on the kidneys liver.	Eyes, skin, respiratory system, central nervous system, liver, kidneys	10	1.21	500	-2.0	6.5	15.5
Trichloroethene	100 ppm (TWA) 200 ppm (Ceiling)	10 ppm (TWA) 25 ppm (STEL)	Inhalation, Ingestion, dermal and/or eye contact	Irritation of respiratory system, CNS depression, mental confusion, headache, nausea, liver and kidney disturbance	CNS depression, liver and kidney disturbances, Cancer, adverse reproductive effects (female fertility, birth defects)	Respiratory System, central nervous system, liver, kidneys, heart	NA	1.47	57.8	NA	8.0	12.5
Arsenic (inorganic, as metal)	0.01 mg/m^3	0.01 mg/m^3 (TWA)	Inhalation, skin absorption, ingestion, dermal and/or eye contact	Ulceration of nasal septum, dermatitis, gastrointestinal disturbances	Cancer, lung, and lymphatic cancer	Liver, kidneys, skin, lungs, lymphatic system	NA	5.72	0	NA	NA	NA
Chromium (Cr)	As Cr III, 0.5 mg/m^3 As Cr VI, 0.5 ug/m^3	0.5 mg/m^3	Inhalation, Ingestion, Contact, Absorption	Caustic to skin and mucous membranes	Cr VI -Cancer	Lung, kidney, and liver	NA	2.7	NA	NA	NA	NA
Lead	0.05 mg/m^3	0.05 mg/m^3	Inhalation, Ingestion, Contact	Eye irritation	Weakness, anorexia, tremors, neuropathy, Hypo-tension	GI tract, CNS, kidneys, blood, gingival tissue	N/A	11.34	0	N/A	N/A	N/A
Benzene	1 ppm 5 ppm = STEL	0.5 ppm	Inhalation, Ingestion, Contact, Absorption	Irritation of eyes, skin, nose, and throat, headache, dizziness, nausea, staggered gait, fatigue	Cancer (leukemia), adverse reproductive effects (female fertility, birth defects)	Eyes, skin, respiratory system, blood, central nervous system, bone marrow	9.24	0.88	75	12	1.2	7.8

Notes:

PEL	=	Permissible Exposure Limit	UEL	=	Upper Explosive Limit	STEL	=	Short Term Exposure Limit
TLV	=	Threshold Limit Value	%	=	Percent	CNS	=	Central Nervous System
IP	=	Ionization Potential	mg/m^3	=	Milligrams per cubic meter of air	ppm	=	parts per million
eV	=	Electron volt	TWA	=	Time weighted average	°F	=	Degrees Fahrenheit
VP	=	Vapor Pressure	g/cm^3	=	Grams per cubic centimeter			
mm Hg	=	Millimeters of mercury	LEL	=	Lower Explosive Limit			

Properties of the Primary Contaminants of Concern (continued)

Contaminant	PEL	TLV	Route(s) of Exposure	Signs and Symptoms of Exposure		Target Organs	IP (eV)	Specific Gravity	VP (mm Hg)	Flash Point (°F)	LEL %	UEL %
				Acute	Chronic							
Toluene	200 ppm (750 mg/m³) Ceiling 300 ppm	20 ppm	Inhalation, Ingestion, Contact, Absorption	Irritation of eyes, skin, nose, drowsiness, fatigue, weakness, confusion, headache, nausea, dilated pupils	Liver and kidney damage	Eyes, skin, respiratory system, CNS, liver, kidneys	8.82	0.87	21	40	1.1	7.1
Ethylbenzene	100 ppm (435 mg/m³)	100 ppm (434 mg/m³)	Inhalation, Ingestion, Contact, Absorption	Irritation of eyes, and skin, may also cause conjunctivitis (eyes)	CNS depression, pulmonary aspiration	CNS, eyes, skin, respiratory system	8.76	0.87	7	55	0.8	6.7
Xylenes (o-, m-, p-isomers)	100 ppm	100 ppm	Inhalation, Ingestion, Contact, Absorption	Irritation of eyes, skin, nose	CNS, permanent brain and nervous system damage	CNS, liver, and urinary system/kidneys	21	0.864	8	76	1.0	7.0
Perchlorate (as potassium perchlorate)	None – 15 mg/ m³ (total nuisance dust)	Not established	Skin contact/absorption Inhalation of aerosol, Ingestion	Irritation of the eyes, skin, and respiratory tract	May have affects on the blood, when converts to nitrites resulting in formation of methemoglobin	Red Blood Cells, liver, kidneys	NA	Density 2.52 g/cm³	NA	NA	NA	NA
Nitrate (as potassium nitrate)	None- 15 mg/ m³ (total nuisance dust)	Not established	Inhalation, ingestion, dermal or eye contact	Irritation of the eyes, skin, and respiratory tract	May cause effects on the blood when converts to nitrites, resulting in formation of methemoglobin when ingested	Red Blood Cells, kidneys	NA	Density 2.11 g/cm³	NA	NA	NA	NA

Notes:

PEL	=	Permissible Exposure Limit	UEL	=	Upper Explosive Limit	STEL	=	Short Term Exposure Limit
TLV	=	Threshold Limit Value	%	=	Percent	CNS	=	Central Nervous System
IP	=	Ionization Potential	mg/m³	=	Milligrams per cubic meter of air	ppm	=	parts per million
eV	=	Electron volt	TWA	=	Time weighted average	°F	=	Degrees Fahrenheit
VP	=	Vapor Pressure	g/cm³	=	Grams per cubic centimeter			
mm Hg	=	Millimeters of mercury	LEL	=	Lower Explosive Limit			

ATTACHMENT C

USACE ACCIDENT INVESTIGATION REPORT (FORM 3394 [VER. 2] MAR. 1999)

(For Safety Staff only)	REPORT NO.	EROC CODE	**UNITED STATES ARMY CORPS OF ENGINEERS ACCIDENT INVESTIGATION REPORT** *(For Use of this Form See Help Menu and USACE Suppl to AR 385-40)*	**REQUIREMENT CONTROL SYMBOL: CEEC-S-8(R2)**

1. ACCIDENT CLASSIFICATION

PERSONNEL CLASSIFICATION	INJURY/ILLNESS/FATAL	PROPERTY DAMAGE	MOTOR VEHICLE INVOLVED	DIVING
GOVERNMENT ☐ CIVILIAN ☐ MILITARY	☐	☐ FIRE INVOLVED ☐ OTHER	☐	☐
☐ CONTRACTOR	☐	☐ FIRE INVOLVED ☐ OTHER	☐	☐
☐ PUBLIC	☐ FATAL ☐ OTHER		☐	

2. PERSONAL DATA

a. Name *(Last, First, MI)*	b. AGE	c. SEX ☐ MALE ☐ FEMALE	d. SOCIAL SECURITY NUMBER	e. GRADE

f. JOB SERIES/TITLE	g. DUTY STATUS AT TIME OF ACCIDENT	h. EMPLOYMENT STATUS AT TIME OF ACCIDENT
	☐ ON DUTY ☐ TDY ☐ OFF DUTY	☐ ARMY ACTIVE ☐ ARMY RESERVE ☐ VOLUNTEER ☐ PERMANENT ☐ FOREIGN NATIONAL ☐ SEASONAL ☐ TEMPORARY ☐ STUDENT ☐ OTHER *(Specify)*

3. GENERAL INFORMATION

a. DATE OF ACCIDENT *(month/day/year)*	b. TIME OF ACCIDENT *(Military time)* hrs	c. EXACT LOCATION OF ACCIDENT	d. CONTRACTOR'S NAME (1) PRIME: (2) SUBCONTRACTOR:

e. CONTRACT NUMBER	f. TYPE OF CONTRACT	g. HAZARDOUS/TOXIC WASTE ACTIVITY
☐ CIVIL WORKS ☐ MILITARY ☐ OTHER *(Specify)*	☐ CONSTRUCTION ☐ SERVICE ☐ A/E ☐ DREDGE ☐ OTHER *(Specify)*	☐ SUPERFUND ☐ DERP ☐ IRP ☐ OTHER *(Specify)*

4. CONSTRUCTION ACTIVITIES ONLY *(Fill in line and corresponding code number in box from list - see help menu)*

a. CONSTRUCTION ACTIVITY	(CODE) #	b. TYPE OF CONSTRUCTION EQUIPMENT	(CODE) #

5. INJURY/ILLNESS INFORMATION *(Include name on line and corresponding code number in box for items e, f & g - see help menu)*

a. SEVERITY OF ILLNESS/INJURY	(CODE) #	b. ESTIMATED DAYS LOST	c. ESTIMATED DAYS HOSPITALIZED	d. ESTIMATED DAYS RESTRICTED DUTY

e. BODY PART AFFECTED	(CODE)	g. TYPE AND SOURCE OF INJURY/ILLNESS	(CODE)
PRIMARY	#	TYPE	#
SECONDARY	#	SOURCE	#
f. NATURE OF ILLNESS/INJURY	#		

6. PUBLIC FATALITY *(Fill in line and correspondence code number in box - see help menu)*

a. ACTIVITY AT TIME OF ACCIDENT	(CODE) #	b. PERSONAL FLOATATION DEVICE USED? ☐ YES ☐ NO ☐ N/A

7. MOTOR VEHICLE ACCIDENT

a. TYPE OF VEHICLE	b. TYPE OF COLLISION	c. SEAT BELTS	USED	NOT USED	NOT AVAILABLE
☐ PICKUP/VAN ☐ AUTOMOBILE ☐ TRUCK ☐ OTHER *(Specify)*	☐ SIDE SWIPE ☐ HEAD ON ☐ REAR END ☐ BROADSIDE ☐ ROLL OVER ☐ BACKING ☐ OTHER *(Specify)*	(1) FRONT SEAT			
		(2) REAR SEAT			

8. PROPERTY/MATERIAL INVOLVED

a. NAME OF ITEM	b. OWNERSHIP	c. $ AMOUNT OF DAMAGE
(1)		
(2)		
(3)		

9. VESSEL/FLOATING PLANT ACCIDENT *(Fill in line and correspondence code number in box from list - see help menu)*

a. TYPE OF VESSEL/FLOATING PLANT	(CODE) #	b. TYPE OF COLLISION/MISHAP	(CODE) #

10. ACCIDENT DESCRIPTION *(Use additional paper, if necessary)*

11. CAUSAL FACTOR(S) *(Read Instruction Before Completing)*

a. (Explain YES answers in item 13)

	YES	NO
DESIGN: Was design of facility, workplace or equipment a factor?	☐	☐
INSPECTION/MAINTENANCE: Were inspection & maintenance procedures a factor?	☐	☐
PERSON'S PHYSICAL CONDITION: In your opinion, was the physical condition of the person a factor?	☐	☐
OPERATING PROCEDURES: Were operating procedures a factor?	☐	☐
JOB PRACTICES: Were any job safety/health practices not followed when the accident occurred?	☐	☐
HUMAN FACTORS: Did any human factors such as, size or strength of person, etc., contribute to accident?	☐	☐
ENVIRONMENTAL FACTORS: Did heat, cold, dust, sun, glare, etc., contribute to the accident?	☐	☐

a. *(CONTINUED)*

	YES	NO
CHEMICAL AND PHYSICAL AGENT FACTORS: Did exposure to chemical agents, such as dust, fumes, mists, vapors or physical agents, such as, noise, radiation, etc., contribute to accident?	☐	☐
OFFICE FACTORS: Did office setting such as, lifting office furniture, carrying, stooping, etc., contribute to the accident?	☐	☐
SUPPORT FACTORS: Were inappropriate tools/resources provided to properly perform the activity/task?	☐	☐
PERSONAL PROTECTIVE EQUIPMENT: Did the improper selection, use or maintenance of personal protective equipment contribute to the accident?	☐	☐
DRUGS/ALCOHOL: In your opinion, was drugs or alcohol a factor to the accident	☐	☐

b. WAS A WRITTEN JOB/ACTIVITY HAZARD ANALYSIS COMPLETED FOR TASK BEING PERFORMED AT TIME OF ACCIDENT?

☐ YES *(If yes, attach a copy.)* ☐ NO

12. TRAINING

a. WAS PERSON TRAINED TO PERFORM ACTIVITY/TASK?	b. TYPE OF TRAINING.	c. DATE OF MOST RECENT FORMAL TRAINING.
☐ YES ☐ NO	☐ CLASSROOM ☐ ON JOB	(Month) (Day) (Year)

13. FULLY EXPLAIN WHAT ALLOWED OR CAUSED THE ACCIDENT; INCLUDE DIRECT AND INDIRECT CAUSES *(See instruction for definition of direct and indirect causes.) (Use additional paper, if necessary)*

a. DIRECT CAUSE

b. INDIRECT CAUSE(S)

14. ACTION(S) TAKEN, ANTICIPATED OR RECOMMENDED TO ELIMINATE CAUSE(S).

DESCRIBE FULLY:

15. DATES FOR ACTIONS IDENTIFIED IN BLOCK 14.

a. BEGINNING (Month/Day/Year)	b. ANTICIPATED COMPLETION (Month/Day/Year)

c. SIGNATURE AND TITLE OF SUPERVISOR COMPLETING REPORT	d. DATE *(Mo/Da/Yr)*	e. ORGANIZATION IDENTIFIER *(Div, Br, Sect)*	f. OFFICE SYMBOL
CORPS _____ CONTRACTOR _____			

16. MANAGEMENT REVIEW *(1st)*

a. ☐ CONCUR b. ☐ NON CONCUR c. COMMENTS

SIGNATURE	TITLE	DATE

17. MANAGEMENT REVIEW *(2nd - Chief Operations, Construction, Engineering, etc.)*

a. ☐ CONCUR b. ☐ NON CONCUR c. COMMENTS

SIGNATURE	TITLE	DATE

18. SAFETY AND OCCUPATIONAL HEALTH OFFICE REVIEW

a. ☐ CONCUR b. ☐ NON CONCUR c. ADDITIONAL ACTIONS/COMMENTS

SIGNATURE	TITLE	DATE

19. COMMAND APPROVAL

COMMENTS

COMMANDER SIGNATURE	DATE

*U.S. GOVERNMENT PRINTING OFFICE: 1993-0-791-757

10.	ACCIDENT DESCRIPTION *(Continuation)*

13a.	DIRECT CAUSE *(Continuation)*

13b.	INDIRECT CAUSES *(Continuation)*

14.	ACTION(S) TAKEN, ANTICIPATED, OR RECOMMENDED TO ELIMINATE CAUSE(S) *(Continuation)*

ATTACHMENT D

REPORTING CIVILIAN EMPLOYEE INJURIES AND ILLNESSES (USACE, 1990)

APPENDIX E

Reporting Civilian Employee Injuries and Illnesses+

When a civilian employee sustains a work-related injury or illness he will immediately notify his supervisor. The supervisor will contact the FOA*s designated Federal Employees* Compensation Program (FECA) Program Administrator for instructions on obtaining medical treatment and completing and filing the required forms. (Forms are described on page E-5.)

TRAUMATIC INJURY.

1. Notice of Injury. The employee (or person acting on his behalf) and supervisor will complete Form CA-l. If the supervisor determines that the injury was medically related and warrants medical care, the supervisor will authorize the medical care in accordance with paragraph 2, below. If the employee incurs medical expense or loses time from work beyond the date of injury the FOA FECA Program Administrator will submit the Form CA-l to the Office of Workers* Compensation Programs (OWCP) district office: otherwise the form should be retained in the employee*s Employee Medical Folder in accordance with OWCP requirements.

a. The supervisor will review the form for completeness and accuracy and assist the claimant in correcting any deficiencies.

b. The supervisor will advise the employee:

(1) Of his right to continuation of pay (COP) or annual or sick leave;

(2) Of his right to select the physician or facility which is to provide treatment.

(3) Whether COP will be controverted, and if so, the basis for the controversion and whether pay will be terminated;

(4) Of the employee*s responsibility to submit medical evidence establishing the fact of disability within ten working days or risk termination of COP;

+ This appendix describes the procedures and forms for reporting civilian employee injuries and illnesses. The intent is to provide employees and supervisors with guidance on the safety and occupational health, not Workers* Compensation, requirements of such reporting. Information on processing OWCP claims, obtaining medical care and compensation, etc., can be obtained from the FOA*s Federal Employees* Compensation Act (FECA) Program Administrator.

(5) To obtain, from the medical care provider, a description of work restrictions if light duty is available and, when a specific job has been identified for the employee*s light duty, to seek the medical care provider*s approval of the job. See paragraph 2.c., below.

c. The supervisor will complete his portion of Form CA-l and sign and return to the employee the “Receipt of Notice of Injury” attached to the form.

d. The supervisor will complete USACE Accident Investigation Report, ENG Form 3394, through block 15. A copy of the completed ENG Form 3394 will be attached to the original Form CA-1 and forwarded to the FOA Safety and Occupational Health Office as expeditiously as possible. The original of the completed ENG Form 3394 shall be forwarded, with its instructions, through management channels as indicated on the form.

e. The Safety and Occupational Health Office will encode the following information on the original Form CA-l. Upon completion of the encoding (but within three working days of its receipt) the Safety and Occupational Health Office will make a copy of the completed Form CA-1 and forward the original to the FOA FECA Program Administrator.

(1) Type and source code (shaded items b. and c. on Form CA-l) from item 5.g. on ENG Form 3394.

(2) If applicable, enter “first aid case” on the upper-right corner of page 2. The Safety and Occupational Health Office shall review the accident information and determine if the accident should be classified in accordance with the definition of first aid case as given in this supplement.

(3) OSHA site code (item 17 on page 2), which is the FOA*s Unit Identification Code (UIC). If the FOA has been assigned both a civil and military UIC, the military UIC will be used; if the FOA has been assigned only a civil UIC, the civil UIC will be used. In the event an FOA has sub-elements (e.g., area offices or detachments) and the sub-elements have their own unique UIC, the UIC of the sub-element will be used when reporting accidents occurring within them.

f. The Safety and Occupational Health Office will review the USACE Accident Investigation Report, ENG Form 3394, to ensure:

(1) All required information is provided and correct, obtaining omitted information or information updates as required.

(2) That the severity of injury/illness as indicated on the

accident report form is correct.

(3) That accident causation correctly addresses operational and managerial deficiencies and the actions taken, anticipated, or recommended to eliminate causes are effective.

g. Upon receipt of the CA-1 from the Safety and Occupational Health Office, the FOA*s FECA Program Administrator will:

(1) Review the completed form for sufficiency and coordinate unresolved deficiencies with the injured employee and supervisor.

(2) Encode the occupation code (shaded item a. on Form CA-1). This code is made up of the two letters designating the employee*s pay plan and the four numbers of the employee*s occupational series.

(3) Encode the OWCP agency code (item 17 on page 2). The OWCP agency code for USACE employees is “3493” plus the servicing CPO two-digit alpha identifier code. Do not use the USACE agency code for injured non-USACE employees that are serviced by the servicing CPO.

(4) Enter the employee*s duty station zip code in item 18 on page 2. The zip code indicated in this block must be the zip code of the employee*s duty station at the time of the injury, not the zip code of a reporting office processing compensation forms: duty station is defined as the building or other place (base, post, or activity) where an employee regularly reports for duty. Those employees whose official duty station does not have a zip code (e.g., employees whose official duty station is a dredge) shall use the zip code of the unit or section, as applicable, to which they are assigned. For an employee officially detailed (not TDY) to another duty station, use the zip code for the detail duty station.

2. Medical Care. If an employee requires medical care because of a work-related injury, the supervisor will promptly complete his portions of Forms CA-16, CA-17, and OWCP-1500a and accompany the employee to the medical care provider.

a. The supervisor is responsible for providing the medical care provider with Forms CA-16, CA-17, and OWCP-1500a, to be completed by the supervisor and the provider. Upon completion of the medical care, the supervisor will retain a copy of the Form CA-17 and forward the Forms CA-17, CA-20, and CA-20a to the FOA*s FECA Program Administrator. The medical care provider will forward Forms CA-16 and OWCP-1500a to the OWCP district office.

b. For all cases sent to OWCP, a medical report from the attending physician is required. This report may be made on Form

CA-16 or by a narrative report on the physician*s letterhead stationary, or in the form of an emergency room summary.

c. Form CA-17 will be used by the agency to obtain interim medical reports concerning the employee*s fitness for duty; it should be used initially with Form CA-16. The supervisor will complete his portion of the Form CA-17 describing the physical requirements of the employee*s job, attach a copy of the FOA*s Light-duty Program, and note the availability of any light duty. The medical care provider should monitor the employee*s medical status and ability to return to light or full duty and provide an original copy of Form CA-17 to the employee*s supervisor at reasonable (preferably weekly). intervals. The supervisor and FOA FECA program administrator are responsible for maintaining contact with both the medical provider and the injured employee to ensure the employee is returned to work as soon as he is medically able.

OCCUPATIONAL DISEASE.

1. Notice of Occupational Disease. The employee (or person acting on his behalf) and supervisor will complete Form CA-2. The employee should also complete the appropriate checklist on Forms CA-35a through CA-35h, as applicable, for the disease claimed. The supervisor will explain the need for detailed information to the employee and advise him to furnish the supporting medical and factual information requested on the checklist: this information shall accompany the appropriate Forms CA-35a through CA-35h when it is submitted.

a. The supervisor will:

(1) Review Form CA-2 for completeness and accuracy and assist the claimant in correcting any deficiencies found.

(2) Of his right to select the physician or facility which is to provide treatment.

(3) Advise the employee of the right to elect sick or annual leave or leave without pay pending adjudication of the claim.

(4) Complete his portion of Form CA-2 and sign and return to the employee the “Receipt of Notice of Injury” attached to the form.

(5) Complete USACE Accident Investigation Report, ENG Form 3394, through block 15. A copy of the completed ENG Form 3394 will be attached to the original Form CA-2 and forwarded to the Safety and Occupational Health Office as expeditiously as possible. The original of the completed ENG Form 3394 shall be

forwarded, with its instructions, through management channels as indicated on the form.

(6) Prepare a supporting statement to include exposure (monitoring) data, test results, copies of previous medical examinations, and/or witness statements, depending on the nature of the case. The appropriate checklist on Forms CA-35a through CA-35h may be used to coordinate compilation of material by FOA personnel, including compensation specialists and safety and occupational health personnel.

b. The Safety and Occupational Health Office will encode the following information on the original Form CA-2:

(1) Type and source codes (shaded items b. and c. on Form CA-2) from item 5.g. on ENG Form 3394.

(2) OSHA site code (item 17 on page 2), which is the FOA*s Unit Identification Code (UIC). If the FOA has been assigned both a civil and military UIC, the military UIC will be used; if the FOA has been assigned only a civil UIC, the civil UIC will be used. In the event an FOA has sub-elements (e.g., area offices or detachments) and the sub-elements have their own unique UIC, the UIC of the sub-element will be used when reporting accidents occurring within them.

Upon completion of the encoding (but within three working days of its receipt) the Safety and Occupational Health Office will make a copy of the completed Form CA-2 and forward the original to the FOA*s FECA Program Administrator.

c. The Safety and Occupational Health Office will review the USACE Accident Investigation Report, ENG Form 3394, to ensure:

(1) All required information is provided and correct, obtaining omitted information or information updates as required.

(2) That the severity of injury/illness as indicated on the accident report form is correct.

(3) That illness/disease causation correctly addresses operational and managerial deficiencies and actions taken, anticipated, or recommended to eliminate causes are effective.

d. Upon receipt of the CA-2 from the Safety and Occupational Health Office, the FOA*s FECA Program Administrator will:

(1) Review the completed form for sufficiency and coordinate unresolved deficiencies with the injured employee and supervisor.

(2) Encode the occupation code (shaded item a. on Form CA-2). This code is made up of the two letters designating the employee*s pay plan and the four numbers of the employee*s occupational series.

(3) Encode the OWCP agency code (item 17 on page 2). The OWCP agency code for USACE employees is “3493” plus the servicing CPO two-digit alpha identifier code. Do not use the USACE agency code for injured non-USACE employees that are serviced by the servicing CPO.

(4) Enter the employee*s duty station zip code in item 18 on page 2. The zip code indicated in this block must be the zip code of the employee*s duty station at the time of the injury, not the zip code of a reporting office processing compensation forms: duty station is defined as the building or other place (base, post, or activity) where an employee regularly reports for duty. Those employees whose official duty station does not have a zip code (e.g., employees whose official duty station is a dredge) shall use the zip code of the unit or section, as applicable, to which they are assigned. For an employee <u>officially</u> detailed (not TDY) to another duty station, use the zip code for the detail duty station.

2. Medical Care. Only in rare instances is medical care authorized by the employing agency in occupational disease claims. The agency must contact OWCP before issuing a Form CA-16 in such a claim.

<u>FORMS</u>. CA and OWCP forms can be obtained from the Government Printing Office: these forms can be reproduced. Submit purchase orders to the Superintendent of Documents, U.S. Government Printing Office, Washington, DC, 20402.

1. CA-1, Federal Employee*s Notice of Traumatic Injury and Claim for Continuation of Pay/Compensation.

2. CA-2, Federal Employee*s Notice of Occupational Disease and Claim for Compensation.

3. CA-16, Authorization for Examination and/or Treatment.

4. CA-17, Duty Status Report.

5. CA-20, Attending Physician*s Report.

6. CA-20a, Attending Physician*s Supplemental Report.

7. CA-35 series, Evidence Required in Support of Claim for:

a. -a, Occupational Disease.

b. -b, Hearing Loss.

c. -c, Asbestos-related Illness.

d. -d, Work-related Coronary/Vascular Condition.

e. -e, Work-related Skin Disease.

f. -f, Work-related Pulmonary Illness (not Asbestosis).

g. -g, Work-related Psychiatric Illness.

h. -h, Work-related Carpal Tunnel Syndrome.

8. ENG Form 3394, USACE Accident Investigation Report.

9. OWCP-1500a, Federal Employee*s Compensation Program Medical Provider*s Claim Form.

APPENDIX B

SITE-SPECIFIC ADDENDUM TO BASEWIDE QUALITY ASSURANCE PLAN

QUALITY ASSURANCE PROJECT PLAN ADDENDUM

NITRATE CHARACTERIZATION STUDY
HOLLOMAN AIR FORCE BASE, NEW MEXICO

Prepared for:

49 CES/CEAN
Holloman Air Force Base
New Mexico

Under Contract to:

U.S. Army Corps of Engineers
Omaha District
1616 Capitol Avenue
Omaha Nebraska 68102-1618

Prepared by:

NationView, LLC
1608 13th Avenue South, Suite 160
Birmingham, Alabama 35205
NationView Project No. 11-0017

Contract No. W9128F-11-D-0029
Task Order No. 0001

January 2012

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QUALITY ASSURANCE PROJECT PLAN ADDENDUM

NITRATE CHARACTERIZATION STUDY
HOLLOMAN AIR FORCE BASE, NEW MEXICO

REVIEW SHEET

COMMITMENT TO IMPLEMENT THIS QUALITY ASSURANCE PROJECT PLAN ADDENDUM

		1/5/2012
David D. Martin Corporate Sponsor	Signature	Date
		1/5/2012
Frank Gardner, P.G. Program Manager	Signature	Date
		1/5/2012
Jim Moore, P.G. Sr. Geologist, Field Manager	Signature	Date
		1/5/2012
Marcia Olive Project Chemist	Signature	Date

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QUALITY ASSURANCE PROJECT PLAN ADDENDUM
NITRATE CHARACTERIZATION STUDY
HOLLOMAN AIR FORCE BASE, NEW MEXICO

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4-1 Summary of Nitrate Characterization Study Field QC Samples
4-2 Summary of Laboratory QC Limits

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LIST OF ACRONYMS

Bhate	Bhate Environmental Associates, Inc.
DoD	Department of Defense
EDD	Electronic data deliverable
ELAP	Environmental Laboratory Accreditation Program
ERP	Environmental Restoration Program
HAFB	Holloman Air Force Base
LF-58	Incinerator Landfill
NELAP	National Environmental Laboratory Accreditation Program
OT-04	Acid Trailer Burial Site
OT-37	Early Missile Test Site
OT-38	Test Sled Maintenance Area
QA	Quality Assurance
QAM	Quality Assurance Manual
QAPP	Quality Assurance Project Plan
QC	Quality Control
SOPs	Standard Operating Procedures
SS-36	Unconventional Fuels Area Spill Site
SS-39	Missile Fuel Spill Area
TA	Test America Laboratories of Savannah, Georgia
USACE	United States Army Corps of Engineers
USEPA	United States Environmental Protection Agency

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PREFACE

This Quality Assurance Project Plan Addendum (QAPP Addendum) has been developed to assure that sample collection, analyses, and evaluations are legally and scientifically defensible for the Nitrate Characterization Study at Holloman Air Force Base (HAFB), New Mexico. This document is an addendum to the *Basewide Quality Assurance Project Plan, Holloman Air Force Base, New Mexico* (Bhate Environmental Associates, Inc. [Bhate], 2003) (Basewide QAPP) and must be used in conjunction with that document. This document contains site specific information for the work at several Environmental Restoration Program (ERP) sites (Acid Trailer Burial Site [OT-04], Unconventional Fuels Area Spill Site [SS-36], Early Missile Test Site [OT-37], Test Sled Maintenance Area [OT-38], Missile Fuel Spill Area [SS-39], and the Incinerator Landfill [LF-58]) included in the *Nitrate Characterization Study Work Plan, Holloman Air Force Base, New Mexico* (NationView, 2011).

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1 INTRODUCTION

NationView, LLC, has been retained by the U.S. Army Corps of Engineers (USACE), Omaha District under contract W9128F-11-D-0029, Task Order No. 0001, to conduct a Nitrate Characterization Study at Holloman Air Force Base (HAFB), New Mexico (USACE, 2011).

The primary objectives of this work are twofold; first to conduct a background study of nitrate and other nitrogen-bearing compounds in groundwater and soil to establish reliable background levels (Nitrate Background Study) and secondly to conduct a Nitrate Source Area Investigation at Environmental Restoration Program (ERP) sites where nitrate is a suspected groundwater contaminant of anthropogenic origin (e.g., ERP sites which were utilized for manufacturing, storing, or disposing liquid or solid rocket fuel propellants which contained nitrogen compounds).

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2 PROJECT LABORATORY

The soil and groundwater analysis for this project will be performed by Test America of Savannah, Georgia (TA).

TA-Savannah Laboratory
5102 LaRoche Avenue
Savannah, GA 31404
Phone: (912) 354-7858
Fax: (912) 352-0165

The laboratory personnel who will be involved with this project include:

Ms. Linda Wolfe, TA Project Manager

TA is certified by the National Environmental Laboratory Accreditation Program (NELAP), holds the Department of Defense (DoD) Environmental Laboratory Accreditation Program certification, and has extensive previous experience in working on USACE projects. The TA Quality Assurance Manual (QAM) and Standard Operating Procedures (SOPs) have been reviewed by NationView and found to meet all the requirements for this project. The QAM and SOPs are available for further review if required.

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3 DATA CATEGORIES

The data use determines the required levels of data quality. The two levels of data quality established by the USACE are screening and definitive. Under this QAPP Addendum, the data to be generated under each level in this additional delineation are presented in Table 3-1 (Screening) and Table 3-2 (Definitive). The screening data will be generated in the field using field instruments. The definitive data generated by the laboratory will be presented as a Level IV data package, using a standard turn-around-time for the soil and groundwater samples collected during the investigation. All definitive data produced by the laboratory will also be presented in an electronic data deliverable (EDD) format.

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4 DATA QUALITY ASSURANCE AND QUALITY CONTROL

The general data quality assurance (QA) and quality control (QC) requirements for HAFB are presented in the Basewide QAPP (Bhate, 2003). The field QC requirements for this project are presented in Table 4-1. The project specific laboratory QC limits are listed in Table 4-2.

All final definitive data will be reviewed and validated by a NationView Senior Chemist based on the logic and guidelines of the *USEPA* [United States Environmental Protection Agency] *Contract Laboratory Program National Functional Guidelines for Inorganic Superfund Data Review* (USEPA, 2010) and the site specific laboratory QC limits presented in this QAPP Addendum.

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5 REFERENCES

Bhate Environmental Associates Inc. November 2003. *Basewide Quality Assurance Project Plan, Holloman Air Force Base, New Mexico.*

NationView. November 2011. *Nitrate Characterization Work Plan, Holloman Air Force Base, New Mexico.*

U.S. Army Corps of Engineers, Omaha District. June 27, 2011. *Statement of Work, Nitrate Study.*

United States Environmental Protection Agency (USEPA). January 2010. *USEPA Contract Laboratory Program National Functional Guidelines for Inorganic Superfund Data Review*.

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TABLES

Table 3-1
Summary of Screening Data

Parameter	Matrix	Testing Method
Volatile Organic Compounds (VOCs)	Soil	Organic Vapor Analyzer
Noticeable odors	Soil	Olfactory sense
pH	Water	Multi-parameter sonde and a flow-through cell
Conductivity	Water	Multi-parameter sonde and a flow-through cell
Dissolved Oxygen	Water	Multi-parameter sonde and a flow-through cell
Turbidity	Water	Multi-parameter sonde and a flow-through cell
Temperature	Water	Multi-parameter sonde and a flow-through cell

Table 3-2
Summary of Definitive Data

Parameter	Matrix	Preparation Method	Analytical Method
Nitrate	Soil	USEPA Method 300/9056	USEPA Method 300/9056
Nitrite	Soil	USEPA Method 300/9056	USEPA Method 300/9056
Ammonia	Soil	USEPA Method 350.1	USEPA Method 350.1
TKN	Soil	USEPA Method 351.2	USEPA Method 351.2
Nitrate	Groundwater	USEPA Method 300/9056	USEPA Method 300/9056
Nitrite	Groundwater	USEPA Method 300/9056	USEPA Method 300/9056
Ammonia	Groundwater	USEPA Method 350.1	USEPA Method 350.1
TKN	Groundwater	USEPA Method 351.2	USEPA Method 351.2
TDS	Groundwater	USEPA SM19 Method 2540C	USEPA SM19 Method 2540C

Notes:
USEPA = U.S. Environmental Protection Agency
SM = Standard Methods for the Examination of Water and Wastewater
TKN = Total Kjeldahl Nitrogen
TDS = Total Dissolved Solids

Table 4-1
Summary of Nitrate Characterization Study Field QC Samples

Project Phase	Matrix	Analysis	Number of Field Samples	Field Duplicates [1]	MS [2]	MSD [3]	Equipment Rinsate Blanks [4]	Total
Nitrate Background Study	Drainage Outcrop Surface Soil	Nitrate per USEPA Method 300/9056	40	4	2	2	NA	48
		Nitrite per USEPA Method 300/9056	40	4	2	2	NA	48
		Ammonia per USEPA Method 350.1	40	4	2	2	NA	48
		TKN per USEPA Method 351.2	40	4	2	2	NA	48
	Soil	Nitrate per USEPA Method 300/9056	72	8	4	4	4	92
		Nitrite per USEPA Method 300/9056	72	8	4	4	4	92
		Ammonia per USEPA Method 350.1	72	8	4	4	4	92
		TKN per USEPA Method 351.2	72	8	4	4	4	92
	Groundwater	Nitrate per USEPA Method 300/9056	24	3	2	2	NA	31
		Nitrite per USEPA Method 300/9056	24	3	2	2	NA	31
		Ammonia per USEPA Method 350.1	24	3	2	2	NA	31
		TKN per USEPA Method 351.2	24	3	2	2	NA	31
		TDS per USEPA SM19 Method 2540C	24	3	2	2	NA	31
Nitrate Source Area Investigation	Soil	Nitrate per USEPA Method 300/9056	54	6	3	3	3	69
		Nitrite per USEPA Method 300/9056	54	6	3	3	3	69
		Ammonia per USEPA Method 350.1	54	6	3	3	3	69
		TKN per USEPA Method 351.2	54	6	3	3	3	69
	Groundwater	Nitrate per USEPA Method 300/9056	62	7	4	4	NA	77
		Nitrite per USEPA Method 300/9056	62	7	4	4	NA	77
		Ammonia per USEPA Method 350.1	62	7	4	4	NA	77
		TKN per USEPA Method 351.2	62	7	4	4	NA	77
		TDS per USEPA SM19 Method 2540C	62	7	4	4	NA	77

Notes:

USEPA = U.S. Environmental Protection Agency
SM = Standard Methods for Chemical Analysis of Water and Wastewater
MS = Matrix Spike

MSD = Matrix Spike Duplicate
TKN = Total Kjeldahl Nitrogen
TDS = Total Dissolved Solids
NA = Not Applicable

[1] Duplicate samples will be collected at a minimum frequency of 1 for every 10 primary samples
[2] MS samples will be collected at a minimum frequency of 1 for every 20 primary samples collected
[3] MSD samples will be collected at a minimum frequency of 1 for every 20 primary samples collected
[4] Equipment rinsate blanks will be a water matrix, but are related to soil sampling activities with non dedicated equipment

Table 4-2
Summary of Laboratory QC Limits

Parameter	CAS No.	RL / Evaluation Criteria					LCS				Matrix Spike Water			Matrix Spike Soil		
		Water			Soil		Water		Soil		MS Recovery		MSD	MS Recovery		MSD
		RL	NMWQCC[1]	USEPA MCL [2]	RL	SSL[3]	LCL	UCL	LCL	UCL	LCL	UCL	RPD	LCL	UCL	RPD
General Chemistry		mg/L	mg/L	mg/L	mg/kg	mg/kg	%	%	%	%	%	%	%	%	%	%
Nitrate by USEPA Method 300/9056	14797-55-8	0.1	10	10	1	125,000	86	110	90	110	86	110	20	90	110	20
Nitrite by USEPA Method 300/9056	14797-65-0	0.05	NV	1	1	7,820	90	110	90	110	90	110	20	90	110	20
TKN by USEPA Method 351.2	--	0.20	NV	NV	50	NV [4]	75	125	75	125	75	125	40	75	125	40
Ammonia by USEPA Method 350.1	7664-41-7	0.10	NV	NV	0.30	NV [4]	90	110	90	110	90	110	30	90	110	30
Total Dissolved Solids by USEPA SM18 Method 2540C	--	10	1,000	500 [5]	--	--	90	110	--	--	--	--	--	--	--	--

Notes:

USEPA = U.S. Environmental Protection Agency
LCL = Lower Control Limit
LCS = Laboratory Control Sample
mg/kg = Milligrams per kilogram
mg/L = Milligrams per liter
MS = Matrix Spike
MSD = Matrix Spike Duplicate
RL = Reporting Limit
NV = No Value
CAS No. = Chemical Abstract Number
NMED = New Mexico Environment Department
SSL = Soil Screening Level
MCL = Maximum Contaminant Level
NMWQCC = New Mexico Water Quality Control Commission
SM = Standard Methods for the Examination of Water and Wastewater
TKN = Total Kjeldahl Nitrogen

[1] NMWQCC Standards for Groundwater, if 10,000 mg/L TDS Concentration or Less, New Mexico Administrative Code 20.6.2.3103
[2] USEPA National Primary Drinking Water Regulations MCLs (816-F-09-004, May 2009)
[3] NMED, Technical Background Document for Development of Soil Screening Levels, Revision 5.0, December 2009 (Residential Soil)
[4] No Value established for NMED Residential SSL (December 2009) and USEPA Regions 3, 6, and 9 RSLs (June 2011)
[5] USEPA Secondary Drinking Water Standard (816-F-09-004, May 2009)

APPENDIX C

FIELD FORMS

HTW DRILLING LOG

		HOLE NO.
1. COMPANY NAME	2. DRILLING CONTRACTOR	SHEET OF SHEETS
3. PROJECT	4. LOCATION	
NAME OF DRILLER	6. MANUFACTURER'S DESIGNATION OF DRILL	
7. SIZES & TYPES OF DRILLING & SAMPLING EQUIPMENT	8. HOLE LOCATION North East	
	9. SURFACE ELEVATION (ft. NGVD)	
	10. DATE STARTED	11. DATE COMPLETED
12. OVERBURDEN THICKNESS	15. DEPTH GROUNDWATER ENCOUNTERED	
13. DEPTH DRILLED INTO ROCK	16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED	
14. TOTAL DEPTH OF HOLE	17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY)	

18. GEOTECHNICAL SAMPLES	DISTURBED	UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES			
20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE REC %
22. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR		

ELEV a	DEPTH b	DESCRIPTION OF MATERIALS c	Field Screening Results d	Geotech Sample or Core Box No. e	Analytical Sample No. f	Blow Counts g	REMARKS h
	0						
	1						
	2						
	3						
	4						
	5						

PROJECT

HOLE NO.

HTW DRILLING LOG

PROJECT	INSPECTOR	HOLE NO SHEET OF SHEETS

ELEV a	DEPTH b	DESCRIPTION OF MATERIALS c	Field Screening Results d	Geotech Sample or Core Box No. e	Analytical Sample No. f	Blow Counts g	REMARKS h

PROJECT HOLE NO.

NATIONVIEW

DAILY QUALITY CONTROL REPORT

Project Number/Name: _____ DQCR No.: _____

Date ___/___/___ Time On-Site: _____ Time Off-Site: _____ Site Name: _____

Weather: _____ Temperature: _____ Wind: _____

Contractor Personnel On-Site: _____

_____

Visitors On-Site: _____

Summary of Work Performed: _____

_____

_____

_____

_____

_____

Level of Health & Safety Protection: _____

_____

Equipment Used: _____

_____

Calibration(s) Performed: _____

_____

Equipment Problem(s)/Remedies: _____

_____

Samples Collected* _____

_____

_____

Sample Collection Method(s): _____

Quality Control: _____

Proposed Schedule for Tomorrow: _____

Additional Remarks: _____

Signature: _____ **Job Title:** _____

*Indicates sample media: groundwater, surface water, soil or sediment; sample type: composite, grab, split, duplicate, rinsate, and sample I.D. numbers

NATIONVIEW

CALIBRATION AI ,AINTENANCE LOG

_____ of _____

LOCATION	Site:	Location ID:	Date:
	Project Name:	Project No./Phase:	Recorded By:
EQUIPMENT	Description/Model No.:	Bhate ID No.:	Equipment Serial No.:
	Manufacturer:	Vendor:	Location Stored:
CALIBRATON INFO	Calibration Standards:	Source:	Lamp Voltage:
	Calibration Concentration:	Instrument Settings:	Alarms:
	Expiration:		Response Factors:

Parameter	Date	Time	Operator	Lot #	Battery Check	Calibration Method	True Value	Meter Value	Acceptable?[a] (Y/N)	Comments

[a] If calibration is unacceptable recalibrate and make new entry. Calibration checks should be made at the end of each day to check for instrument stability.

NATIONVIEW

CALIBRATION AND MAINTENANCE LOG

DATE	NAME/SIGNATURE	DESCRIPTION OF MAINTENANCE ACTIVITY

MONITORING WE VELOPMENT FORM

NATIONVIEW

LOCATION	Site:	Location ID:	Date:
	Project Name: Nitrate Characterization Study	Project No./Phase: 11-0017	Recorded By:
EQUIPMENT	Pump Type/ID#:	Water Quality Meter/ID#:	PID Type/ID#:
	Water Level Indicator Type/ID#:	Other Equipment/ID#:	Decon Method: Liquinox / DI water rinse
	Tubing Type/Diameter (in):	Other Equipment/ID#:	PPE Level: D C B
WELL INFO	(A) Initial Depth to Water (ft BTOC):	Casing: Type PVC Diam. (in) 2.00	Weather:
	(B) Total Well Depth (ft BTOC):	(E) Casing Volume Multiplier (gal/lin ft): 0.16	Background PID (ppm):
	(C) Water Column Thickness (ft) (B-A):	Screen Length (lin ft):	Breathing Zone PID (ppm):
	(D) Well Volume (gal) (C x E):	Screen Info: Type: PVC Size:	Well Opening PID (ppm):

CASING INFO										
Riseer/Well Casing Inner Diameter (in)	0.50	1.00	1.50	2.00	3.00	4.00	5.0	6.0	8.0	
(D) Casing Volume Multiplier(gal/lin ft)	0.02	0.04	0.10	0.16	0.38	0.65	1.02	1.47	2.61	

DATE (mmddyy)	TIME (24 Hr)	Water Level (BTOC)	Volume Removed (mL)	Pumping Rate (mLpm)	Temp (C)	pH	Cond. (mS/cm)	Dissolved Oxygen (mg/l)	Turbidity (NTU)	Oxidation Reduction Potential (mV)	Remarks (odor, clarity
DEVELOPMENT CRITERIA											
+/- 10% unless otherwise noted					+/- 10%	+/- 0.1	+/- 10%	+/- 10%	+/- 5 NTU	NA	

COMMENTS:

MONITORING WELL DEVELOPMENT FORM

NATIONVIEW

LOCATION	Site:	Location ID:	Date:
	Project Name: Nitrate Characterization Study	Project No./Phase: 11-0017	Recorded By:

DATE (mmddyy)	TIME (24 Hr)	Water Level (BTOC)	Volume Removed (mL)	Pumping Rate (mLpm)	Temp (C)	pH	Cond. (mS/cm)	Dissolved Oxygen (mg/l)	Turbidity (NTU)	Oxidation Reduction Potential (mV)	Remarks (odor, clarity

NATIONVIEW

WATER LEVEL DATA SUMMARY

Project Name:		Date:		Page		of	
Project Number:		Site Name:					
Field Personnel #1		Field Personnel #2					
Survey Datum (NGVD)		Weather (previous 24 hours):					
Measuring Device							

Well Number	Time (hhmm)	Measuring Point		Depth to Water (ft, TOC)	Elevation of Water (ft, NGVD)
		Description	Elevation (ft, NGVD)		

Notes: NGVD = National Geodetic Vertical Datum
TOC = Top of Well Casing

Comments/Observations:

NATIONVIEW

WATER LEVEL DATA SUMMARY (Contd.)

Project Name:	HAFB-	Date:		Page		of	
Project Number:		Site Name:					

Well Number	Time (hhmm)	Measuring Point		Depth to Water (ft, TOC)	Elevation of Water (ft, NGVD)
		Description	Elevation (ft, NGVD)		

Notes: NGVD = National Geodetic Vertical Datum
TOC = Top of Well Casing

Comments/Observations:

NATIONVIEW

Page: _____ of _____

Project No: 11-0

COC Number(1): _____

LIMS Number: _____

Chain of Custody and Analytical Request

Facility/Base I.D.: HAFB, New Mexico

Project/Site Name: Nitrate Characterization Study

Client Name: USACE- Omaha

Collected by:

Field Sample ID (30 Characters Max)	ERPIMS LOCID (15 Characters Max)	Date Collected (dd-mmm-yyyy)	Time Collected (Military) (hhmm)	Sample Depth (beginning - ending)	SA Code (2)	Sample Number (3)	Sample Matrix (4)	Sample Analysis Requested (5): Number of containers	Nitrate (353.2)	Nitrite (353.2)	TKN (351.2)	Ammonia (350.1)	TDS (2540C)							Quality Assurance Samples (6): Ambient Blank Lot Control Number	Equipment Blank Lot Control Number	Trip Blank Lot Control Number	Cooler ID
				-																			
				-																			
				-																			
				-																			
				-																			
				-																			
				-																			
				-																			
				-																			

COMMENTS: _____

Custody Transfers Prior to Receipt by Laboratory

Relinquished By (Signed)	Date	Time	Received by (signed)	Date	Time
1.			1.		
2.			2.		
3.			3.		

Sample Delivery Details / Laboratory Receipt

Delivered Directly to Lab: _____ Shipped No.: _____

Method of Shipment: _____ Airbill Number: _____

Analytical Lab: _____ Delivery Location: _____

Lab Recipient: Delivery Date/Time:

1.) Chain of Custody Number = date collected + custody number (e.g. 09-02-1999-01)

2.) Sample Type (SA) Codes: N = Normal Sample, TB = Trip Blank (-c) Sample, FD = Field Duplicate (-a) Samples, FR = Field Replicate (-b) Samples, EB = Equipment Blank (-d) Samples, MS = Matrix Spike, SD = Matrix Spike Duplicate, AB = Ambient Blank (-e)

3.) Sample Number: Unique sample number collected from a particular location per day. (e.g. Groundwater sample collected from MW-1 on 10/10/99 = 01, if sampled again on 10/10/99 = 02, etc.)

4.) Matrix Codes: GS = Soil Gas, WG = Groundwater, WS = Surface Water, SO = Soil, SE = Sediment, SL = Sludge, SS = Surface Soil Samples, WQ = Aqueous Blank Samples (trip, equipment, ambient, etc), SQ = Soil Blanks

5.) Sample Analysis Requested: Analytical method requested and number of containers provided for each.

6.) Quality assurance samples are assigned by date (ddmmyy) and the sample number associated with the sample (01, 02, etc) (e.g. Equipment blank collected in association with MW-1 on 10/10/99 will be designated 10109901 in the Equipment Blank Lot Control

NATIONVIEW

WELL CONSTRUCTION DIAGRAM (Flush Mount)

SITE:
PROJECT NAME: Nitrate Characterization Study
PROJECT NO./PHASE: 11-0017
DRILLING CONTRACTOR:
DRILLER:
GEOLOGIST:

WELL/BORING ID:
DRILLING METHOD: Hollow Stem Auger
DATE(S):
SURVEYOR:
NORTHING (NAD 83):
EASTING (NAD 83):

NOT TO SCALE

Surface Elevation (NAVD 88):

Casing Elevation (NAVD 88):

Borehole Diameter (in):
Well Casing Diameter (in):

DEPTH TO WATER
During Drilling:
Date
Pre Development:
Date
Post Development:
Date

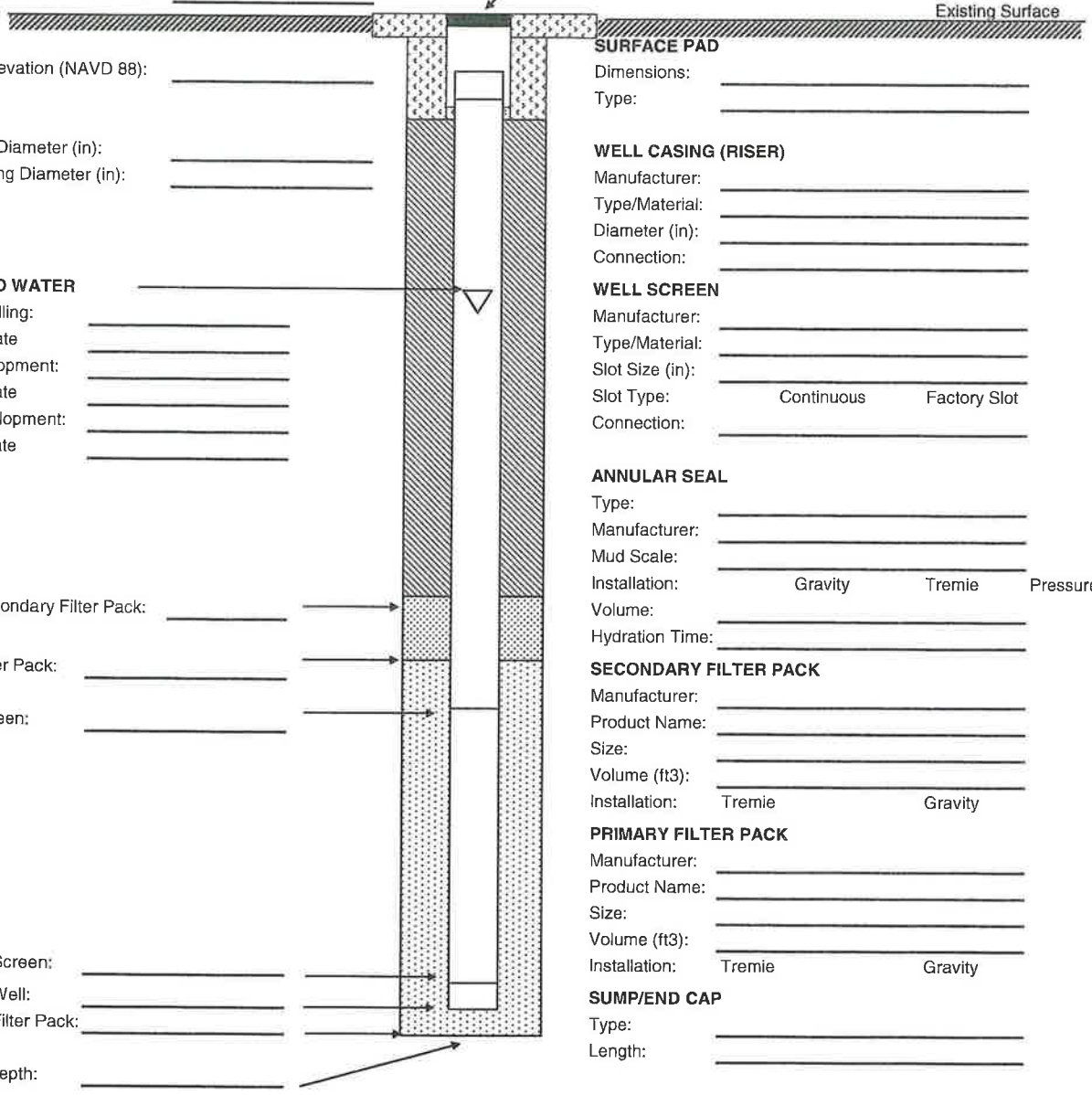
Top of Secondary Filter Pack:

Top of Filter Pack:

Top of Screen:

Bottom of Screen:
Bottom of Well:
Bottom of Filter Pack:

Borehole Depth:



PROTECTIVE CASING
Type:
Dimensions:
Length:

SURFACE PAD
Dimensions:
Type:

WELL CASING (RISER)
Manufacturer:
Type/Material:
Diameter (in):
Connection:

WELL SCREEN
Manufacturer:
Type/Material:
Slot Size (in):
Slot Type: Continuous Factory Slot
Connection:

ANNULAR SEAL
Type:
Manufacturer:
Mud Scale:
Installation: Gravity Tremie Pressure
Volume:
Hydration Time:

SECONDARY FILTER PACK
Manufacturer:
Product Name:
Size:
Volume (ft3):
Installation: Tremie Gravity

PRIMARY FILTER PACK
Manufacturer:
Product Name:
Size:
Volume (ft3):
Installation: Tremie Gravity

SUMP/END CAP
Type:
Length:

BACKFILL MATERIAL
Type:
Volume:

Comments:

MONITORING WELL LE COLLECTION FORM

NATIONVIEW

Page 1 of

LOCATION	Site:	Location ID:	Date:
	Project Name: Nitrate Characterization Study	Project No./Phase: 11-0017	Recorded By:
EQUIPMENT	Pump Type/ID#:	Water Quality Meter/ID#:	PID Type/ID#:
	Water Level Indicator Type/ID#:	Other Equipment/ID#:	Decon Method: Liquinox / DI water rinse
	Tubing Type/Diameter (in):	Other Equipment/ID#:	PPE Level: D C B A
WELL INFO	(A) Initial Depth to Water (ft BTOC):	Casing: Type PVC Diam. (in) 2.00	Weather:
	(B) Total Well Depth (ft BTOC):	(E) Casing Volume Multiplier (gal/lin ft): 0.16	Background PID (ppm):
	(C) Water Column Thickness (ft) (B-A):	Screen Length (lin ft):	Breathing Zone PID (ppm):
	(D) Well Volume (gal) (C x E):	Screen Info: Type: PVC Size:	Well Opening PID (ppm):

CASING INFO											
Riseer/Well Casing Inner Diameter (in)	0.50	1.00	1.50	2.00	3.00	4.00	5.0	6.0	8.0	10
(D) Casing Volume Multiplier(gal/lin ft)	0.02	0.04	0.10	0.16	0.38	0.65	1.02	1.47	2.61	4.08

DATE (mmddyy)	TIME (24 Hr)	Water Level (BTOC)	Volume Removed (mLl)	Pumping Rate (mLpm)	Temp (C)	pH	Cond. (mS/cm)	Dissolved Oxygen (mg/l)	Turbidity (NTU)	Oxidation Reduction Potential (mV)	Remarks (odor, clarity, etc.)

Colorimeter Results				
Time	Analyte	Dilution	Result	Units
Sample Time				
Sample Identification				

Conversions	Stabilization Criteria			
1 L = 0.26 gals	Temp	+/- 10%	DO	+/- 10%
1 gal = 3.79 L	pH	+/- 0.1	Turb	+/- 5 NTU
	Cond	+/- 10%		

No. Containers/Volume/Type			Preserv.	Filter (Y/N)	Method	Parameter(s)
1	125 mL	Poly	H2SO4	N	353.2	Nitrate
1	125 mL	Poly	None	N	353.2	Nitrite
1	250 mL	Poly	H2SO4	N	351.2	TKN
					350.1	Ammonia
1	500 mL	Poly	None	N	2540C	TDS

MONITORING WELL SAMPLE COLLECTION FORM

NATIONVIEW

Page _____ of _____

LOCATION	Site:	Location ID:	Date:
	Project Name: Nitrate Characterization Study	Project No./Phase: 11-0017	Recorded By:

DATE (mmddyy)	TIME (24 Hr)	Water Level (BTOC)	Volume Removed (mL)	Pumping Rate (mLpm)	Temp (C)	pH	Cond. (mS/cm)	Dissolved Oxygen (mg/l)	Turbidity (NTU)	Oxidation Reduction Potential	Remarks (odor, clarity, etc.)