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NAVAL AIR STATION FORT WORTH JRB CARSWELL FIELD TEXAS

ADMINISTRATIVE RECORD COVER SHEET

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DRAFT WORK PLAN

RCRA FACILITY INVESTIGATION (RFI) OF THE OFFSITE WEAPONS STORAGE AREA (WSA)

AT

NAVAL AIR STATION (NAS) FORT WORTH
JOINT RESERVE BASE (JRB)
CARSWELL FIELD, TEXAS

The Environmental Company, Inc.

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NAVAL AIR STATION (NAS) FORT WORTH JOINT RESERVE BASE (JRB) CARSWELL FIELD, TEXAS

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LIST OF ACRONYMS AND ABBREVIATIONS

ACC	Air Combat Command
ACBM	Asbestos Containing Building Material
AFB	Air Force Base
AFBCA	Air Force Base Conversion Agency
AFCEE	Air Force Center for Environmental Excellence
AHERA	Asbestos Hazard Emergency Response Act
AHU	Air Handling Unit
AL/OEBZ	Armstrong Laboratory Health Physics Branch
ARARs	Applicable or Relevant and Appropriate Requirements
ATSDR	Agency for Toxic Substances and Disease Registry
BTEX	Benzene, Toluene, Ethyl-Benzene, Xylenes
CAA	Clean Air Act
CAAA	Clean Air Act Amendment
CDRL	Contracts Data Requirements List
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CERFA	Community Environmental Response Facilitation Act
CFR	Code of Federal Regulations
cm^2	square centimeters
COC	Contaminant of Concern
COR	Contracting Officer Representative
CSM	Conceptual Site Model
DBCRA	Defense Base Closure and Realignment Act
DEQPPM	Defense Environmental Quality Program Policy Memorandum
DoD	Department of Defense
DQO	Data Quality Objective
EBS	Environmental Baseline Survey
EC	Electrical Conductivity
EOD	Explosive Ordnance Disposal
°F	Degrees Fahrenheit
FSP	Field Sampling Plan
GC	Galson Corporation
HEAST	Health Effect Assessment Summary Table
HQ	Headquarters
HSP	Health and Safety Plan

LIST OF ACRONYMS AND ABBREVIATIONS

HUD	Housing and Urban Development
IDW	Investigation Derived Waste
IRIS	Integrated Risk Information System
IRP	Installation Restoration Program
IRPIMS	Installation Restoration Program Information Management System
JRB	Joint Reserve Base
LBP	Lead-Based Paint
LDR	Land Disposal Requirements
LLRW	Low-Level Radioactive Waste
LLRWDA	Low-Level Radioactive Waste Disposal Area
LPST	Leaking Petroleum Storage Tank
LSA	Limited Site Assessment
m	meter
M & E	Metcalf & Eddy
MCL	Maximum Contaminant Levels
MCLG	Maximum Contaminant Levels Goals
mg/kg	milligrams per kilogram
mg/L	milligrams per liter
MSC	Medium Specific Concentrations
NAS	Naval Air Station
ND	Non-Detectable
NCP	National Contingency Plan
NPDWR	National Primary Drinking Water Regulations
NPDWS	National Primary Drinking Water Standards
O & M	Operations & Maintenance
OSHA	Occupational Safety and Health Administration
PAHs	Polyaromatic Hydrocarbons
PCB	Polychlorinated Biphenyls
pCi/L	microcuries per liter
PEL	Permissible Exposure Limit
ppb	parts per billion
PPE	Personal Protective Equipment
ppm	parts per million
PQL	Practical Quantitation Limits
PR	Preliminary Review

LIST OF ACRONYMS AND ABBREVIATIONS

PST	Petroleum Storage Tank
QA	Quality Assurance
QAPP	Quality Assurance Project Plan
QC	Quality Control
RCRA	Resource Conservation and Recovery Act
RFA	RCRA Facility Assessment
RFI	RCRA Facility Investigation
RI/FS	Remedial Investigation/Feasibility Study
RRSN	Risk Reduction Standard Number
SAC	Strategic Air Command
SAP	Sampling and Analysis Plan
SARA	Superfund Amendments and Reauthorization Act
SDWA	Safe Drinking Water Act
SOW	Statement of Work
SVOC	Semi-Volatile Organic Contaminant
SWMU	Solid Waste Management Unit
TAC	Texas Administrative Code
TBC	To Be Considered
TCE	Trichloroethylene
TCLP	Toxicity Characteristic Leachate Procedure
TDH	Texas Department of Health
TDS	Total Dissolved Solids
TEC	The Environmental Company, Inc.
TEPH	Total Extractable Petroleum Hydrocarbons
TNRCC	Texas Natural Resources Conservation Commission
TPH	Total Petroleum Hydrocarbons
TSCA	Toxic Substances Control Act
µg/g	micrograms per gram
µg/kg	micrograms per kilogram
USAF	United States Air Force
USEPA	United States Environmental Protection Agency
USNRC	United States Nuclear Regulatory Commission
UST	Underground Storage Tank
VSI	Visual Site Inspection

LIST OF ACRONYMS AND ABBREVIATIONS

PST	Petroleum Storage Tank
QA	Quality Assurance
VOC	Volatile Organic Compound
WBS	Work Breakdown Structure
WP	Work Plan
WSA	Weapons Storage Area
PST	Petroleum Storage Tank
QA	Quality Assurance

1.0 INTRODUCTION

This Work Plan (WP) was prepared by The Environmental Company, Inc. (TEC) under Contract No. F41624-95-D-8002, Delivery Order 0009. This WP defines the scope of services for the Resource Conservation and Recovery Act (RCRA) and Site Assessment of the Offsite Weapons Storage Area (WSA) at Naval Air Station (NAS) Fort Worth, Joint Reserve Base, Carswell Field, Texas (Project No. 96-8117). The Statement of Work (SOW) for Project No. 96-8117 is included with this WP as Appendix A.

This WP was prepared in accordance with guidelines provided in the Headquarters (HQ) Air Force Center for Environmental Excellence (AFCEE) *Handbook for the Installation Restoration Program (IRP) Remedial Investigations and Feasibility Studies (RI/FS),* dated September 1993 (hereafter referred to as the *Handbook*). The *Handbook* presents standard outlines and information requirements for IRP scoping documents. The outlines presented in the *Handbook* are required to be used in preparing IRP scoping documents. This WP is consistent with the WP outline and section numbering scheme presented in the *Handbook*. All components of the standard outline are addressed in this WP. It should be noted that, where appropriate, the section numbering system presented in the *Handbook* was expanded to accommodate further levels of detail.

In addition, this WP incorporates those requirements and guidelines provided in the U.S. Environmental Protection Agency (USEPA) *Interim Final RCRA Facility Investigation Guidance* dated May 1989 and applicable provisions in the Texas Administrative Code (TAC) 30, Chapter 335, Subchapters A, R, and S.

This investigation is in part being conducted to fulfill a directive issued by the Texas Natural Resources Conservation Commission (TNRCC). A letter from the TNRCC to Air Force Base Conversion Agency (AFBCA) dated February 16, 1995 summarized Solid Waste Management Units (SWMUs) requiring RCRA Facility Investigations (RFIs). One of the SWMUs identified was No. 59, the Offsite WSA Waste Accumulation Area located adjacent to Building 8503.

In addition to determining potential environmental impacts associated with Solid Waste Management Unit (SWMU) 59, activities described in this WP will support the future disposal/reuse of Offsite WSA property. NAS Fort Worth (formerly Carswell Air Force Base [AFB]) is undergoing property disposal/reuse pursuant to the Defense Base Closure and Realignment Act of 1990 and Round II of the Base Closure Commission deliberations. An assessment will therefore be made of the entire Offsite WSA to determine if potential contaminants have entered the environment or if they pose a risk to human health or the environment in fulfillment of the Community Environmental Response Facilitation Act (CERFA) requirements.

1.1 DESCRIPTION OF THE AIR FORCE INSTALLATION RESTORATION PROGRAM

The objective of the U.S. Air Force (USAF) IRP is to assess past hazardous waste disposal and spill sites at USAF installations and to develop remedial actions consistent with the National Contingency Plan (NCP) for those sites that pose a threat to human health and welfare or to the environment.

RCRA enacted in 1976, governs the disposal of hazardous wastes. RCRA Sections 6001 and 6003 require Federal agencies to comply with local and state environmental regulations and to provide information to the USEPA concerning past disposal practices at Federal sites.

Executive Order 12580, adopted in 1987, gave various Federal agencies, including the Department of Defense (DoD), the responsibility to act as lead agencies for conducting investigations and implementing remediation efforts when the Federal agencies are the sole or co-contributor to contamination on or off their properties.

To ensure compliance with Executive Order 12580, the DoD developed the IRP under the Defense Environmental Restoration Program to identify potentially contaminated sites, investigate these sites, and evaluate and select remedial actions for contaminated sites. The DoD issued Defense Environmental Quality Program Policy Memorandum (DEQPPM) 80-6 regarding the IRP program, dated June 1980. The DoD formally revised and expanded IRP directives, and amplified all previous directives and memoranda concerning the IRP, through DEQPPM 81-5, dated 11 December 1981. The memorandum was implemented by a USAF message dated 21 January 1982.

IRP requirements have been developed to ensure DoD compliance with Federal laws such as RCRA, Comprehensive Environmental Reponse, Compensation and Liability Act (CERCLA), and the Superfund Amendments and Reauthorization Act (SARA). In November 1986, in response to SARA and other USEPA interim guidance, the USAF modified the IRP to provide for a Remedial Investigation/Feasibility Study (RI/FS) program. The IRP was modified so that RI/FS studies could be conducted as parallel activities instead of serial activities. The IRP now encompasses applicable or relevant and appropriate requirements (ARAR) determinations, identification and screening of remedial technologies, and the development of remedial alternatives. A project conducted under the IRP may include field activities and studies prior to a detailed final analysis of remedial alternatives.

1.2 HISTORY OF ENVIRONMENTAL ACTIVITIES AT THE OFFSITE WSA

The following subsections describe previous environmental investigations completed at the Offsite WSA. A description of the Offsite WSA is provided, followed by a brief history of environmental investigations completed at the site.

1.2.1 Offsite WSA Description

The Offsite WSA was an off-base facility supporting Carswell AFB. Carswell AFB has since been realigned as NAS Fort Worth. NAS Fort Worth is located in north-central Texas in Tarrant County, approximately 8 miles west of Fort Worth, Texas (Figure 1-1).

NAS Fort Worth property totals 2,555 acres and consists of a main station and two noncontiguous land parcels. The area surrounding NAS Fort Worth is predominantly suburban, and includes the residential areas of Fort Worth, Westworth Village, and White Settlement.

The Offsite WSA is a 247-acre off-site facility under the ownership and control of NAS Fort Worth. The Offsite WSA is located about 4 miles west of NAS Fort Worth, just north

of White Settlement Road (Figure 1-2). The facility, built in 1956, consists of 247 acres of fee-owned land surrounded by an additional 264 acres of easements. An aerial photograph of the site taken in 1984 is provided in Figure 1-3. The Offsite WSA is primarily bordered by rural property, with some ranches and farms located nearby. A residential development is located south of White Settlement Road.

Facilities at the Offsite WSA include 2 munitions inspection shops, 16 ordnance storage buildings (including 11 igloos), 1 entry control building, a less than 90-day hazardous waste storage area (SWMU 59), and an emergency power plant. During its operational period, the Offsite WSA also maintained an Explosive Ordnance Disposal (EOD) Range, a small radioactive waste disposal facility (SWMU 60), a water storage tank, and two non-potable water wells. The range and disposal facility have been closed and remediated since the Offsite WSA operations were terminated.

1.2.1.1 NAS Fort Worth History

Prior to 1941, the area that is now NAS Fort Worth consisted of woods and pasture in an area called White Settlement. NAS Fort Worth started as an earthen runway constructed to service an aircraft manufacturing facility. When established in 1942, the installation was referred to as the Tarrant Field Airdome and was under the jurisdiction of the Gulf Coast Army Air Field Training Command. The installation's mission was to provide transition training for B-24 bomber pilots.

The Strategic Air Command (SAC) assumed control of Tarrant Field Airdome in 1946 and the installation served as the HQ for the Eighth Air Force and as a heavy bomber base. The installation was renamed Carswell AFB in 1948 in honor of Major Horace S. Carswell, a City of Fort Worth native. HQ 19th Air Division was located at Carswell AFB in 1951 and the installation became a home base for B-52s and KC-135s in 1956. The Air Combat Command (ACC) assumed control of Carswell AFB in 1992 concurrent with the disestablishment of the SAC.

Carswell AFB was selected for closure and associated property disposal/reuse during Round II of Base Closure Commission deliberations pursuant to the Defense Base Closure and Realignment Act (DBCRA) of 1990. The planning process for closure and property disposal/reuse at Carswell AFB was initiated in 1992 and Carswell AFB officially closed on 30 September 1993.

The U.S. Navy assumed control of Carswell AFB on 1 October 1994 and renamed the installation NAS Fort Worth, Joint Reserve Base, Carswell Field.

1.2.1.2 Offsite WSA History

The Offsite WSA was built in 1956 to store and maintain munitions. The Offsite WSA, with the rest of Carswell AFB, officially closed on 30 September 1993. Table 1-1 lists the buildings constructed at the Offsite WSA and their primary uses. The locations of Offsite WSA buildings are shown on Figure 1-4. Much of the indoor maintenance of the ordnance took place inside Building 8503. Due to these activities, which included painting, paint booths were installed in Building 8503. In addition to indoor maintenance activities, it has been reported by Air Force (AF) personnel that maintenance (painting and sanding) took place outdoors. The majority of outdoor maintenance took place around the perimeter of Building 8503; north of Buildings

8554, 8556, 8558, 8560 and 8852; and between Buildings 8503 and 8531. Two other areas located on the Offsite WSA are the Explosive Ordnance Disposal (EOD) Range and the Low-Level Radioactive Waste Disposal Area (LLRWDA).

The EOD Range was constructed in 1971 for the purpose of burying ordnance and spent engine cartridges. It consists of 83 acres of land located on the western edge of the Offsite WSA property. As discussed below, the EOD Range is no longer used and was cleared in February of 1993.

The LLRWDA, also known as SWMU 60, was located 400 feet west of Building 8503. The LLRWDA was used between 1957 and 1969. The burial site consists of 3 dry wells constructed from 12-inch diameter cast iron pipes encased in 2-1/4 inches of grout. These pipes are vertically embedded 18 feet into the ground. The pipes were permanently capped in 1969. These pipes were removed in November of 1996 and soil around them was sampled for radiation, as will be discussed further in Section 1.2.2.

1.2.2 Previous Investigative Activities and Documentation

Because a wide variety of waste generating activities have occurred at the Offsite WSA, a number of environmental investigations and studies have been conducted to identify sources of possible contamination, and to assess the extent and magnitude of contamination and its potential impacts on human health and the environment. A chronological summary of investigative activities performed at the Offsite WSA is presented in Table 1-2. These studies are discussed in more detail below.

1.2.2.1 RI/FS for Carswell AFB

An RI/FS Stage II investigation was conducted at NAS Fort Worth, including the Offsite WSA (Radian, 1989). Small quantities of waste cleaners and solvents were reported to have been disposed of west of Building 8503 (SWMU 65) in a shallow ditch at an estimated rate of 5 to 10 gallons per year. Eight hand-augered holes were drilled in the ditch west of Building 8503. 6 were dug at a depth of 1 foot below the surface, 1 at 4 feet and 1 at 3 feet below the surface. The borings were terminated upon encountering refusal on indurated sandstone or limestone at shallow depths. Groundwater was not encountered in the hand-augered borings. A total of 12 soil samples were collected from the hand-augered borings and submitted for laboratory analysis of volatile organic compounds (VOCs) and semi-volatile organic compounds (SVOCs).

Low levels of trichloroethylene (TCE) (non-detectable (ND) to 0.0619 micrograms per gram (µg/g)) were reported in soil samples collected from the ditch by Building 8503. Indicator chemicals, including metals, polyaromatic hydrocarbons and VOCs, were also found in at least one soil sample. Toluene was detected in several soil samples in concentrations ranging from 0.0028 milligrams per kilograms (mg/kg) to 0.049 mg/kg.

A baseline risk assessment was also performed to determine potential carcinogenic risks associated with the Carswell AFB IRP sites, including the Offsite WSA. The Offsite WSA was reported to present a low risk to human health. In a ranking of 1 to 7, with 1 indicating the greatest need for remedial action, the Offsite WSA was ranked 4. According to AF criteria, each IRP site is assigned to one of three categories. Category 1 defines sites where no further action is required, Category 2 defines sites where

additional effort is needed to determine health risks of contaminants and remedial alternatives, and Category 3 defines sites where a feasibility study process has been completed. The Offsite WSA was placed as a Category 2. It was recommended that additional work be performed and include a detailed evaluation and selection of remedial alternatives to address TCE contamination in soil.

1.2.2.2 RCRA Facility Assessment PR/VSI (Kearney, 1989)

A.T. Kearney conducted a Preliminary Review (PR) and Visual Site Inspection (VSI) for Carswell AFB, including the Offsite WSA to evaluate SWMUs and other areas of concern for releases to soil and groundwater. The RCRA Facility Assesement (RFA) made a broad assessment of release pathways at all SWMUs located at Carswell, including SWMUs 59, 60 and 65 which are discussed below.

The Offsite WSA Waste Accumulation Area (SWMU 59) was located directly west of the southern end of Building 8503, along the edge of the concrete surface. This was the less than 90-day Waste Accumulation Point for the Offsite WSA. Waste stored here was primarily from Buildings 8503 and possibly from 8514. Based on known activities at the site, waste types stored in the accumulation area included metal related materials and solvents and paints. During the course of this RFI, attempts will be made to obtain additional information regarding waste storage practices.

The RFA identified the Low-Level Radioactive Waste (LLRW) Burial Site (SWMU 60) located 400 feet west of Building 8503. The assessment described the unit as consisting of 3 dry wells constructed from 12-inch diameter cast iron pipes encased in 2-1/4 inches of grout. The pipes are vertically embedded 18 feet into the ground and reportedly contain plutonium-contaminated swipe samples, rubber gloves, paper bags, and uranium oxide. It was not known if the cast iron pipes were sealed at the bottom, how the waste was stored, and if any rainwater entered the pipes before they were permanently capped in 1969. The pipes were located approximately 100 yards from a farm pond. No documented history of radioactive releases for this site was cited. However, groundwater from the potable supply well was reported to contain total radium (8.5 microcuries per liter (pCi/L)) in excess of federal drinking water standards (5 pCi/L). It was not known if the radium detected in the groundwater sample from this well was the result of releases from the burial site.

The RFA reported that paint thinners and TCE were likely being discharged at the Offsite WSA at a rate of 5 to 10 gallons per year into a ditch west of Building 8503. This area was identified in the RFA as SWMU 65. Based on the results the RI/FS investigation (Radian, 1989), the past and ongoing potential for release of TCE to soil and groundwater was considered high. The RFA recommended initiating an RFI for this unit because of the presence of TCE in the soil. Additional sampling was suggested to characterize the extent of the TCE contamination.

1.2.2.3 Basewide Environmental Baseline Survey for Carswell AFB (USAF, 1993a)

An Environmental Baseline Survey (EBS) of Carswell AFB which included the Offsite WSA was conducted by The Earth Technology Corporation in 1993. The EBS placed areas of the Offsite WSA property into one of seven categories:

Category 1 - Areas where no storage, release or disposal of hazardous substances or petroleum products has occurred (including no migration of these substances from adjacent areas);

Category 2 - Areas where only storage of hazardous substances or petroleum products has occurred (but no release, disposal, or migration from adjacent areas has occurred);

Category 3 - Areas where storage, release, disposal, and/or migration of hazardous substances or petroleum products has occurred, but at concentrations that do not require a removal or remedial action;

Category 4 - Areas where storage, release, disposal, and/or migration of hazardous substances or petroleum products has occurred, and all remedial actions necessary to protect human health and the environment have been taken;

Category 5 - Areas where storage, release, disposal, and/or migration of hazardous substances or petroleum products has occurred, removal and/or remedial actions are under way, but all required remedial actions have not yet been taken;

Category 6 - Areas where storage, release, disposal, and/or migration of hazardous substances or petroleum products has occurred, but required response actions have not yet been implemented; and

Category 7 - Areas that are unevaluated or require additional evaluation.

The EBS placed most of the Offsite WSA as a Category 2. A small portion in the southwest portion of the fenced area that includes Buildings 8505, 8506, and 8507 was placed as a Category 3, and a small area adjacent to it that includes Building 8503 and SWMU 65 was placed as a Category 6. The EOD Range was unevaluated and required additional evaluation, thus making it a Category 7.

The EBS stated that no potable water source was available at the Offsite WSA. Bottled water was provided instead. Two wells delivered non-potable water to the site for toilet flushing and other non-contact uses.

In addition, asbestos and polychlorinated biphenyls (PCB) inventories were performed. The asbestos survey identified asbestos containing building materials (ACBM) in six buildings at the Offsite WSA which included the following: 8500, 8502, 8503, 8505, 8506, and 8514. ACBM identified during the survey included sheet rock, pipe fittings, floor tiles, asphalt and gravel, piping, pipe insulation and roof materials. Sampling was limited during the survey. The results are not considered comprehensive.

During the PCB inventory, all transformers with 50 parts per million (ppm) or more PCBs were replaced or retrofitted with PCB-free equipment to bring the PCB concentration to below 50 ppm. All transformers at the Offsite WSA are currently labeled as being PCB-free.

1.2.2.4 Explosive Ordnance Disposal Range Clearance

EOD Range Survey (USAF, 1993b)

A survey of the 83-acre range was conducted by AF personnel from Ogden Aerial Logistics Center, Hill AFB, Utah, to determine if munition residue was present and the project-associated remediation costs. AF personnel swept the area within a radius of 900 feet from the demolition point with an ordnance locator excavating all indications of ordnance. Due to the condition of the range and its projected usage, ripping was not required. Small arms, actuators, and starter cartridges were observed in two EOD burial pits. The survey team was unable to determine the size of the pits, so a sweep of the area was recommended.

Certificate of Clearance (USAF, 1996a)

A clearance of the EOD Range was conducted by EOD personnel between 16 August 1995 and 15 September 1995. The EOD Range was swept to an approximate depth of 10 feet below ground surface during the clearance using metal detectors. All metallic items were excavated and removed. See Section 1.2.3 Existing Remedial Actions for further details.

1.2.2.5 Soil and Debris Removal Activity

Metcalf & Eddy (M & E) was retained to remove debris located at the Waste Dump at the Offsite WSA (M & E, 1993). The Waste Dump is located approximately 250 feet north of the north fence of the Offsite WSA. The debris included non-hazardous material such as wooden pallets, used bomb crates, scrap metal, newspapers, loose sand, and other materials.

The Waste Dump represented a potential public health risk because the public has access to the site and has used it to dispose of debris. In addition, the site is located in a gorge that drains into a tributary to Live Oak Creek which empties into Lake Worth. The investigation of the site took place in two phases: (1) the initial characterization of the debris which took place on July 20, 1993; and (2) the removal of the debris and confirmatory sampling which took place on September 30, 1993.

In the initial characterization performed by M & E, three soil samples and four associated Quality Control samples were taken. To quantify potential contaminants associated with the dump debris, soil samples were taken upgradient of the dump, downgradient of the dump, and within the dump. The samples were analyzed for VOCs, BTEX (benzene, toluene, ethylbenzene, xylene), SVOCs, total petroleum hydrocarbons (TPH), radionuclides (including gross alpha and gross beta particles) and metals. Most of the analytical results were below the method detection limits and the rest were below regulatory levels. Based upon these results, the debris was treated as non-hazardous waste and was hauled to a local non-hazardous landfill.

1.2.2.6 Offsite WSA Radiological Site Assessment

WSA Site Assessment (USAF, 1995)

During a survey conducted by Armstrong Laboratory's Health Physics Branch (AL/OEBZ) of Offsite WSA Bunker 8531, three small, localized areas of low-level

radioactive contamination were detected. The contaminated areas cover approximately 8 square feet and are co-located within the B Bay Area. A total of three swipe samples were taken from the contaminated areas. Swipe sample results (Table 1-3) indicated that only a very small amount of localized contamination was found here with minimal radiological or toxicological hazards.

AL/OEBZ recommended that additional swipe samples be collected to determine which alpha-emitting isotope is present and to identify which release limit criteria applies,

- 450 pCi/100 square centimeters (cm^2) for U-235 and U-238 or
- 9 pCi/100 cm^2 for Pu-239.

One swipe sample was taken per 100 cm^2. The additional sampling performed in March of 1995 was also used to determine if any decommissioning requirements were necessary. Access to the facility was restricted until it would be classified as "Available for Unrestrictive Use."

Consultative Letter: Radiological Evaluation of Suspected Hot Spots in Bunker 8531 (USAF, 1996b)

During March 1995, three swipe samples were collected from the elevated area of radiation in Building 8531 in B Bay for further testing by the Armstrong Laboratory's, Radioanalytical Branch. Qualitative results indicated that the levels were potentially above the U-235/U-238 and Pu-239 public use release limits as published by the *United States Nuclear Regulatory Commission (USNRC) Regulatory Guide 1.86.* Therefore, it was concluded that additional swipe samples were needed to identify radionuclides present in the suspected area. One swipe sample was taken from the center of five distinct regions (i.e. hot spots, within the elevated area). Each swipe sample was taken over an area of 100 cm^2. Swipe sample results are presented in Table 1-4.

Sampling activities were performed by Armstrong Laboratory as follows:

- removable alpha and beta contamination was determined by swiping the five hot spots with filter paper;
- fixed alpha and beta contamination levels were assessed using a single radiation detector; and
- fixed gamma-ray exposure rate measurements were taken at 1 meter (m) from the surface of the hot spots using a typical survey meter. Background levels of alpha and beta contamination as well as gamma-rays were measured inside and outside the bunker.

The radiological evaluation concluded that the entire elevated area is actually below release criteria in accordance with *USNRC Regulatory Guide 1.86*; therefore, it should be considered releasable for public use.

Consultative Letter: Final Status Decommissioning Survey of WSAs (USAF, 1996c)

A final status decommissioning survey was performed by AL/OEBZ for AFBCA from 5 December through 9 December 1994. The purpose of this survey was to demonstrate that all relevant radiological parameters satisfied established guideline values. This

demonstration would, in turn, be used to justify releasing the WSAs for unrestricted public use. Background radiation levels were measured to determine the magnitude of naturally occurring radioactivity within the Offsite WSA facilities. Fixed alpha/beta/gamma and x-ray contamination levels were assessed, as were removable alpha/beta/gamma and tritium contamination.

A presurvey visit was conducted in September 1994 to obtain building drawings and determine necessary equipment. Information collected during this visit was used to create bunker drawings and determine swipe sample locations. All floor surfaces were 100 percent scanned for fixed alpha/beta/gamma contamination using mobile floor monitors. Swipe samples were taken from pre-determined floor and wall locations. The results of the swipe samples are listed in Table 1-5. Walls were checked for alpha/beta/gamma fixed contamination using hand-held monitors at the same locations where swipe samples were taken.

All swipe samples were reported well below USNRC standards for removable alpha/beta/gamma contamination. All measurements recorded with the alpha/beta/gamma monitoring instruments were below action levels. X-ray measurements did not significantly differ from ambient background levels. Therefore, this evaluation demonstrated that the Offsite WSA meets the release criteria in accordance with *USNRC Regulatory Guide 1.86* and the Offsite WSA is considered releasable for public use.

1.2.2.7 LLRW Burial Site (SWMU 60)

Final Sampling and Analysis Plan Interim Remedial Action Low-Level Radioactive Waste Burial Site (M & E, 1996)

M & E was tasked to remove and dispose of LLRW and affected soils buried at SWMU 60 (M & E, 1996). The LLRW burial site (SWMU 60) is located 400 feet west of Building 8503 and consisted of radium-painted aircraft instrument dials that were disposed of in 18-foot long tubes (dry wells), buried 17 feet below the surface, with 12 inches protruding above the surface.

According to the Sampling and Analysis Plan (SAP), soil was removed from around the tubes and screened to determine whether it had been affected by radioactive materials or organic chemicals. Soil was to be excavated from around the tubes until field screening results indicated that the affected soil had been removed. Four confirmation samples were collected by an independent party from the side walls and one from the bottom of the excavation to verify the absence of radioactive materials. From the stockpiling of excavated soils, samples were collected to characterize the materials for disposal.

Four soil borings were advanced at SWMU 60 to evaluate background concentrations of selected radionuclides. Each boring was advanced to a depth of 18 feet. Soil samples were continuously collected and field-screened for radioactivity. Four samples were selected from each borehole and submitted for laboratory analysis of selected radionuclides. The samples were collected from intervals of 0-1 feet, 5-6 feet, 11-12 feet, and 17-18 feet below ground surface.

The three burial tubes and soil adjacent to the tubes were excavated in May 1996. According to a visual inspection conducted by the AF before soil sampling took place, there was no evidence of any release of hazardous materials to the environment. According to M & E (1996), sampling was completed in May 1996. The results of the soil sampling performed by M & E are not yet available to confirm observations made on the visual inspection.

1.2.2.8 Background Study

A background study was proposed in a work plan by Jacobs Engineering (Jacobs, 1996). The study focused on previously detected radionuclides in groundwater. Existing wells were sampled and additional wells were installed to determine whether the radionuclides are naturally occurring or were the result of disposal practices at the Offsite WSA. Surface and subsurface soils were also sampled.

Contamination identified in previous investigations includes TCE in the soil west of Building 8503 and total radium in excess of the Federal drinking water standards (5 pCi/L) in the on-site potable water supply well. Ten surface soil samples were collected from 0 to 2 feet below ground surface during the Offsite WSA background investigation to determine if concentrations of total radium detected in the on-site well are attributable to the radioactive waste storage site or are naturally occurring background concentrations of radium-226 and -228. Also, the presence of total extractable petroleum hydrocarbons (TEPH) was determined in the sampling. The soil samples were collected from the western portion of the Offsite WSA buffer zone since the surface soil in the east is either thin or absent.

20 subsurface soil samples were to be collected to detect any contaminants (TEPH and radium-226 and radium-228) which may have leached from the surface into the vadose zone via infiltration. 10 subsurface soil samples were to be co-located with the surface-soil samples, while another 10 samples were to be collected from soil boreholes completed for monitoring well construction. The samples were to be collected at depths of 4 to 10 feet by GeoProbe or other direct-push methods in order to intersect the type of clayey sand/sandy clay with varying amounts of fine to medium gravel that had been observed at this interval.

Two deep (220 feet) and three shallow (5 feet, which previous studies have identified as the depth to groundwater) monitoring wells were proposed to detect any radium leakage into the water supply. 17 unfiltered groundwater samples were taken. The two deep wells were located upgradient within the Offsite WSA buffer zone. The deep wells will establish background concentrations of radium-226 and -228. These wells will be sampled four times each over a 2- to 3-month period. The intervals between the samples will be based on the average linear velocity of the groundwater.

The three shallow wells were to be installed within the fenced area of the Offsite WSA. One was established upgradient of the radioactive waste storage site to evaluate background conditions, one was downgradient from the radioactive waste storage site and the remaining well was installed immediately upgradient of the primary water supply. These were to be sampled soon after completion.

Two existing water supply wells were also proposed to be sampled following removal of previously installed submersible pumps.

According to the work schedule proposed in this RCRA Background Study Work Plan document (Jacobs, 1996), a background study was conducted between 31 October and 13 November 1996. Soil borings were advanced between 14 November and 5 December 1996 with monitoring wells installed between 14 November and 5 December 1996.

1.2.2.9 Underground Storage Tank (UST) Removal

Five USTs were also installed and later removed at the Offsite WSA. These reportedly contained fuel oil and diesel and were used for power generation, heating and vehicle fueling. The approximate location of the removed USTs are represented on Figure 1-5. Diagrams for the USTs are provided in Appendix C. Documentation for the UST removal activities is not currently available.

1.2.3 Existing Remedial Actions

Some of the contaminated areas have been remediated. Specifically, these areas are the Soil/Debris Waste Dump, the EOD Range and the SWMU 60.

Based upon the November 1993 sampling results reported for the Waste Dump by M & E, the found debris was treated as a non-hazardous waste. The debris was removed from the site and transported to a local, non-hazardous landfill. A confirmation sample was taken from the cleaned, cleared area. A closure sample was taken under the limestone edge of the ravine at the edge of the dump. These samples indicated that all parameters were below method detection limits or below regulatory levels with the exception of a trace concentration of TCE. The parameters tested included VOCs, BTEX, semi-volatile compounds, TPHs, gross alpha, gross beta and metals. Based on the analytical results of this closure sample obtained by M & E, this waste dump was considered clean and closed.

A clearance of the EOD Range was conducted by EOD personnel between 16 August 1995 and 15 September 1995. The EOD Range was swept to an approximate depth of 10 feet below ground surface during the clearance using metal detectors. All metallic items were excavated and removed. Based on the clearance survey, the EOD Range was determined to be cleared of all detected explosive ordnance and ordnance residue by EOD personnel. No restrictions have been placed on future use of the land and the land has been identified as legal land description according to EOD personnel. However, EOD personnel should be contacted if the land is to be used for a purpose other than livestock grazing and if there is the possibility of going underground below 0.5 to 1 foot in depth.

M & E was tasked to remove the three 18-foot tubes containing LLRW located 400 feet west of Building 8503 known as SWMU 60. The three burial tubes and soil adjacent to the tubes were excavated in May 1996. According to a visual inspection conducted by the AF before soil sampling took place, there was no evidence of any release of hazardous materials to the environment. The results of the soil sampling performed by M & E are not yet available to confirm observations made during the visual inspection.

1.3 DESCRIPTION OF CURRENT STUDY

The following sections describe the project objectives and identify the scoping documents to be prepared in order to help achieve these objectives. In addition, a summary of the activities to be performed during this project will be presented.

1.3.1 Project Objectives

The overall goal of this project is to characterize environmental conditions at the Offsite WSA in support of SWMU 59 closure and the disposal/reuse of the property. Specific objectives needed to achieve this goal include:

- determination of the nature and extent of any potential equipment, structures and soil contamination associated with the Offsite WSA Waste Accumulation Area located adjacent to Building 8503 (SWMU 59);
- assessment of the nature and extent of potential surface soil, subsurface soil, sediment and groundwater contamination resulting from other activities and/or sources at the Offsite WSA;
- characterization of potential surface and subsurface soil contamination related to potential leaks from previously removed USTs and past UST fueling operations;
- identification and characterization of potential contaminants and/or hazardous constituents associated with buildings and structures;
- characterization of potential threats to human health and ecological receptors posed by any contamination identified; and
- development of corrective measures needed to control, minimize or eliminate any contamination and/or hazardous constituents identified during the project.

1.3.2 Project Scoping Documents

This WP constitutes one of the scoping documents required by the SOW for this contract and delivery order. Other scoping documents prepared by TEC for this contract and delivery order include a SAP and a Health and Safety Plan (HSP). The SAP consists of two deliverables: the Field Sampling Plan (FSP) and a Quality Assurance Project Plan (QAPP). These scoping documents are referenced as necessary and appropriate.

1.3.3 Summary of Project Activities

Activities performed during this project will be designed to achieve the objectives identified above in Section 1.3.1. Descriptions of these activities as they correspond to the project objectives are presented below. A summary of specific tasks including sample locations and analyses to be performed is provided in Section 3.3 of this WP. Details of the field activities sampling procedures and analytical requirements are provided in the SAP.

Waste Accumulation Area (SWMU 59)

An evaluation of the Waste Accumulation Area will be conducted during the investigation. The investigation will characterize the nature and extent of potential contamination associated with the area. The investigation will include chemical characterization of surface soils and subsurface soils. Based on the location and extent of any observed soil

contamination, monitoring wells will be installed downgradient from the contamination within the upper water bearing zone. These wells will be monitored in conjunction with other upgradient monitoring wells to be installed as part of an ongoing background study of the Offsite WSA (Jacobs, 1996). In addition to a characterization of environmental media, the interior surfaces of the Waste Site Accumulation Area structure will be tested to determine the need for decontamination as discussed below.

Outdoor Maintenance and Material Storage Areas

Due to the nature of activities which may have taken place at the Offsite WSA, other potentially impacted areas will be assessed. Activities which may have impacted the environment at the Offsite WSA include maintenance activities such as sanding and painting, equipment and/or parts cleaning; and outdoor material storage. Surface and subsurface soils associated with unconfined areas where such activities are suspected to have taken place will be characterized.

EOD Range

Although previous efforts have effectively cleared the area of explosive hazards, documentation of residual explosive contamination is not available. Surface and subsurface samples will be collected to characterize this area.

Surface Water and Groundwater

Contaminant migration pathways associated with these areas will also be assessed. These pathways include drainageways and ditches which transmit surface water runoff, seeps which discharge shallow groundwater to ravines surrounding the perimeter or the site, and the shallow groundwater. Surface sediment samples will be collected and analyzed from the drainageways and ditches, and water samples will be collected and analyzed from all perimeter seeps. Following an evaluation of results from surface and subsurface soil samples, monitoring wells will be installed in the shallow aquifer and sampled in conjunction with those installed to characterize potential contaminant migration from the Offsite WSA Waste Accumulation Area.

UST Related Characterization.

Five USTs have previously been removed from the site. Four of the tanks were used in conjunction with power generation and heating. One tank supported vehicle fueling. Although tank removal was completed, soils potentially impacted by the tanks were not characterized. In order to fill this data gap, the subsurface soils beneath all removed tanks will be characterized for petroleum related contaminants. In addition, surface soil samples will be collected and analyzed in the area surrounding the UST which supported vehicle fueling operations.

Building Surveys and Characterization

Buildings located at the Offsite WSA will be surveyed and assessed to identify any hazardous materials and/or constituents which may be present within or on the structures themselves. For instance, the EBS (1993) identified that buildings contain asbestos materials. Comprehensive sampling at all buildings and of all suspect materials was not pertinent. Therefore, a complete asbestos survey will be conducted to determine the types and extent of such material. Lead-based paint may also be present on the site

buildings as indicated by the construction. The building survey will therefore include paint chip sampling to determine the presence and possible extent of lead-based paint. Documentation of a PCB inspection is provided in the EBS (1993) as well as on labels placed directly on transformers located throughout the site. Further analyses for PCB materials will therefore not be completed.

As indicated in Table 1-1, primary facility functions included munitions storage, and munitions inspections and maintenance. Munitions storage took place in 16 buildings including 11 igloo or bunker structures. Munitions inspections and maintenance were performed at two shops. Historic use of these facilities may have resulted in the deposition of contaminants on interior surfaces. In order to determine if decontamination is required due to surficial contamination, a series of wipe samples will be collected from the interior floor and wall surfaces of buildings which were involved in munitions storage, inspection and maintenance and waste storage. Floor and wall samples will be collected from each building in a manner representative of individual functions or activities within the buildings.

Risk Assessment

Following data collection, an analysis will be conducted to estimate the potential risk to human health and the environment resulting from exposure to site contaminants. The level of effort and detail provided for the risk assessment will be commensurate with the amount and types of contamination identified during the site characterization. Results from the risk assessment will aid in determining the need for corrective measures.

Corrective Measures

As part of the overall data evaluation, a corrective measures study will be completed. The study will incorporate the results of the field investigation as well as results from the risk assessment. Corrective measures will be designed to reduce or eliminate site contaminant concentrations to either those of background conditions or to acceptable risk-based levels.

Reporting of Findings

The results of this investigation will be primarily compiled into a single report. The report will comply with and fulfill the requirements of a RCRA RFI report with respect to SWMU 59. The report will also include Phase II Site Assessment information for the entire Offsite WSA to satisfy the requirements of CERFA. In addition to this report, a risk assessment report will be prepared. In support of the implementation of corrective measures by a third party, an interim corrective measures WP will be prepared based on recommendations presented in the RFI report.

Other reports to be submitted will include preliminary laboratory review packages and electronic compilation data into the AFCEE Installation Restoration Program Information Management System (IRPIMS). Field and laboratory data will be entered into the computerized format as required by the most current version of the *IRPIMS Data Loading Handbook.*

1.4 PROJECT ORGANIZATION AND RESPONSIBILITIES

TEC has assembled a team of highly qualified professionals to both manage and execute the range of tasks required for the successful completion of this project. Figure 1-6 is a project organizational chart that identifies key project personnel. Table 1-6 presents point-of-contact information for key project personnel.

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Table 1-1. Offsite WSA Facilities

Facility No.	Use	Year Constructed	Square Footage
8500	Safety, Control & Identification	1956	932
8501	Water Tank Storage	1956	1219*
8502	Water Supply Facility	1956	78
8503	Surveillance Inspection Shipping	1956	6,959
8504	Water Supply Facility	1956	78
8505	Electric Power Station	1956	1,488
8506	Small Arms Ammunition Storage	1956	5,000
8507	Spares Storage	1956	2,500
8508	Pyrotechnic Storage	1956	351
8509	Segmented Magazine Storage	1956	540
8510	Low-Level Radioactive Waste Burial Site (Removed and Remediated)	1989	385*
8511	Detonator Storage	1956	126
8512	Waste Accumulation Area (SWMU 59)	1991	86
8514	Conventional Munitions Shop	1956	2,600
8515	Vehicle Fuel Station (Removed)	1956	4
8520	Explosive Ordnance Disposal Range (Cleared)	1971	NA
8531	Munitions Storage Igloo	1956	1,576
8533	Munitions Storage Igloo	1956	1,266

318 30

Table 1-1. continued

Facility No.	Use	Year Constructed	Square Footage
8535	Munitions Storage Igloo	1956	2,147
8537	Munitions Storage Igloo	1956	2,147
8539	Munitions Storage Igloo	1956	2,147
8541	Munitions Storage Igloo	1956	2,147
8552	Munitions Storage Igloo	1956	1,060
8554	Munitions Storage Igloo	1956	2,146
8556	Munitions Storage Igloo	1956	2,146
8558	Munitions Storage Igloo	1956	2,146
8560	Munitions Storage Igloo	1956	2,146

* Approximate square footage extrapolated from Jacobs Engineering Site Survey Drawing, 1996.

Table 1-2

CHRONOLOGICAL SUMMARY OF ENVIRONMENTAL REPORTS

Date	Report Title	Scope	Contaminants Reported	Actions/Recommendations
1989	RI/FS Stage II Technical Report	Evaluated previously identified contamination, performed risk assessment, and provided recommendations at 13 sites at Carswell AFB including one at Offsite WSA.	TCE and other indicator contaminants found in boreholes drilled in ditch west of Building 8503/Waste Accumulation Area.	Indicated site posed low risk and recommended determination of TCE extent.
1989	RCRA Facility Assessment PR/VSI Report	Evaluated SWMUs at Carswell AFB (including three at Offsite WSA) and provided preliminary determination of releases.	SWMU 59 - No reference of previous contamination reported. SWMU 60 - No contamination cited, except previously reported radium (8.5 pCi/L) in supply well. SWMU 65 - Reference previously detected TCE contamination.	SWMU 59 - no further action recommended. SWMU 60 - No further action recommended. SWMU 65 - RFI recommended.

Table 1-2. continued

Date	Report Title	Scope	Contaminants Reported	Actions/Recommendations
March 1993	EOD Range Survey	Surveyed and swept EOD Range for ordnance and ordnance residue.	Ordnance found all over range, small arms and actuators in one pit, radioactive burial pit, and TCE found in soil.	All indications of ordnance excavated.
November 1993	Report of Soil Debris Removal Activity at the Offsite Weapons Storage Area	Sampled soil around Waste Dump to determine potential contaminants and remove debris from Waste Dump.	No hazardous constituents found in the soil above background levels.	Debris in Waste Dump treated and transported as non-hazardous waste. Dump clean and closed.
1993	Basewide Environmental Baseline Survey Carswell Air Force Base	Conducted EBS to document physical condition of WSA. Included asbestos and PCB inventories.	LLRWDA containing radium located at west end of WSA. TCE suspected near building 8503.	Most of WSA classified as Category 2, EOD Range as a Category 7 and the LLRWDA as a Category 6.

Table 1-2. continued

Date	Report Title	Scope	Contaminants Reported	Actions/Recommendations
December 1994	Weapons Storage Area Site Assessment	Collected three swipe samples from three co-located areas of contamination in Bunker 8531 to determine what contamination was present.	Radionuclides were detected in the area of contamination.	Additional swipe samples needed to determine type of alpha-emitting isotope present
December 1994	Final Status Decommissioning Survey of Weapons Storage Areas	Measured background radiation levels in all munition bunkers on the Offsite WSA.	Alpha/beta/gamma radiological contamination found in low levels in all bunkers.	Results were below USNRC Standards. The bunkers considered releasable for public use.
March 1995	Radiological Evaluation of Suspected Hot Spots in Bunker 8531	Collected five swipe samples from five regions in elevated area of contamination discovered in previous investigation to determine quantity of alpha/beta/gamma contamination.	Alpha/beta/gamma contamination as well as uranium isotopes and a plutonium isotope discovered in bunker.	All contaminants below release criteria and considered releasable for public use.

Table 1-2. continued

Date	Report Title	Scope	Contaminants Reported	Actions/Recommendations
August 1995	Certificate of Clearance	Conducted clearance of EOD Range. Swept and cleared area of all metallic items.	Ordnance and ordnance residue found throughout Range.	Area identified as legal land description.
May 1996	Final Sampling and Analysis Plan Interim Remedial Action Low-Level Radioactive Waste Burial Site	Removed three tubes from LLRWDA and sampled soil from within the excavation and from four soil borings to determine if any radiation leakage occurred.	Results have not yet been obtained from soil samples. Radium would be the primary contaminant if contamination occurred.	No further action mentioned.
November 1996	RCRA Facility Investigation for Parcel D and Background Study Work Plan	Collected surface and subsurface soil samples to detect contamination from TEPH and radium. Installed five monitoring wells to determine background concentrations of radium.	Radium and petroleum hydrocarbons may be found in soil around WSA, mostly west of Building 8503.	Samples will be collected from monitoring wells over a 2- to 3-month period.

Table 1-2. continued

Date	Report Title	Scope	Contaminants Reported	Actions/Recommendations
Date Unknown	Unknown	Installed and later removed five USTs on the WSA	Tanks reported to contain fuel and diesel oil. There is no documentation as to anycontamination caused by these tanks.	USTs were removed from the WSA, however, there is no documentation of further action to be taken.

Table 1-3. Radiological Swipe Sample Results For Building 8531

Sample Number	Gross Alpha	Uncertainty
WW945346	13 pCi/swipe	+/-1.1 pCi/swipe
WW945347	26 pCi/swipe	+/-1.6 pCi/swipe
WW945348	25 pCi/swipe	+/-1.6 pCi/swipe

Table 1-4. Hot Spot Swipe Sample Results of Building 8531

Area	# of Samples	Alpha	Beta	Gamma	Pu-239	U-234	U-235	U-238
Structure 8531	1	48.5*	30.3	NA	1	191.5	5	0.4
Structure 8531	1	6.9	9.7	NA	2.16	27.4	0.86	0.3
Structure 8531	1	8.1	8.9	NA	1.58	33.24	0.88	0.42
Structure 8531	1	28.2	15.6	NA	1.98	41.08	1.18	0.52
Structure 8531	1	13.7	29.8	NA	1.12	36.04	0.56	0.74

*All measurements in pCi/swipe.

Table 1-5. Radiological Swipe Sample Results for Entire Offsite WSA

Area	# of Samples	Alpha	Beta	Gamma
Structure 8503	52	<2 pCi/swipe	<2 pCi/swipe	<50 pCi/swipe
Structure 8506	108	<2 pCi/swipe	<2 pCi/swipe	<50 pCi/swipe
Structure 8507	51	<2 pCi/swipe	<2 pCi/swipe	<50 pCi/swipe
Structure 8531	90	<2 pCi/swipe	<2 pCi/swipe	<50 pCi/swipe
Structure 8533	68	<2 pCi/swipe	<2 pCi/swipe	<50 pCi/swipe
Structure 8535	44	<2 pCi/swipe	<2 pCi/swipe	<50 pCi/swipe
Structure 8537	44	<2 pCi/swipe	<2 pCi/swipe	<50 pCi/swipe
Structure 8539	44	<2 pCi/swipe	<2 pCi/swipe	<50 pCi/swipe
Structure 8541	44	<2 pCi/swipe	<2 pCi/swipe	<50 pCi/swipe
Structure 8552	28	<2 pCi/swipe	<2 pCi/swipe	<50 pCi/swipe
Structure 8554	52	<2 pCi/swipe	<2 pCi/swipe	<50 pCi/swipe
Structure 8556	52	<2 pCi/swipe	<2 pCi/swipe	<50 pCi/swipe
Structure 8558	52	<2 pCi/swipe	<2 pCi/swipe	<50 pCi/swipe
Structure 8560	52	<2 pCi/swipe	<2 pCi/swipe	<50 pCi/swipe

Table 1-6. Key Personnel Point-of-Contact Listing

Mr. Jerry W. Outley **AFCEE Contracting Officer**	HSC/PKV 3207 North Road Brooks AFB, TX 78235-5353 (210) 536 4410 (210) 536 6003 (FAX)
Mr. Charles Rice **AFCEE COR/TC**	AFCEE/ERB 3207 North Road, Bldg. 532 Brooks AFB, TX 78235-5363 (210) 536 6452 (210) 536 3609 (FAX)
Ms. Randi Audello **AFBCA Contracting Officer**	AFBCA/OL-H (Contracting Officer) 6550 White Settlement Road Fort Worth, TX 76114-3520 (817) 731 8284 (817) 731 8137 (FAX)
Mr. Olen Long, P.E. **AFBCA Site Manager/Base POC**	AFBCA/OL-H 6550 White Settlement Road Fort Worth, TX 76114-8137 (817) 731 8284 (817) 731 8137 (FAX)
Mr. Jack E. Wilson, P.E. **TEC Project Director**	The Environmental Company, Inc. 1230 Cedars Court, Suite 100 Post Office Box 5127 Charlottesville, VA 22905 (804) 295 4446 (804) 295 5535 (FAX) JEWILSON@tecinc.com (electronic)
Mr. Bob Duffner, P.E. **TEC Project Manager**	The Environmental Company, Inc. 710 NW Juniper Street, Suite 208 Issaquah, WA 98027 (206) 557-7899 (206) 557-7878 (FAX) RMDUFFNER@tecinc.com (electronic)

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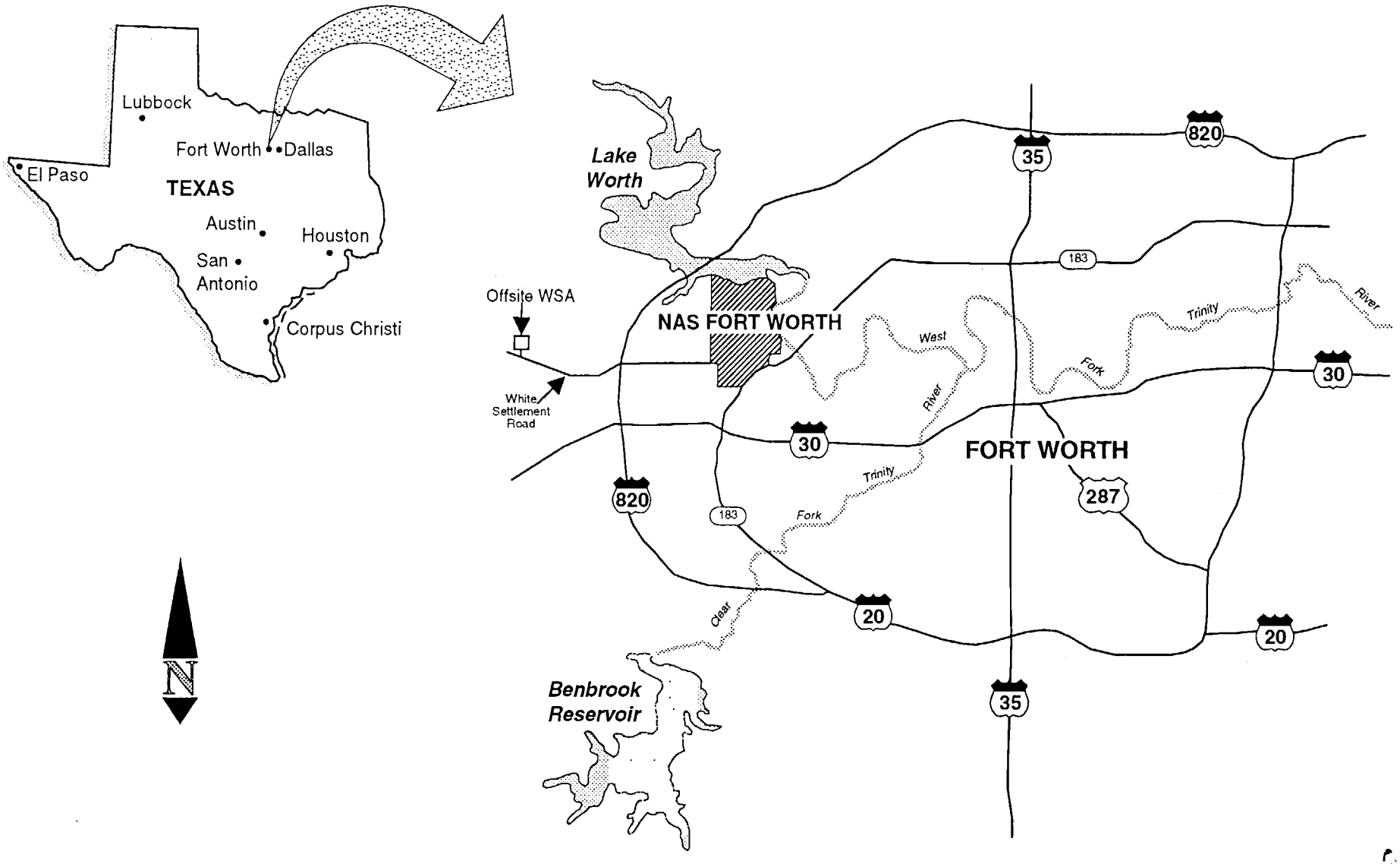


Date
13 November 1996

Project No.
P3109

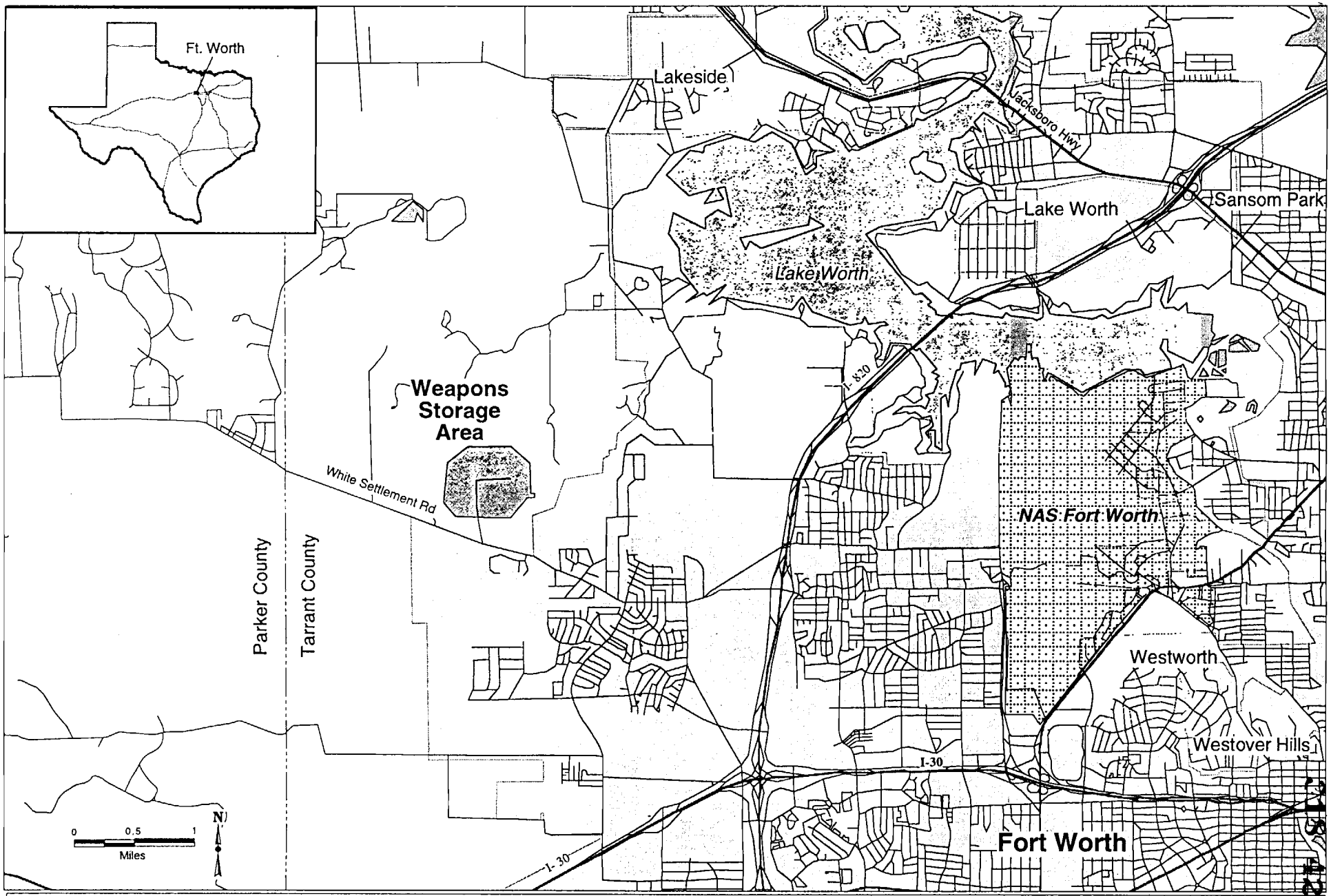
Project Manager
B. Duffner

Prepared by
EAD

The Environmental Company, Inc.

SOURCE: Radian Corporation 1986

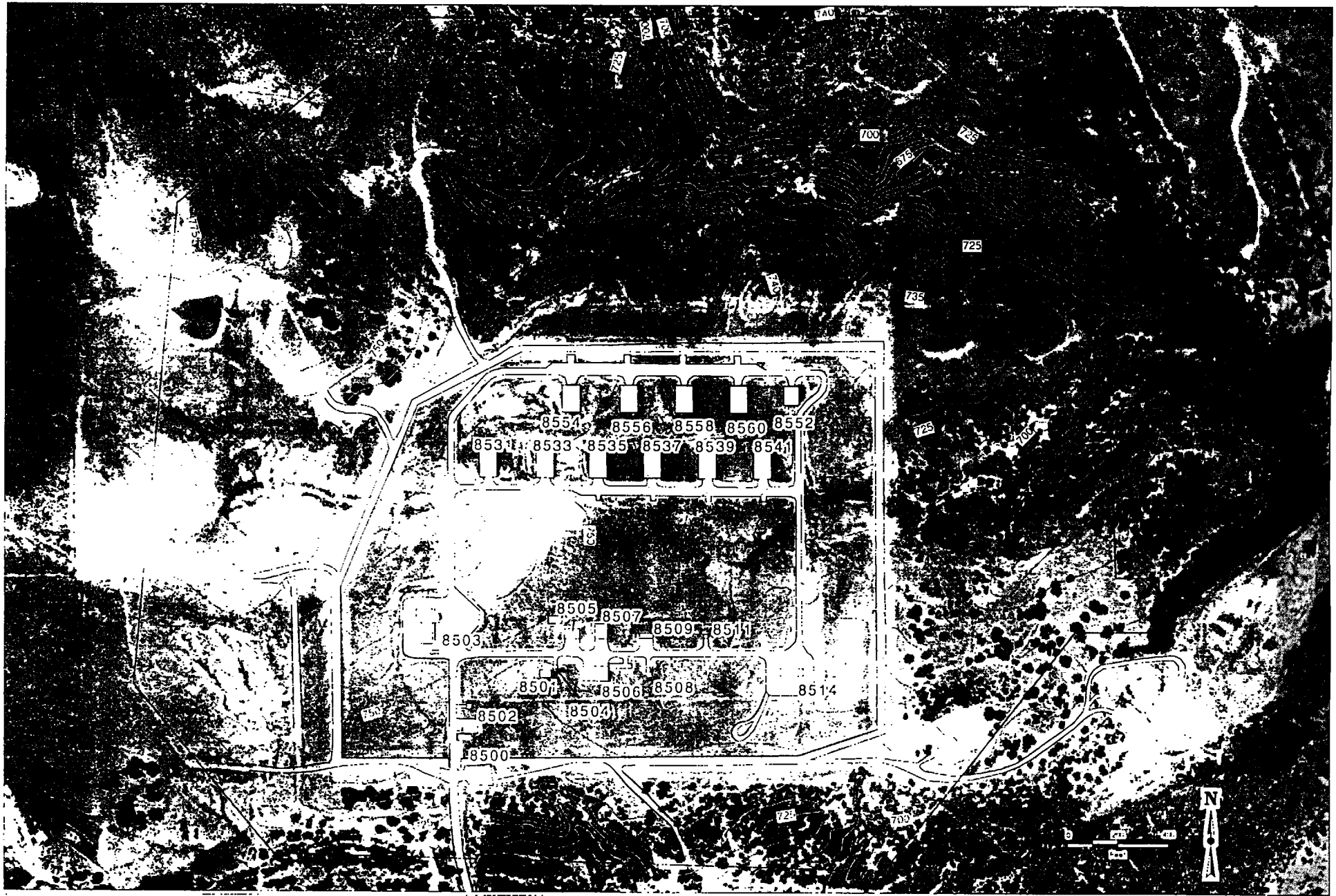
FIGURE 1-1
OFFSITE WEAPONS STORAGE AREA
NAS FORT WORTH
LOCATION MAP



The Environmental Company, Inc.

Date: December 1996
Project Manager: Bob Duffner
Prepared By: WSM
Project No: P-3109

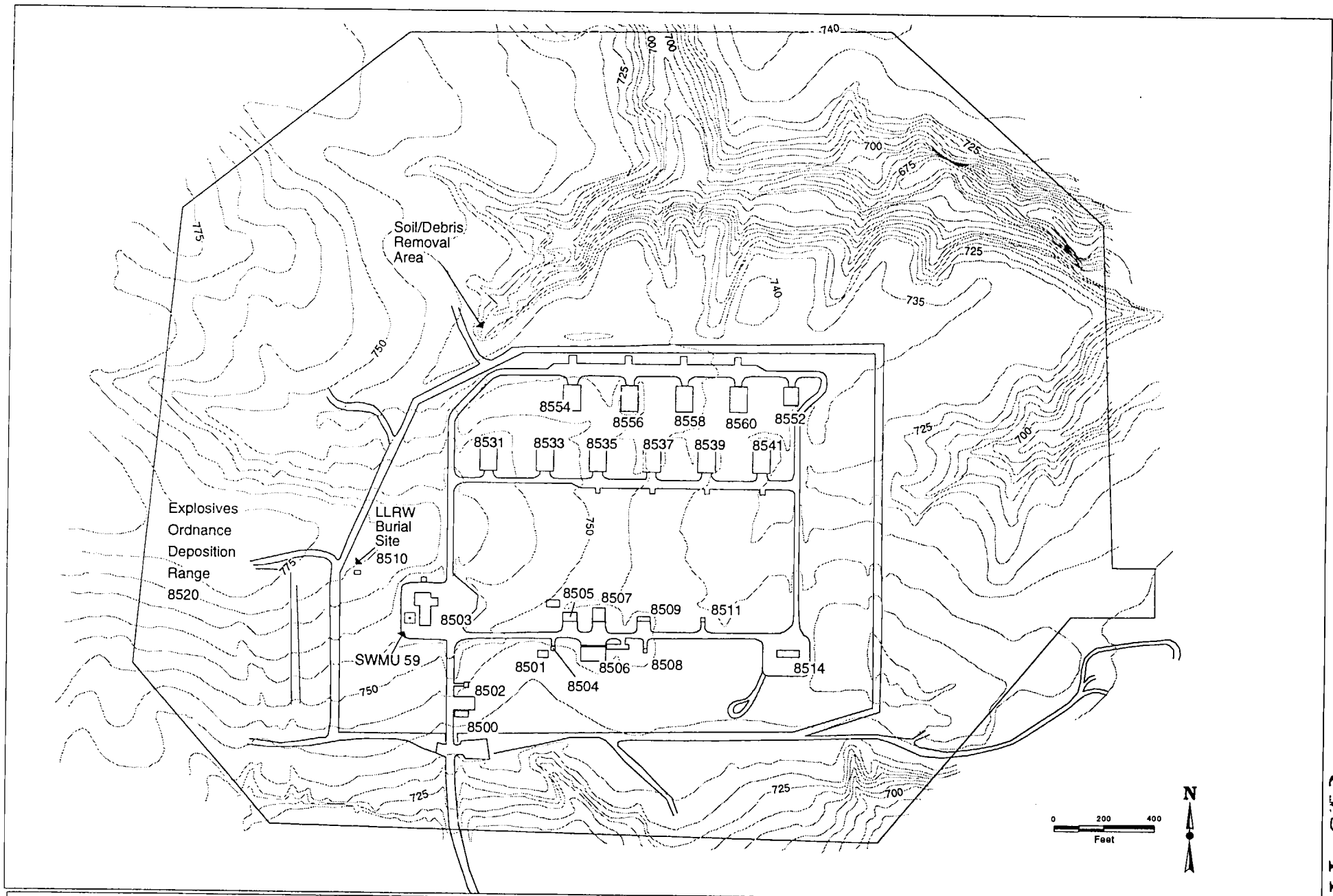
Figure 1-2 -- NAS Fort Worth Offsite Weapons Storage Area Vicinity Map



The Environmental Company, Inc.

Date: December, 1996
Project Manager: Bob Duffner
Prepared By: DEB
Project No: P-3109

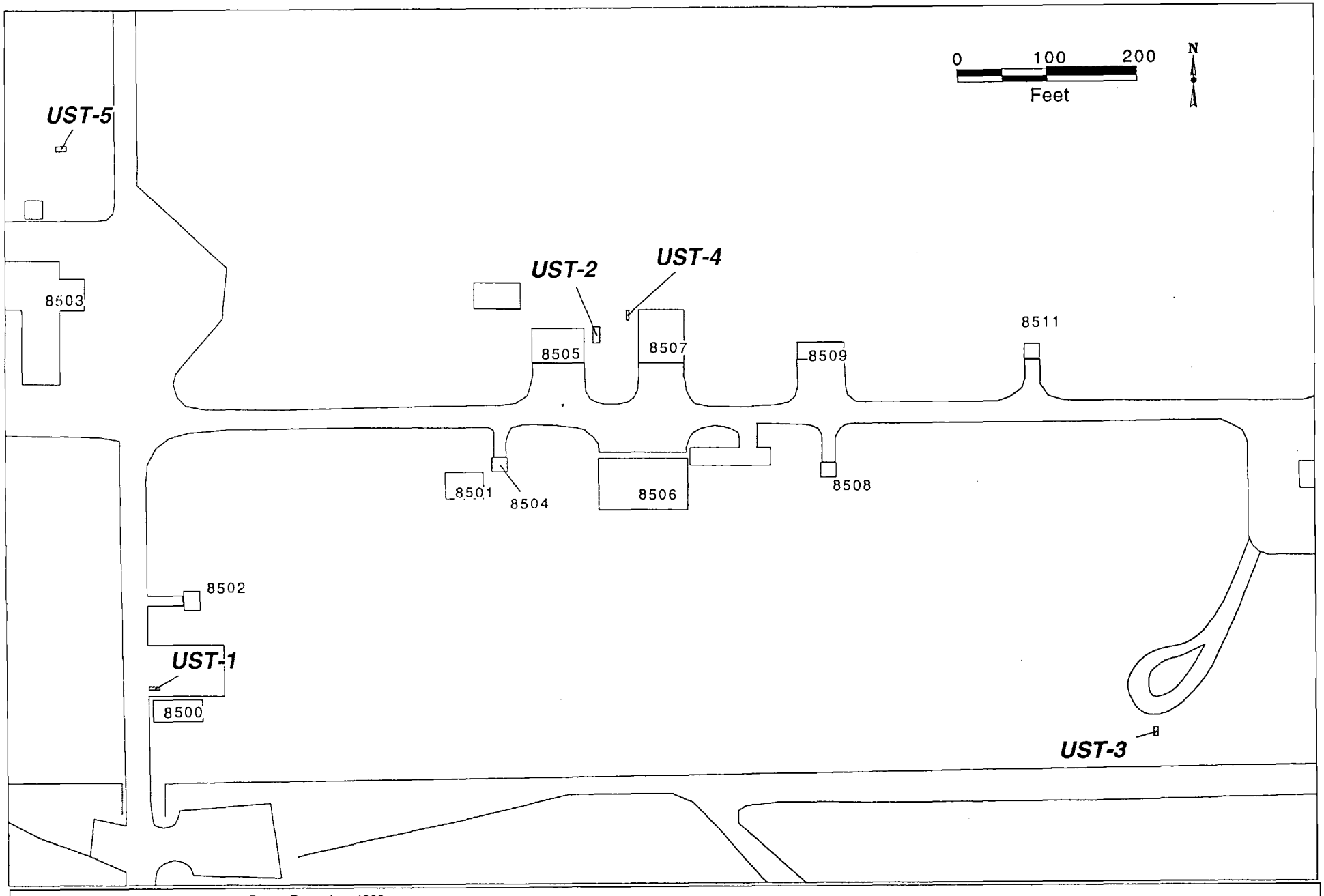
Figure 1-3 -- Aerial Photograph of Offsite Weapons Storage Area



The Environmental Company, Inc.

Date: December, 1996
Project Manager: Bob Duffner
Prepared By: WSM
Project No: P-3109

Figure 1-4 -- NAS Fort Worth Offsite Weapons Storage Area Building Location Map

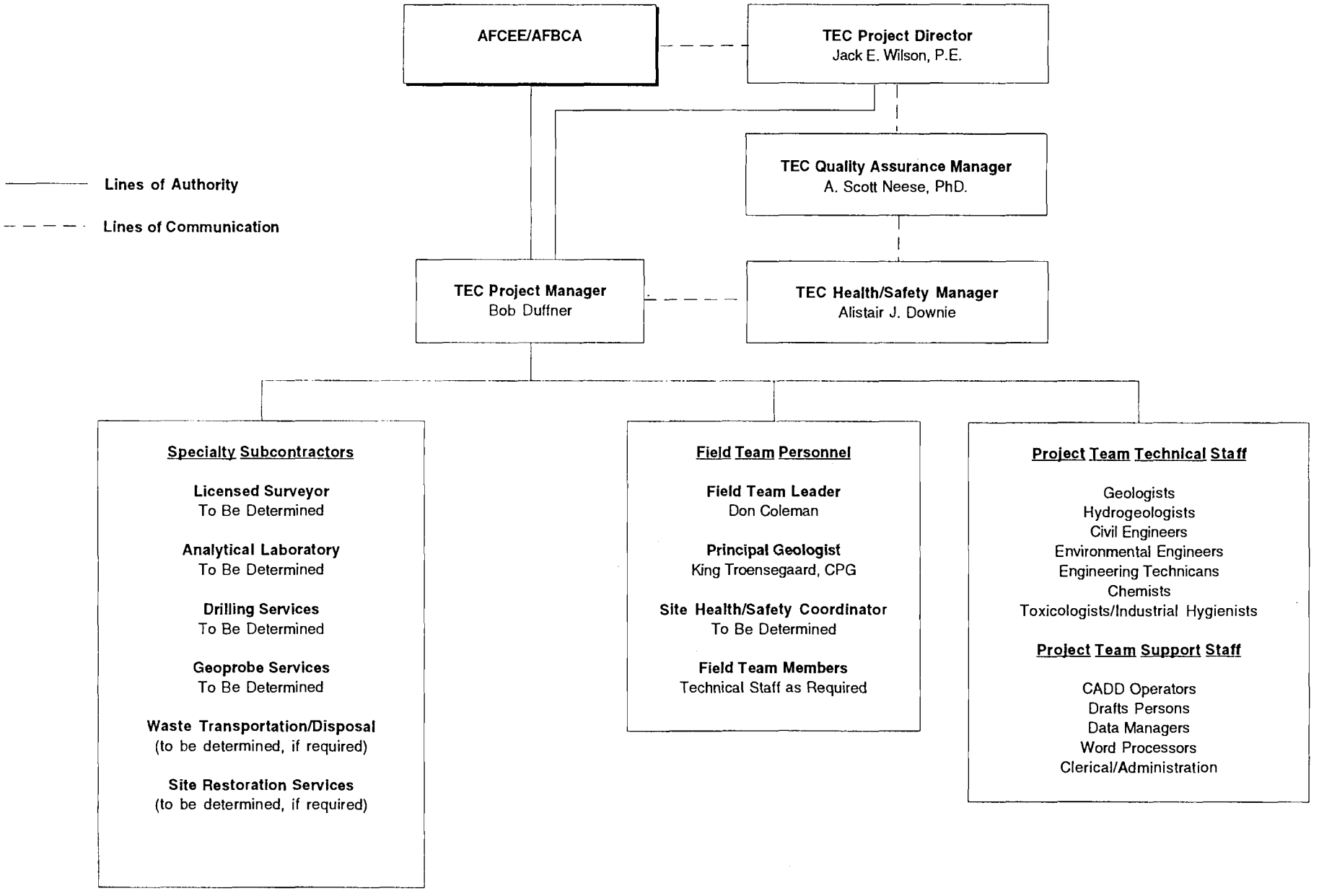


The Environmental Company, Inc.

Date: December, 1996
Project Manager: Bob Duffner
Prepared By: WSM
Project No: P-3109

Figure 1-5 -- NAS Fort Worth WSA Underground Storage Tanks

FIGURE 1-6. PROJECT ORGANIZATION



2.0 SUMMARY OF EXISTING INFORMATION

This section provides a summary of existing information associated with the Offsite WSA as it relates directly to the RFI.

2.1 OFFSITE WSA ENVIRONMENTAL SETTING

The Offsite WSA is located within the Grand Prairie section of the Central Lowlands Physiographic Province. The land area is characterized by broad, gently to moderately sloping terraces of sedimentary rock mantled by a variable thickness of light brown to black loamy soil. The soil layer is thin to virtually nonexistent in some areas of the Offsite WSA. The topography within the fenced area of the Offsite WSA consists of a gently sloping surface with elevations ranging from approximately 720 feet above mean sea level (msl) along east fence to approximately 770 feet above msl near the western boundary fence. The topography is more variable outside of the fenced area. The stream valleys of Live Oak Creek and a tributary are found to the north and southeast of the Offsite WSA fenced area.

2.2 SITE-SPECIFIC ENVIRONMENTAL SETTING

The following subsections provide a brief summary of available information on the Offsite WSA.

2.2.1 Contaminant Sources and Contamination

The investigative activities listed in Sections 1.2.1.1 and 1.2.2 identified several sources of contamination. This section summarizes these source areas and identifies contaminants of concern.

Outdoor Materiel Storage and Maintenance Areas

The area between Building 8503 and Munitions Storage Bunkers 8531, 8533, and 8535 (area A-1) was reportedly used to temporarily store munitions components. Maintenance activities such as sanding, painting and general cleaning may also have been performed in this area. Contaminants of concern associated with these operations include,

- inorganic materials;
- VOCs; and
- explosive compounds.

Waste Accumulation Area (SWMU 59) and Building 8503

A 1989 analysis of soil in an area of bare ground west of Building 8503 (Radian, 1989), used to dump waste cleaners and solvents, revealed the presence of

- TCE (ND to 0.0619 µg/g);
- Metals (antimony, arsenic, barium, beryllium, cadmium, chromium, lead, nickel, selenium, silver); and
- Benzene (1.2 micrograms per kilogram (µg/kg)) and toluene (2.8 µg/kg to 49 µg/kg).

Vehicle Fueling Area

A vehicle fueling area was located approximately 300 feet southwest of Building 8514 on an unpaved circular drive. Remnants of the fuel pump(s) are present on site in the form of a 2 foot by 4 foot concrete pad. The pad is located at the southern most extent of the circular drive. The pump station was served by a 1000 gallon UST located approximately 12.5 feet south of the drive. Contaminants of concern include:

- BTEX;
- TPH; and
- polyaromatic hydrocarbons (PAHs).

Disturbed Surface Area Southwest of the Control Fence

A disturbed surface area was noted inside of the southwest corner of the property and outside of the inner security fence encompassing approximately 20,000 square feet. It appeared that earth moving equipment had been used and that the area had possibly been used as a source for fill material. Contaminants of concern include

- inorganics;
- organic compounds; and
- explosive compounds.

Munition Bunkers

The Offsite WSA contains 11 abandoned munitions storage bunkers. Possible contamination found in these bunkers may include

- explosives and
- metals.

Removed UST Locations

The Offsite WSA contained five USTs. These tanks provided fuel in support of emergency power generation, heating and vehicle fueling. Contaminants of concern associated with these tanks include

- BTEX;
- TPH; and
- PAHs.

Explosive Ordnance Range

An EOD Range consisting of 83 acres of land is located on the western side of the Offsite WSA. The Range was used to store munitions before it was cleared in 1995. The main concerns of this area include

- explosives and
- metals.

Facility Structures

Several potential sources of contamination are present in most of the Offsite WSA buildings. Potential contaminants include,

- ACBM in the buildings;
- Lead-based paint (LBP) on the interior and exterior walls; and
- Explosive residue and metals on the interior surfaces of the munitions storage buildings.

2.2.2 Geology

The stratigraphy of the Offsite WSA consists of the Goodland Limestone, the Walnut Formation, the Paluxy Formation and the Glen Rose Formation, in descending order.

At the Offsite WSA, moderately to highly weathered outcrops of Goodland Limestone and Walnut Formation are present. Very little, if any, fill or soil exists at the site. Alluvial materials assigned to the Tertiary Alluvium are found only along stream channels of Live Oak Creek and its tributary, which are located outside the boundary fence of the site.

Goodland Limestone also outcrops west of the Offsite WSA property boundary. This formation consists of chalky white, fossiliferous, dense, thinly to massively bedded limestone interbedded with gray to yellow-brown stiff clay and marl. Extensive jointing is common in weathered portions of the formation. The thickness of this formation is variable depending on the amount of erosion that has taken place. The Goodland Limestone is 47 feet at its thickest point near Plant 4.

Weathered Walnut Formation outcrops over most of the area inside the fenced boundary of the Offsite WSA (Barnes, 1972). The unit is composed of shell-agglomerate limestone with varying amounts of clay and shale. The limestone is usually fractured and contains considerable jointing and flaking. This formation is 45 feet thick. A disconformity separates the base of the Walnut Formation from the top of the Paluxy Formation.

Underlying the Walnut Formation is the Paluxy Formation. The Paluxy Formation is approximately 45 feet thick and is only exposed along Live Oak Creek and its northern tributary, and in a quarry south of the Offsite WSA. This formation consists predominantly of sands separated by thin, discontinuous shale and claystone layers, as well as lesser amounts of lignite. The lower part of the Paluxy Formation is generally coarser grained than the upper part. The Paluxy Formation may range in thickness from 140 feet to 190 feet (Leggat, 1957).

2.2.3 Groundwater

Groundwater beneath the Offsite WSA occurs within the following four primary units:

- surficial overburden;
- Walnut Formation aquitard, consisting primarily of dry limestone with some locally perched groundwater in shallow weathered zones;
- Paluxy Aquifer; and

- Glen Rose Formations aquitard.

Previous investigations have identified shallow groundwater at a depth of 5 feet below ground surface (Radian, 1989). Groundwater flow direction follows the topography and radiates out from the site to the south, east, and north. Surface erosion in the direction of groundwater flow has exposed the Goodland Limestone and Walnut Formation. The majority of shallow groundwater is expected to discharge to numerous ravines around the site perimeter which feed tributaries of the Live Oak Creek.

The Walnut Formation is typically dry and is not a source of groundwater in the area. Previous investigations, however, report groundwater at the interface between weathered and unweathered rock of the Walnut Formation and small amounts of groundwater may occur in the Walnut Formation along bedding planes and fractures (Hargis + Associates, 1985). This formation is estimated to be approximately 45 feet thick in the vicinity of the Offsite WSA.

The Paluxy Aquifer is the principal source of groundwater in the vicinity of the Offsite WSA. The Paluxy is believed to exist under unconfined or semi-confined conditions, depending on depth of encounter and the local stratigraphic sequence. Most of the water wells in the area are completed in the lower, coarser grained and more permeable, section of the Paluxy Aquifer. Most recharge to the Paluxy occurs where the formation crops out west and north of the Offsite WSA along the Clear Fork of the Trinity River and along tributaries to the West Fork and South Fork of the Trinity River. The amount of recharge via outcrops along Live Oak Creek is unknown. Regional groundwater flow in the Paluxy is southeastward in the direction of the regional dip.

The Paluxy Aquifer is an important source of groundwater for the Fort Worth area. Many of the communities surrounding Air Force Plant 4 and NAS Fort Worth develop their municipal water supplies from the Paluxy Aquifer. Groundwater is also used by many of the surrounding farms and ranches for agricultural and livestock purposes.

The underlying Glen Rose Formation is composed of fine-grained limestone, shale, marl, and sandstone beds. Although the sands in the Glen Rose Formation yield small amounts of water to wells in Fort Worth and western Tarrant County, the relatively impermeable limestone is an aquitard, and restricts water movement between the Paluxy Aquifer above and the Twin Mountains Aquifer below.

Two wells are located on the Offsite WSA property. Both of these reportedly deliver non-potable water to the site for toilet flushing and other non-contact uses. Since there is not a potable water source at the site, bottled water was provided instead.

2.2.4 Surface Water

The primary surface water features in the vicinity of the Offsite WSA are Live Oak Creek, located approximately 400 feet south of the Offsite WSA boundary, and an unnamed ephemeral tributary to Live Oak Creek located immediately north of the boundary of the Offsite WSA property. Live Oak Creek flows northeast from the Offsite WSA and enters Lake Worth approximately 10 miles east of the site. A series of drainageways and ditches transmit surface water runoff directly off the site. All surface

water associated with the site is collected in the perimeter ravines which eventually discharge into Live Oak Creek.

Lake Worth is primarily used for recreational purposes and fishing. Live Oak Creek is used for aquatics and fisheries. There is no reported use of surface water in the area for drinking water purposes. This information will be confirmed in a later stage of the RFI.

2.2.5 Climate

The Offsite WSA is located at approximately 32 degrees north latitude and 97 degrees west longitude, in north-central Texas. The climate of the sites is typified by hot summers and cool, relatively dry winters.

The average annual precipitation is 31.5 inches with the majority of precipitation falling between the months of April and October. The average annual air temperature is 66 degrees Fahrenheit (°F). July is the warmest month with an average monthly air temperature of 86°F and January is the coldest month with an average monthly air temperature of 45°F. Temperature changes may be rapid in the region and often change 20°F to 30°F in a matter of hours. The average annual relative humidity is 63 percent.

Prevailing winds are southerly from March through November and northerly from December through February. The average wind speed is 8 knots. Thunderstorms with wind speeds in excess of 65 knots as well as hail storms are common in the region. Climate conditions in the summer make tornado formations possible.

2.2.6 Biology

There are no threatened or endangered species known to permanently live on the Offsite WSA, according to the Texas Department of Parks and Wildlife and the U.S. Fish and Wildlife Service. None of the Federally listed plant species for Texas are known to exist within 100 miles of Tarrant County (CH_2M Hill, 1984). The Arctic peregrine falcon (threatened), the bald eagle (endangered), and the whooping crane (endangered) are Federally listed bird species known to occasionally frequent the area. These species are migrants attracted by Lake Worth. None of these migrants are expected to reside in the vicinity of the Offsite WSA (USAF, 1993a). Animals expected to inhabit this area include mice, gophers, squirrels, rabbits, granivorous and insectivorous birds, lizards, rattlesnakes, skunks, and higher predators such as hawks, owls, and foxes.

Two Federally listed Category 2 candidate reptile species are known or suspected in Tarrant County. (A Category 2 species is one for which there is some evidence of vulnerability, but for which there is not enough data to support an Endangered or Threatened listing at this time.) One is the Texas horned lizard, which lives on grassy hillsides. The other is the Texas garter snake, which prefers prairie seeps and wet grassy swales. The garter snake may also reside along streams but prefers grassy areas to woody vegetation. There is a slight possibility that either reptile could be present in the unfenced grassland of the Offsite WSA. There is also a slight possibility for the garter snake to be present along the drainages on the Offsite WSA. It is unlikely that either species occurs at the Offsite WSA due to the fragmentation of their habitat into isolated parcels (USAF, 1993).

The closest sensitive habitat to the Offsite WSA are the great blue heron rookeries. The rookeries are located north of NAS Fort Worth, across Lake Worth.

2.2.7 Demographics

The Offsite WSA is located in Tarrant County. Based on the 1990 census, the population of Tarrant County (which encompasses most of the Fort Worth metropolitan area) is approximately 1.17 million; approximately 447,600 people live in the City of Fort Worth. Numerous small communities represent the balance of the population. Land in the vicinity of the Offsite WSA is primarily rural and characterized by grazing and agriculture use. Currently, the area surrounding the Offsite WSA is relatively undeveloped although several small residential communities either have recently been built, or are currently being built in the area.

2.3 CONCEPTUAL SITE MODEL

This section presents a preliminary Conceptual Site Model (CSM) for the Offsite WSA. The CSM is not intended to be a definitive evaluation of the current conditions at the Offsite WSA. It is presented instead as a basis for organizing and understanding available data pertaining to the contaminant sources, release and migration mechanisms, and either potential or actual exposure mechanisms and receptors. Critical gaps in the current understanding of the site conditions are defined and used to focus the subsequent RFI tasks described in Section 3. As more data are collected in the RFI process, the CSM will be refined to further focus on the areas of greatest concern to decision makers.

A preliminary CSM for the Offsite WSA is presented in Figure 2-1. Brief descriptions of key aspects of the model are discussed below as they pertain to potential contaminant sources, migration pathways, and receptors. Where pertinent, gaps in the current understanding of site conditions are identified for resolution during the RFI.

2.3.1 Potential Contaminant Sources

Potential contaminant sources identified during the review of available background information include the following:

- outdoor materiel storage and maintenance areas;
- Waste Accumulation Area (SWMU 59) and Building 8503;
- Vehicle Fueling Area;
- disturbed surface area southwest of the Control Fence;
- munitions bunkers;
- removed UST Locations;
- Explosive Ordnance Deposition Range; and
- facility structures.

A more detailed explanation of these contaminant sources was presented in Section 2.2.1.

2.3.2 Contaminant Migration Pathways

With the exception of sources associated with the site buildings and structures, the potential exists for contaminants to migrate via the groundwater and surface water pathways. The majority of the site is covered with a dense grass vegetation. Therefore, potential contaminant transport from soil to the air is not considered a viable migration pathway. Contaminant sources associated with the site buildings and structures are enclosed within the buildings. The exterior lead-based paint source is considered immobile. Building-related sources are therefore not considered in the contaminant migration pathways discussed below. However, they are included in the RFI field investigation.

Based on these assumptions, groundwater and surface water are considered to be the primary contaminant migration pathways of concern. These pathways along with potentially associated receptors are discussed below.

Groundwater

Contaminant migration via the groundwater pathway is of potential concern at the Offsite WSA. Figure 2-2 represents a conceptual groundwater flow model for the Offsite WSA.

The vertical movement of precipitation through the surficial soils will be restricted by the Walnut Formation Aquitard, the uppermost portions of which are found on site between the surface and depths of approximately 10 feet. As indicated above, previous investigations have identified shallow groundwater at a depth of 5 feet below ground surface (Radian, 1989). The shallow groundwater at the Offsite WSA is assumed to be seasonal and localized in nature. Although no measurements have been made, potentially contaminated groundwater flow direction is expected to follow topography and radiate out from the site to the south, east, and north. Surface erosion in these directions has exposed the weathered surface of the Woodland Limestone and Walnut Formation. Discharging seeps were observed in ravines to the south, east, and north of the site where these outcrops become visible (TEC, 1996). The majority of shallow groundwater is, therefore, expected to discharge to the numerous ravines around the site perimeter which feed tributaries of the Live Oak Creek.

Contaminant migration through the Walnut Formation Aquitard is expected to be restricted based on hydraulic conductivity values of 7.0×10^{-10} centimeters per second (cm/sec) as measured approximately 4 miles east of the Offsite WSA in the vicinity of Plant 4 (Rust Geotech, 1995). Although the formation is typically dry, previous investigations have reported that small amounts of groundwater may occur along bedding planes and fractures (Hargis + Associates, 1985). The vertical migration of potential contaminates through the 45-foot Walnut Formation aquitard and into the underlying Paluxy Formation is not expected. Samples, however, will be obtained from this source.

Surface Water

A series of drainageways transmit surface water runoff associated with potential contaminant sources directly off site. Two primary ditches drain the central portions of the site to the east. Prior to leaving the fence perimeter of the Offsite WSA, surface water runoff collected by these two ditches combine and pool behind a raised culvert. The culvert discharges to the east into a well-established channel contained in a ravine

(Figure 2-2). A number of smaller drainageways transmit surface waters directly off site into other adjacent ravines. In addition to this primary migration pathway, potential contaminants reaching the shallow groundwater may discharge to the surface, as described above and form a secondary surface water migration pathway. All surface water associated with the site is collected in the perimeter ravines which eventually discharge into the Live Oak Creek. Live Oak Creek flows northeast before discharging into Lake Worth, approximately 10 miles to the east.

Receptors

Potential receptors of contaminants originating at the Offsite WSA include future site residents and workers, area residents, recreational users of Live Oaks Creek, local terrestrial wildlife and biota of Live Oaks Creek.

Although the site is currently unoccupied, likely development scenarios include residential use. Future site residents are therefore included in the conceptual model (Figure 2-1). Site residents could be exposed to contaminated soils through ingestion or inhalation of particulates and/or volatiles and through dermal contact. Surface water and sediment would also present potential incidental ingestion, dermal contact, and fish consumption exposure pathways to site residents. Although not a potable source, seasonal shallow groundwater on top of the Walnut Formation is expected. Site residents and workers could come in direct contact with the shallow groundwater discharging through seeps that are exposed during building construction. Future site residents could also come into contact with groundwater contaminants through volatilization of chemicals through the soil and into the air. Although future site residents may use the groundwater in the Paluxy Formation for domestic purposes, it is not expected that this population will be exposed to contaminants via this pathway due to the restricted hydraulic conductivity in the vicinity of the site.

It is currently assumed that area residents have their individual wells screened in the Paluxy Formation and that these wells provide for domestic and agricultural needs. Area residents could be exposed to contaminated surface water and sediment by dermal contact and incidental ingestion, as well as consumption of fish caught in local surface waters.

If site investigations indicate that there is a significant potential for contaminant migration into the Paluxy Formation, exposure to contaminants in the groundwater will be evaluated for potential current and future receptors.

Although an ecological study of the area has not been performed, the area surrounding the Offsite WSA is relatively undeveloped and would be expected to support a variety of terrestrial species. Live Oak Creek is assumed at this time to contain a number of significant aquatic species.

2.4 REMEDIAL ACTION

Potential remedial action alternatives that may be considered in the Corrective Measures Study to address known contaminants at the Offsite WSA and the threats that they pose are described in this section. These potential alternatives are used in the development of the field investigation plans (Section 3.3) so that appropriate sampling and analyses are conducted to support the evaluation of remedial technologies. Development of the

preliminary remedial alternatives presented in this section was performed using the following steps:

- identification of preliminary remedial action objectives;
- preliminary identification of remedial technologies; and
- development of preliminary alternatives.

2.4.1 Preliminary Remedial Action Objectives

The information available on the Offsite WSA suggest that the following contamination hazards exist:

- soils contaminated with organic compounds including VOCs, petroleum products, and explosives;
- soils contaminated with inorganic metals;
- buildings with ACBM;
- building surfaces coated with LBP; and
- building surfaces covered with residual contaminants.

The remedial action objectives for any contaminated soil is to remediate the soil to background conditions or to cleanup goals. The cleanup goals will be governed by the findings of the risk assessment, or by relevant and appropriate requirements of the Texas Industrial Waste Management Regulations, Subchapter S: Risk Reduction Standards or the TNRCC petroleum storage tank (PST) regulations.

The remedial action objectives for asbestos-containing materials and surfaces coated with LBP are to eliminate potential health hazards and to ensure the property's suitability for public transfer.

Closure requirements imposed by the Texas Industrial Waste Management Regulation (TAC 335) are applicable to potential residual contamination present on the surfaces of buildings at the Offsite WSA. In accordance with these regulations, contaminated surfaces must be decontaminated to levels whereby substantial present or future threat to human health and the environment is eliminated.

Remedial action objectives for groundwater are not identified at this preliminary stage. The uppermost groundwater located above the Walnut Formation is assumed to be limited in depth horizontal extent. The field investigation will include an initial evaluation of soil contamination prior to locating actual groundwater monitoring stations. At this stage of the investigation, remedial action objectives for potential groundwater contamination will be assessed.

2.4.2 Preliminary Identification of Remedial Technologies

Remedial technologies identified for soil contaminated with organic compounds, inorganic metals, ACBM, and lead-based painted surfaces and surfaces coated with residual contamination are described in the following sections.

2.4.2.1 Technologies for Soil Contaminated with Organic Compounds

Various types of organic contamination could potentially be present at the site. The use of cleaning solvents may have led to improper disposal of VOCs. Paints used at the site are likely to contain both volatile and semi-volatile compounds. Petroleum products are also composed of both volatile and semi-volatile compounds. The majority of explosives and propellants typically used by the military are organic-based. Although these classes of organic compounds behave differently in the environment and are amenable to different remediation technologies, general forms apply. At this preliminary stage, general remedial technologies for soil contaminated with organic compounds are discussed. Contaminant-specific remedial technologies will be evaluated during the corrective measures study as information is obtained from the field investigation.

Biological Treatment

Biological treatment of organic compounds has been well demonstrated. Biological treatment has been applied both in-situ and ex-situ under aerobic and anaerobic conditions. *Ex situ* aerobic treatment offers the most common forms of treatments including land treatment, composting, and slurry bioreactor. In addition to an identification of the specific organic compounds present, data needs critical to the evaluation of biological treatment technologies include heavy metal concentrations, moisture content, nutrient levels, and gross organic content (i.e., total organic carbon). *In situ* biological remediation technologies also require characterization of site hydrology and evaluation of physical soil characteristics.

Physical Treatment

Physical treatment technologies remove the contaminants from the soil. Generally, this involves transferring the contaminants from the solid phase to either a gas or liquid phase. To transfer contaminants to the gas phase, a process known as thermal desorption may be used. In this technology, the soil is heated, volatilizing the contaminants. The contaminant vapors are removed from the gas phase by downstream air pollution control treatment. To transfer the contaminants to a liquid phase, solvent extraction may be used. For this technology, a solvent, preferably of less toxicity than the contaminant, is mixed with the soil. The contaminant is transferred to the solvent phase. When the soil is separated from the solvent, clean soil is produced. Downstream processing of the soil is required. Potential solvents would include water with surfactant and supercooled propane. Preliminary data needed for the evaluation of these forms of physical treatment include the identification of specific organic compound.

Thermal Oxidation

Thermal oxidation technologies convert the contaminants to carbon dioxide and water. The oxidation is carried out under a high temperature in an incinerator. Many types of incinerators are used for soil treatment including rotary kiln, fluidized bed, and infrared heated. In the event that contaminants do not result in the wastes being a RCRA-listed waste, commercial facilities such as cement kilns may be used if allowed by local and state regulations. Preliminary data needed for the evaluation of thermal oxidation technologies includes the identification of specific organic compounds and determination of moisture content, heat content, solids concentrations, and particle size distribution.

2.4.2.2 Technologies for Soil Contaminated with Inorganic Metals

Metals are inorganic and therefore cannot be destroyed. Treatment of soil contaminated with metals typically involves physical processes which either immobilize the metals or remove them to produce a smaller quantity of contaminated soil. The most common form of immobilization involves solidifying the soil with a combination of fly ash, lime and/or cement. Processes that remove and concentrate metals include solvent extraction and soil washing. Solvent extraction, as discussed in the previous section uses a solvent to solubilize the contaminant and remove it with the liquid phase. A typical solvent would be aqueous with a complexing agent such as a chelator. Soil washing segregates the fine soil particles where the vast majority of contaminants may be found from the coarse soil particles. This hydraulic process produces a significantly smaller volume of contaminated medium, which require additional treatment such as solidification. Preliminary data needed for the evaluation of solidification, soil extraction and soil washing technologies include identification of metal species and determination of particle size distribution.

2.4.2.3 Technologies for ACBM

Various options are available for managing ACBM identified at WSA buildings. Building demolition, building inhabitation, and the present condition of ACBM will determine which remedial technologies are selected to mitigate potential asbestos-related hazards. Remedial options include:

- controlled removal of identified ACBM;
- encapsulation - applying binding or bridging material over friable ACBM;
- enclosure - eonstructing a permanent or semi-permanent structure around the ACBM;
- isolation - restricting access and air flow to ACBM;
- repair - fixing damaged ACBM so that it cannot release fibers to the environment; and
- operations and maintenance - training and alerting personnel to possible asbestos-related hazards. This may involve monitoring asbestos conditions for changes that may require selecting one of the above-referenced response actions.

Friable asbestos will require removal. Non-friable asbestos will require either removal or establishing an Operations and Maintenance (O & M) program if WSA buildings are to be left in place. TEC will perform an economic analysis to determine the most cost-effective measure(s) to mitigate asbestos-related hazards. Preliminary data needed for this analysis include identification of ACBM and assessment of the friability.

2.4.2.4 Technologies for Surfaces Coated with LBP

The viability of remedial options for surfaces coated with LBP is also dependent upon whether the buildings will be demolished or inhabited. Potential remedial technologies include:

- repainting with non LBP, and
- controlled removal.

Preliminary data needed to evaluate the applicability of these technologies include determination of lead in paint.

2.4.2.5 Technologies for Surfaces Covered With Residual Contaminants

Surfaces covered with residual contamination such as explosive compounds and metals may be physically removed by washing the surfaces with cleaning agents. Preliminary data necessary for the evaluation of surface decontamination by washing include identification of contaminant type.

2.4.3 Development of Preliminary Remedial Alternatives

In the event that contamination is identified with concentrations which exceed background or other risk-based levels, remedial alternatives will be fully evaluated during a corrective measures study. A separate corrective measures work plan will be developed for this effort. Remedial alternatives developed at that time may be comprehensive or medium-specific. Presented below are some preliminary comprehensive alternatives which may be considered in the corrective measures study. These preliminary alternatives consist of broadly defined alternatives presenting a range of viable options. They are intended to be a general classification of potential remedial actions identified for the purposes of ensuring preliminary evaluation data elements are collected during the field investigation.

- *Alternative 1: Excavation and Treatment of Soil, Removal of ACBM, Removal of LBP Coatings, and Washing of Interior Building Surfaces.* This alternative would include treatment of organic and inorganic contaminated soil off site using a combination of the technologies discussed in Section 2.4.2. Asbestos and LBP would be removed from the buildings and contaminated interior surfaces would be washed.
- *Alternative 2: In situ Soil Treatment, Removal of ACBM, Removal of LBP Coatings, and Washing of Interior Building Surfaces.* This alternative would include treatment of organic-contaminated soil in place using natural attenuation or other treatment methods discussed in Section 2.4.2.1. This assumes inorganic metal concentrations would not necessitate a remedial action. ACBM and LBP would be removed from the buildings and contaminated interior surfaces would be washed.
- *Alternative 3: Excavation and Treatment of Soil and Washing of Interior Building Surfaces.* This alternative would be identical to Alternative 1, except that however, ACBM and LBP would be left in place. Under this alternative it is assumed that these materials would be disposed of with other materials during future building demolition.
- *Alternative 4: In situ Soil Treatment and Washing of Interior Building Surfaces.* This alternative would be identical to Alternative 2, except that ACBM and LBP would be left in place. Under this alternative it is assumed that these materials would be disposed of with other materials during future building demolition.

Other alternatives, such as no action and institutional actions, may be considered during the corrective measures study. However, these alternatives are not presented here, as

they do not have an influence on the type of sampling and analysis conducted during the field investigation.

2.5 APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS

This section identifies (in accordance with *Section 121(d)* of CERCLA) ARARs and other standards, criteria, and guidance "to be considered" (TBC) when performing the RFI for the Offsite WSA at Carswell AFB, Texas. An "applicable" requirement refers to environmental protection standards, criteria, or limitations promulgated under federal or state law that specifically address a hazardous substance, remedial action, location, or other circumstance at the Offsite WSA. "Relevant and appropriate" requirements are environmental protection requirements promulgated under federal and state law that, while not legally "applicable" to the circumstances at the WSA, address situations sufficiently similar to those encountered at the site, their use is well-suited to the WSA. TBCs are nonpromulgated federal or state advisories, guidance, or proposed rules that are not legally binding and do not have the status of a potential ARAR, but are useful in determining the necessary level of cleanup for protection of human health and the environment where ARARs are not available.

- In accordance with EPA guidance, ARARs and TBCs may be placed into one of three categories:
  - *Chemical-Specific ARARs* - usually health or risk-based numerical values or methodologies that establish an acceptable amount or concentration of a chemical in the ambient environment.
  - *Action-Specific ARARs* - usually technology- or activity-based requirements for remedial actions.
  - *Location-Specific ARARs* - restrictions placed on the concentration of hazardous substances or the conduct of activity solely because they occur in special locations.

The location-specific category does not apply to the Offsite WSA because the site and surrounding area contain no wetlands, national historic properties, endangered species, or other special location characteristics. The following section also subcategorizes ARARs and TBCs as occurring at either the Federal or state level.

2.5.1 Chemical-Specific ARARs and TBCs

Tables 2-1 and 2-2 present a preliminary list of federal and/or state chemical-specific ARARs and TBCs. The areas of concern were identified in previous site investigations and in the conceptual site model. ARARs for groundwater are based on its use as a potable water source. Surface water ARARs are based on non-potable water use (see Appendix B). The following subsections present additional details regarding these ARARs.

2.5.1.1 Federal Chemical-Specific ARARS and TBCs

Drinking Water Standards

During the RFI, the project team will collect and analyze water samples to examine whether or not hazardous substances have migrated from materials used and stored at the WSA to the region's water source. Within *42 Code of Federal Regulations (CFR) 300,*

Safe Drinking Water Act (SDWA), National Primary Drinking Water Regulations (NPDWRs) (40 CFR Part 141), Maximum Containment Levels Goals (MCLGs) and Maximum Containment Levels (MCLs) are established for numerous organic and inorganic contaminants. Appendix B of this document contains a complete listing of all National Primary Drinking Water Standards (NPDWSs).

Lead-Based Paint

Based on previous operations and reporting activities, the presence of lead from past LBP applications will be investigated by the project team. The primary federal regulatory guidance document for investigating LBP hazards is the *Department of Housing and Urban Development (HUD), Guidelines for the Evaluation and Control of Lead-Based Paint Hazards in Housing, June 1995.* These guidelines were issued pursuant to *Section 1017* of the *Residential Lead-Based Paint Hazards Reduction Act of 1992*, often referred to as Title X because it was enacted as Title X of the *Housing and Community Development Act of 1992 (P.L. 102-550).* These guidelines provide comprehensive technical information on how to identify LBP and related hazards (specifically for housing) and how to control such hazards safely and efficiently. Other documents containing regulatory information relevant to LBP include, *40 CFR Part 745, Lead, Requirements for Lead-Based Paint Activities in Target Housing and Child-Occupied Facilities, August 1996* and *29 CFR 1910.1025, Lead.* Table 2-3 lists Federal Lead Standards which will serve as TBCs during project team sampling and analysis activities.

2.5.1.2 State Chemical-Specific ARARS and TBCs

Drinking Water Standards

As noted in Section 2.5.1.1, the project team will collect and analyze water samples to examine whether or not hazardous substances have migrated from materials used and stored at the WSA to the area's water source. In addition to the NPDWSs contained in *40 CFR Part 141,* Texas has issued other primary and secondary drinking water standards in *30 TAC 290.101-290.120, Drinking Water Standards Governing Drinking Water Quality and Reporting Requirements (revised November 25, 1994).* Appendix B of this document contains a complete listing of all Texas drinking water standards.

Hazardous Waste

The TNRCC regulation for industrial solid waste and municipal hazardous waste includes media-specific risk reduction standards (*30 TAC 335.559*). These risk reduction standards are defined in Section 335.8 of the regulations and summarized below (Sections 3.7 and 3.8 of this Work Plan contain details of these risk reduction standards):

- *Risk Reduction Standard 1:* Closure/remediation to background. To remove and/or decontaminate all waste, waste residues, leachate, and contaminated media to background levels unaffected by waste management or industrial activities; or
- *Risk Reduction Standard 2:* Closure/remediation to health-based standards and criteria. To remove and/or decontaminate all waste, waste residues, leachate, and contaminated media to standards and criteria such that any substantial present or future threat to human health or the environment is eliminated.

- *Risk Reduction Standard 3:* Closure/remediation with controls. To remove, decontaminate and/or control all waste, waste residues, leachate, and contaminated media to levels and in a manner such that any substantial present or future threat to human health or the environment is eliminated.

These regulations, combined in *Subchapter S (Risk Reduction Standards)*, specify requirements that can define or modify numeric cleanup levels such as (Medium Specific Concentrations (MSCs)) or require that non-health based criteria be addressed. For surface water, contaminant-specific cleanup levels are based on the Texas Surface Water Quality Standards (*30 TAC 307*). If water quality standards are not available, Federal MCLs or MSCs based upon human ingestion of water are used. Groundwater cleanup levels are based on federal MCLs or, if not promulgated, MSCs for ingestion. For residential soil, determination of cleanup levels considers values 100 times the residential groundwater cleanup level (federal MCLs) or the MSC-based ingestion of soil. A preliminary listing of all media-specific cleanup levels is provided in Appendix B.

Petroleum

Texas regulations regarding petroleum and USTs may be found in the TNRCC regulations entitled *Underground and Aboveground Storage Tanks* (*30 TAC 334*). Guidance on implementing these regulations is provided in the TNRCC, Petroleum Storage Tank (PST) Division's *Technical Guidance: Action Levels for LPST Sites (October 1993).* A total of five USTs containing diesel and fuel oil have been removed from the Offsite WSA in the past. In order to determine if these sites may be considered Leaking Product Storage Tank (LPST) sites, the project team will need to test constituent levels in native soils and ground water on the site. Action levels for petroleum contaminants in groundwater and the native soils are identified in Tables 2-1 and 2-2, respectively. It is important to note that exceeding an action level warrants further assessment of the site, but does not mandate that a site cleanup will be required. These action levels will not be used as cleanup levels, but will serve as levels which signal the need for additional assessment such as a Limited Site Assessment (LSA). The TNRCC soil action levels for petroleum do not apply when:

- groundwater or surface water is known or suspected to be impacted by the release;
- a water well or surface water intake is impacted or threatened;
- buildings or utilities are impacted with vapors;
- the release has resulted in nuisance conditions such as odors, or discoloration or taste degradation to water supplies; or
- there is evidence of an off-site impact.

In addition to the TNRCC PST action levels, the state and federal drinking water standards are applicable to petroleum contaminants found in groundwater.

2.5.2 Action-Specific ARARs and TBCs

2.5.2.1 Federal Action-Specific ARARS and TBCs

Hazardous Waste

Although the RCRA authority has been delegated to the State of Texas, certain federal regulations are adopted by reference and are therefore relevant and appropriate to the site. These regulations are discussed below. RCRA *Subtitle C* governs the "cradle to grave" management of materials that meet the definition of hazardous waste. According to RCRA, "hazardous wastes" are those wastes that are either specifically listed in *40 CFR Subpart D*, or exhibit one of four characteristics: ignitability, corrosivity, reactivity, or toxicity as determined by the toxicity characteristic leachate procedure (TCLP).

The most significant substantive RCRA hazardous waste generator requirement is *40 CFR 262.11*. This is a requirement to determine if waste being generated is a hazardous waste via sampling and analysis or process knowledge (i.e., applicable to wastes being generated through excavation or treatment). Currently, no evidence exists that any "listed" RCRA wastes are present at the WSA. In addition, contaminant levels are expected to be low enough that the project team does not anticipate finding toxic characteristic hazardous wastes at the site. However, if sampling activities identify significantly high levels of contamination, the project team will consider additional TCLP analyses as needed. Soil that fails TCLP will generally have to be managed in accordance with specific RCRA waste management requirements (i.e., land disposal requirements (LDR), treatment, storage, disposal, and closure/post-closure requirements). RCRA hazardous waste management requirements will be applicable to non-UST-related RCRA hazardous waste if:

- spill/disposal occurred after the effective date of the toxicity characteristic rule, or
- response actions constitute treatment, storage or disposal (i.e., contaminated soil is excavated, treated, or disposed).

In regards to RCRA closure and post-closure requirements, *40 CFR 264* contains specific requirements governing the closure and post-closure care of RCRA hazardous waste management units: *General Closure/Post-Closure- 40 CFR 264.110-120;* and *Containers- 40 CFR 264.178*. These requirements are potential ARARs for closure of units used to treat or store wastes (i.e., soil solidification containers/tanks, incinerators, land treatment units, waste piles) and for disposal units (i.e., landfills). These requirements would be applicable to closure units used to manage wastes that failed TCLP RCRA wastes, but would only be potentially relevant and appropriate for closure of units used to manage non-RCRA wastes. Closure performance standards require (*40 CFR 265.111*) the site to be closed in a manner that minimizes the need for further maintenance and that controls, minimizes or eliminates the release of hazardous substances which could adversely impact human health and the environment. Disposal or decontamination of equipment, structures and soils requirements (*40 CFR 265.114*) state that during partial or final closure periods, all contaminated equipment, structures, and soil must be properly disposed of or decontaminated unless specified otherwise in *265.228, 255.258, 265.280,* or *265.300*.

Transfer of Real Property

As part of the RFI at the Offsite WSA, the project team will conduct a Phase II Site Assessment of the entire site to satisfy the requirements of the CERFA, *Public Law 102-425, October 19,1992,* as it amends *Section 120(h) of* CERCLA, and use the *DoD Policy on Implementation of the* CERFA *(May 1996)* for general guidance.

CERFA addresses the identification and documentation of all uncontaminated real property, or parcels thereof, at installations undergoing closure or realignment. "Uncontaminated" property is defined as any real property on which no hazardous substances and no petroleum products or their derivatives, including aviation fuel and motor oil, were known to have been released or disposed. CERFA requires a site to be assessed in order to determine and document its uncontaminated status. The Act specifically requires an EBS to be conducted, including sampling and analysis when required to support a determination of uncontaminated. While an EBS was conducted in 1993 of the Carswell AFB which included the Offsite WSA, further sampling and analysis is required to determine if hazardous substance releases have occurred on the site. The *DoD Policy on Implementation of the CERFA* details procedures for conducting an EBS, documentation requirements, and the responsibilities of various DoD and other Federal officials.

Asbestos

Based on previous investigations and construction dates of those facilities located at the Offsite WSA, the project team will investigate the presence of asbestos, using the following Federal asbestos regulations as guidance:

- *40 CFR Part 61 Subpart M, National Emissions Standards for Asbestos* - This section establishes national emission standards for hazardous air pollutants (e.g., asbestos) pursuant to the Clean Air Act (CAA) and Clean Air Act Amendments (CAAA). This section provides regulations and standards for the demolition and renovation of facilities.
- *40 CFR Part 763 Subpart E, Asbestos-Containing Materials in Schools* - This section establishes asbestos regulations pursuant to the Toxic Substance Control Act (TSCA) and Asbestos Hazard Emergency Response Act (AHERA). The regulatory program mandated and discussed in AHERA specifically addresses asbestos hazards in schools; however, this regulatory program also serves as the industry standard for asbestos hazards in all public and commercial buildings. This section of the CFR discusses numerous regulations regarding building inspections/reinspections, ACBMs sampling and analysis requirements, development of asbestos management plans, and other procedures.
- *40 CFR Part 763 Subpart F, Friable Asbestos-Containing Materials in Schools* - This section provides warning and notification requirements for facilities found to contain friable ACBM as a result of the requirements of *40 CFR 763 Subpart E.*
- *29 CFR Part 1910 Section .1001, Occupational Safety and Health Administration (OSHA) General Industry Asbestos Standards* - This section establishes numerous regulations for occupational exposures to asbestos, including permissible exposure limits (PELs) for worker exposure to airborne asbestos fibers and

requirements for implementation of engineering controls and personal protective equipment (PPE).

- *29 CFR Part 1926 Section .1101, OSHA Construction Industry Asbestos Standards* - This section regulates asbestos exposure in all construction industry work including, demolition or salvage of structures where asbestos is present; removal of materials containing asbestos; and construction, alteration, repair, maintenance, or renovation of structures or substrates that contain asbestos. This section also details information and regulations regarding the OSHA Asbestos Work Classification System, worker PELs, and exposure assessment and monitoring.

2.5.2.2 State Action-Specific ARARS

LBP

In addition to the regulations discussed in Section 2.5.1.1, the project team will follow the requirements presented in the Texas Department of Health's (TDH) *Texas Environmental Lead Reduction Rules (February 1996).* This document establishes the means to control and minimize public exposure to lead-based paint activities. Section 295.212 specifically addresses Texas standards for conducting lead-based paint activities.

Hazardous Waste

In addition to the previouslyt noted in Section 2.5.2.1, the project team will adhere to the TNRCC's general regulations for industrial solid waste and municipal hazardous waste management *(30 TAC 335 Subchapter A), Notification Requirements (*Section 335.6*)* and *Closure (*Section 335.8*).* Both Section 335.6 and Section 335.8 apply to persons who undertake the closure of facilities used for the storage, processing or disposal of industrial solid waste. These regulations also apply to persons undertaking the remediation of contaminated media resulting from the unauthorized discharges from such facilities, either as part of closure or at any time before or after closure.

In addition to the regulations discussed under Subchapter A, TNRCC regulations concerning permitting standards for owners and operators of hazardous waste storage, processing, or disposal facilities (*30 TAC 335 Subchapter F*) mandate all SWMUs to comply with the requirements in Section 335.167. This Section 335.167 requires corrective action to be performed on the site if necessary. The project team will also refer to the TNRCC's regulation on waste classification (*30 TAC 335 Subchapter R*) when detailing waste classification procedures and standards.

2.6 DATA NEEDS

The objectives of the RFI are defined in Section 1.3.1 of this WP. Data needed to accomplish these objectives include:

- *Soil and Sediment Characteristics Data.* Soil characteristics data is necessary to understand the geologic conditions in areas of potential contamination. Lithologic data will be recorded during all subsurface sampling activities conducted in relation to the UST soil boring activities and outdoor materiel

storage/maintenance area assessments. Grain size and moisture content analyses will also be conducted on selected soil and sediment samples.

- *Soil Contamination Data.* Soil contamination data is necessary in areas of potential contamination to identify the types and concentrations of contaminants present in surface and subsurface soils. Soil samples are to be collected during those portions of the investigation related to the USTs, the outdoor materiel storage/maintenance areas, and the Waste Accumulation Area/Building 8503 perimeter. Soil sample analyses will be selected based on potential waste types generated at each area. Specific analyses to be conducted on samples collected from each area are identified in Section 3.3 of this WP.
- *Sediment and Surface Water Contamination Data.* Sediment and surface water contamination data is necessary to identify the types and concentration of contaminants present in the drainageways both on and off site. Sediment and surface water samples will be analyzed for all contaminants potentially present on site. Specific analyses to be conducted for each group of samples are identified in Section 3.3 of this WP.
- *Groundwater Characteristics Data.* Groundwater characteristics data is necessary in areas of potential contamination to understand the hydrogeologic conditions. The depth to groundwater associated with the upper alluvium as well as with the Paluxy Formation will be determined. Measurements will be taken from all wells associated with the site including the existing on-site wells, those to be installed by other ongoing investigations, and those installed as part of this investigation. Direction of groundwater flow will be determined based on these measurements.
- *Groundwater Contamination Data.* Groundwater contamination data is necessary to identify the types and concentrations of contaminants present in groundwater. Measurements will be taken from the existing on-site wells, selected wells to be installed during other ongoing investigations, and those installed as part of this investigation. Four additional groundwater monitoring wells will be installed in the shallow alluvium. The specific location of the wells will be determined after evaluating the results of the soil characterization and the results from an ongoing background study. Groundwater samples will be analyzed for all contaminants potentially present on-site.
- *Biologic Data.* Biologic data is necessary to define the ecological environment surrounding areas of potential contamination. Common biotic communities will be identified as well as any sensitive environments.
- *Demographic Data.* Demographic data is necessary to determine population densities and land use surrounding areas of potential contamination. This data will be obtained during the literature search.
- *Land Survey Data.* Land survey data is necessary to accurately locate property boundaries, easements, soil boring and sample locations, and groundwater monitoring well locations.

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Table 2-1. Preliminary Chemical-Specific ARARs for Groundwater

Constituent	ARARs (mg/L)*
Benzene	.005
Ethyl Benzene	0.7
Toluene	1.0
Xylenes	10.0
Tetrachloroethene	.005
Trichloroethene	.005
Lead	.015
Chromium	0.1

*The final, proposed or listed Maximum Contaminant Level (MCL), from Section 141 of the Federal Safe Drinking Water Act. These numbers are the same as those contained in the Texas Drinking Water Standards 30 TAC290.101-290.120.

Table 2-2. Preliminary Chemical-Specific TBCs for Soils

Constituent	Action Levels (mg/kg)	Medium Specific Concentration (Risk Reduction Std. 2)
Benzene	.5[a]	.5
Ethyl Benzene	70[a] and 10[b]	70
Toluene	100[a] and 20[b]	100
Xylenes	560[a] and 70[b]	1000
TPH (Middle Distillate Releases)	500 ppm	-
TPH (Gasoline Releases[c])	100 ppm	-

[a] Apply the fine soil standard to sites dominated with clays and silts.

[b] Apply the coarse soil standards to sites dominated with sands, gravels, and rock units.

[c] Apply the middle distillate TPH standard to diesel, kerosene, jet fuel, fuel oil, hydraulic oil, and waste oil releases. Apply the gasoline standard to aviation gasoline releases. In a tankhold with gasoline and diesel tanks, the gasoline standard will apply unless it can be demonstrated that gasoline has not been released.

Table 2-3. Federal Lead Standards 318 69

Lead Category	Standard
Paint	1.0 mg/cm² or 5.000 ug/g (0.5 percent)
Leaded Dust Levels for Risk Assessments (by swipe sampling)	• 100 ug/ft² - floors (carpeted and uncarpeted) • 500 ug/ft² - interior window sills • 800 ug/ft² - window troughs
Dust Levels for Lead Hazard Screen Only	• 50 ug/ft² - floors • 400 ug/ft² - window troughs
Leaded Dust Clearance Levels (by swipe sampling)	• 100 ug/ft² - floors (includes carpeted and uncarpeted floors) • 500 ug/ft² - interior window sills • 800 ug/ft² - window troughs • 800 ug/ft² - exterior concrete surfaces
Bare Residential Soil	• 5,000 ug/g - paving and removal criteria • 2,000 ug/g - building perimeter and yard • 400 ug/g - play areas and high-contact areas for children
Airborne Lead Particulate	• 30 ug/m³ - OSHA action level (8-hour time weighted average) • 50 ug/m³ - OSHA permissible exposure limit (8-hour time weighted average)
Waste	5ppb by TCLP

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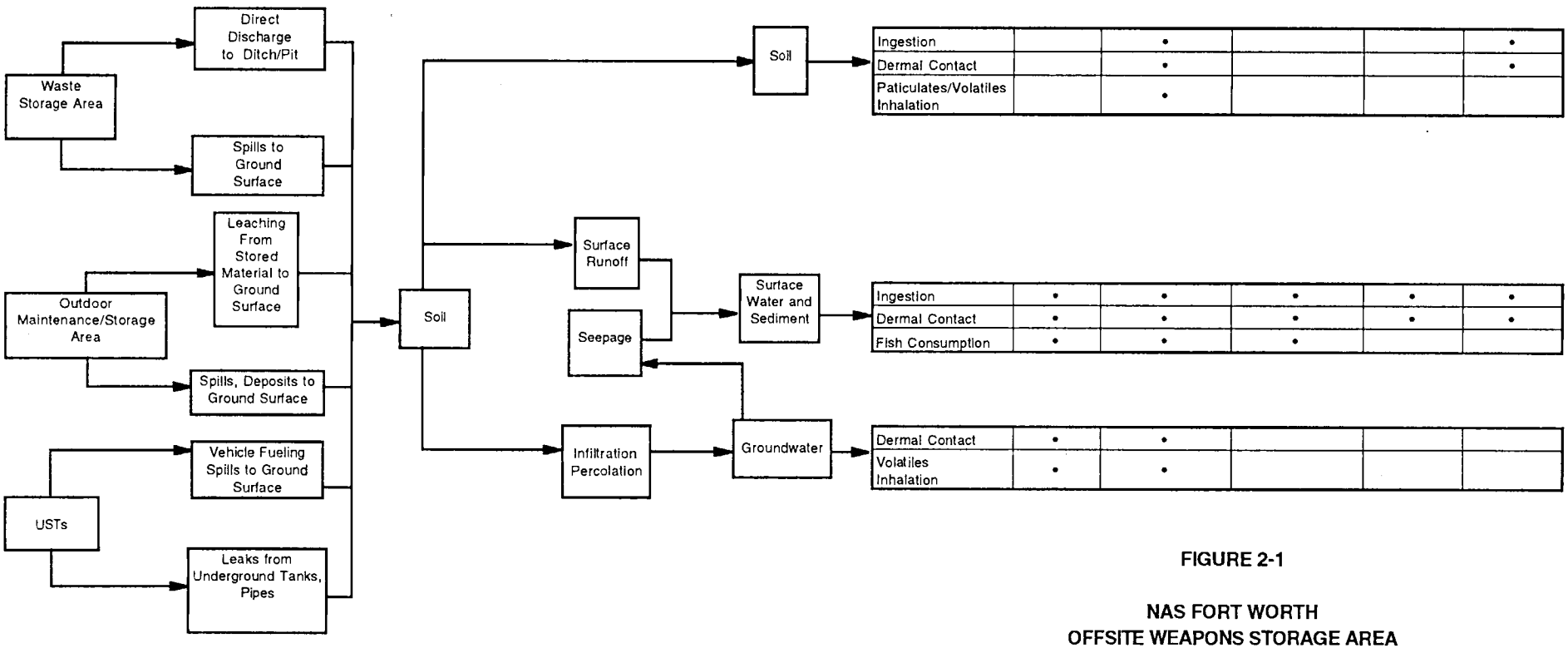
OFFSITE WEAPONS STORAGE AREA PRELIMINARY CONCEPTUAL SITE MODEL

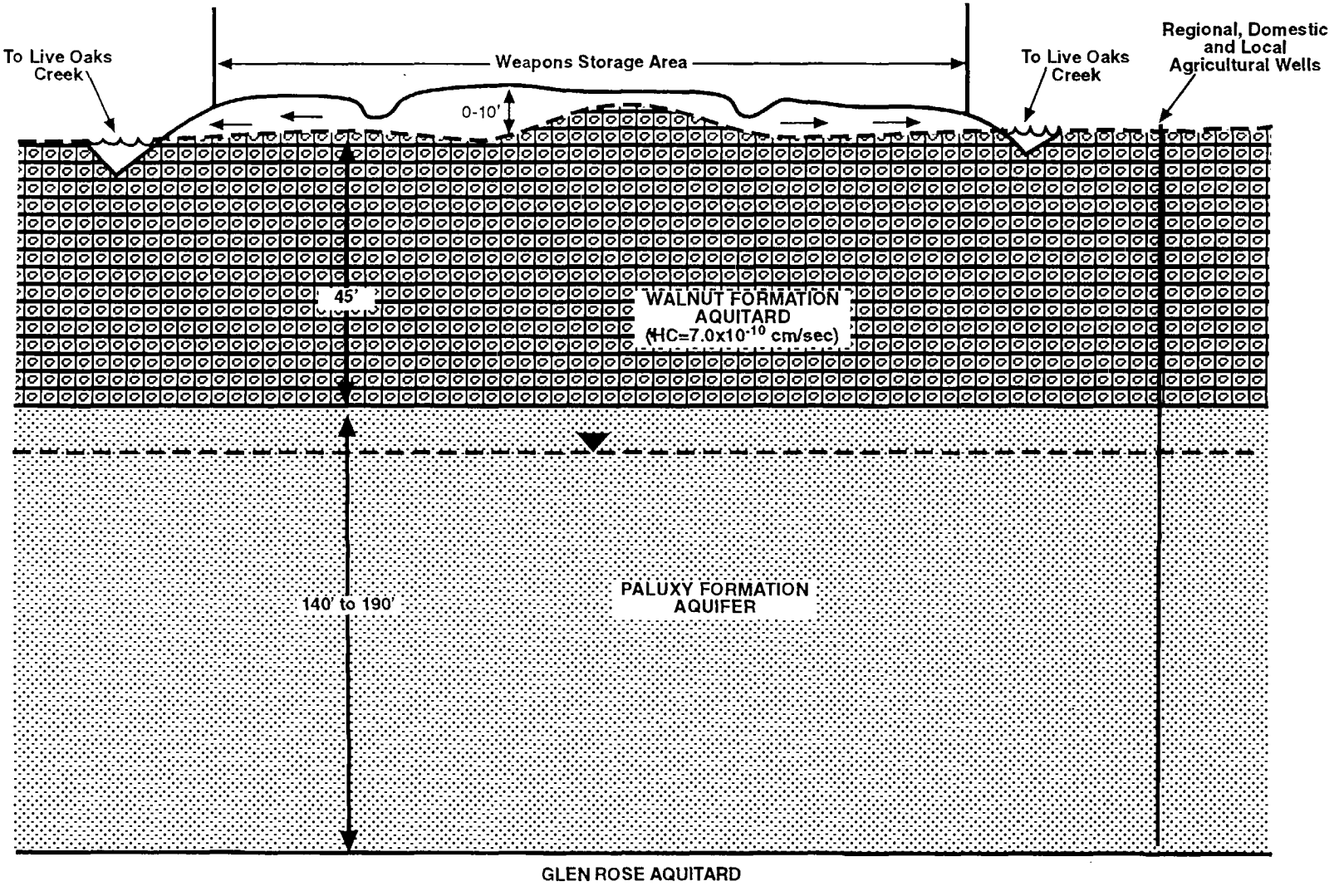


POTENTIAL RECEPTORS

EXPOSURE ROUTE	HUMAN: Current Area Residents	HUMAN: Future Site Residents/Workers	HUMAN: Current/Future Recreational Users	BIOTA: Aquatic	BIOTA: Terrestrial
Soil: Ingestion		•			•
Soil: Dermal Contact		•			•
Soil: Paticulates/Volatiles Inhalation		•			
Surface Water and Sediment: Ingestion	•	•	•	•	•
Surface Water and Sediment: Dermal Contact	•	•	•	•	•
Surface Water and Sediment: Fish Consumption	•	•	•		
Groundwater: Dermal Contact	•	•			
Groundwater: Volatiles Inhalation	•	•			

FIGURE 2-1

NAS FORT WORTH
OFFSITE WEAPONS STORAGE AREA
CONCEPTUAL SITE MODEL



Date 11-14-96

Project No. 3109

Project Manager B. Duffner

Prepared by N. McGillivray

The Environmental Company, Inc.

LEGEND

- Surficial Soil
- Sandstone
- Limestone
- Groundwater Flow
- Water Level
- Ravine with Seeps

FIGURE 2-2
NAS FORT WORTH
OFFSITE WEAPONS STORAGE AREA
CONCEPTUAL GROUNDWATER FLOW MODEL

3.0 RCRA FACILITY INSPECTION TASKS

The following sections describe the tasks that will be conducted during the RFI at the Offsite WSA. The overall investigation objectives are referenced in Section 3.1. Data quality objectives (DQOs) for the inspection tasks are discussed in Section 3.2. These tasks are described in general terms in Section 3.3. Details regarding field activities, sampling methods, laboratory analytical methods, and quality assurance procedures are provided in the SAP (i.e., in the FSP and the QAPP). Health and safety procedures are also provided separately in the HSP. References are made to these scoping documents as necessary and appropriate.

3.1 INVESTIGATION OBJECTIVES

The objectives for this RFI have been presented in Section 1.3.1 of this WP. Data needs associated with these objectives are identified in Section 2.6. Specific tasks as discussed below will be completed to meet these objectives, to fill the identified data gaps and to complete those items required by the SOW for Project No. 96-8117 (see Appendix A).

3.2 DATA QUALITY OBJECTIVES

Key to the successful completion of the Offsite WSA RFI is a properly designed and executed work plan and sampling plan. The Offsite WSA Sampling Plan, presented under separate cover, is based on DQOs which define the quality objective or endpoint to be achieved by the RFI in general and specific field tasks in particular. The Sampling Plan ultimately provides the data from which conclusions of the RFI will be drawn and from which site decisions will be made. Consequently, the Sampling Plan, and associated DQOs, must be responsive to both regulatory and scientific concerns.

In general, DQOs specify the type, quality, and quantity of data required to support anticipated decision requirements at the site. Decision requirements for the Offsite WSA RFI are described in terms of project objectives in Section 1.3. Based on those objectives and on an analysis of existing site information and regulatory requirements in Sections 2.1 through 2.5, data gaps which must be filled during this study to satisfy the project objectives and support informed decisionmaking at the site are presented in Section 2.6.

Table 3-1 summarizes overall DQOs for this study as they relate to the specified RFI objectives and associated data gaps. Specific methods by which the DQOs will be achieved, including sampling numbers, locations, rationale, methods, and analytical requirements are described in detail in the Section 3.3. Additional details are provided in the FSP. Associated quality assurance/quality control (QA/QC) procedures for sample collection, handling, analysis, and documentation are defined in the Offsite WSA QAPP.

3.2.1 Data Categories

As indicated in Table 3-1, two general categories of data will be collected, screening data and definitive data. Collecting screening and definitive data represent qualitative and quantitative approaches to achieving the RFI DQOs.

Screening data are generated by rapid methods of analysis with less rigorous sample preparation, calibration, and/or quality control (QC) requirements than are necessary to produce definitive data. Sample preparation steps may be restricted to simple procedures, such as dilution with a solvent, instead of elaborate extraction/digestion and cleanup. Screening data may provide analyte identification and quantification, although quantification may be relatively imprecise.

Screening data will be collected so that qualitative approaches to data collection meet the RFI DQOs. Qualitative approaches include, identifying field equipment, procedures, and protocols to conduct the subsurface investigation; analytical procedures used to evaluate soil and groundwater samples; specific types of equipment used to collect soil and groundwater samples; methods of sample collection, preservation, and shipment of quality control samples, if applicable; and decontamination procedures to ensure accurate, precise, and representative data. Physical test methods (e.g., dissolved oxygen measurements, groundwater temperature and pH measurements, oxidation/reduction potential, soil moisture content, turbidity, electrical conductance) have been designated by definition as screening methods.

Quantitative approaches to achieve the project DQOs include, monitoring well development and sample purge volume requirements; soil and groundwater sample container volume requirements; accuracy requirements on *in situ* parameter measurements taken during sample purging; reporting units; and detection limits of chemical parameters. Definitive data will be collected using rigorous analytical methods such as USEPA-approved reference methods. Samples will be analyzed at an off-site laboratory. Data are analyte-specific, and both identification and quantification are confirmed. These methods have standardized QC and documentation requirements. Definitive data are not restricted in their use unless quality problems require data qualification. The remainder of Section 3 describes the particular objectives, scope, rationale, and types of data (e.g. screening and/or definitive) to be collected during each of the primary Offsite WSA RFI investigative tasks.

3.3 INVESTIGATION TASKS

The RFI field tasks will be completed in a number of consecutive stages. The preparatory stage will include an initial land survey and utilities location. After mobilizing field equipment, personnel and establishing a temporary on-site field office, environmental media sampling and structural investigations will begin.

Sampling efforts will be focused on areas of concern as identified in Section 2.2.1. Areas associated with potential soil and surface water contamination are identified on Figure 3-1 and Figure 3-2, respectively. Table 3-2 provides a summary of the number of locations within each area and the number samples to be collected and are listed below:

- outdoor materiel storage and maintenance areas (A-1, A-2);
- unpaved perimeter of the Waste Accumulation Area and Building 8503 (A-3);
- Vehicle Fueling Area (A-4);
- disturbed surface area southwest of the Control Fence (A-5);
- EOD Range;

- bunker floor drain outlets;
- removed UST locations;
- drainageways, ditches and seeps; and
- groundwater monitoring.

In addition to these environmental media sampling tasks, structures on site will be assessed for potentially hazardous materials and/or constituents. Tasks associated with the structural investigation include;

- asbestos survey;
- LBP Survey; and
- facility contamination survey.

Other tasks will be completed in support of the overall RFI. These tasks will include;

- literature search;
- recordkeeping;
- data quality assessment;
- characterization of background conditions;
- risk assessment; and
- corrective measures study.

Each of these tasks is discussed below. Included in the discussions are the description of the investigation area, task objective, scope of the task, and rational used to define the effort.

3.3.1 Outdoor Materiel Storage and Maintenance Areas (A-1, A-2)

Investigation Area

Investigations will be conducted in those areas where materiels storage and maintenance activities were either reported or suspected of occurring. The area between Building 8503 and Munitions Storage Bunkers 8531, 8533, and 8535 (area A-1) was reportedly used to temporarily store munitions components. Maintenance activities such as sanding, painting and general cleaning may also have been performed in this area. A second area (A-2) potentially used for similar activities is located directly north of the road serving Munitions Storage Bunkers 8554, 8556, 8558, 8560, and 8552 (see Figure 3-1).

Task Objective

Since these areas are unpaved, waste materials generated could have been deposited directly to the ground surface. The objective of this task is to identify if contaminants are present in the surface and subsurface soils and to determine the extent of any potential contamination.

Task Scope and Rational

In order to meet this objective, surface and subsurface soil samples will be collected from each area. Area A-1 encompasses approximately 179,800 square feet. Samples from area A-1 will be collected on an established grid pattern (see Figure 3-3). The grid lines will be aligned parallel to the adjacent service roads. It is assumed that the majority of activity was performed adjacent to the service roads. The first grid lines adjacent to the roads, therefore, will be placed approximately 10 feet from the edge of the pavement. The next set of lines will be spaced 50 feet apart. All other lines will be spaced 100 feet apart as shown on Figure 3-3. The sampling grid in this area will also be extended across the service roads to the northwest due to the presence of disturbed soil noted during the field reconnaissance effort.

Area A-2 encompasses approximately 36,000 square feet. The area is bound by the service road to the south and the fence to the north. Service road extensions located directly across from each bunker divide the area. Activity in this area is assumed to have taken place close to the roadside. Sample locations will, therefore, be biased towards the edge of the northern service road and the road extensions as shown in Figure 3-3.

Surface and subsurface soil samples will be collected at each borehole location as shown on Figure 3-3 and at additional biased locations where surface anomalies are identified. Four biased locations are assumed in the plan but are not shown on Figure 3-3. Surface samples will be collected between 0 and 6 inches below ground surface. Subsurface soil samples for chemical characterization will be collected at intervals of 5 feet or directly above bedrock if encountered first. The first subsurface soil sample for chemical characterization will be collected between 6 and 28 inches below ground surface. A second sample for chemical characterization will be collected between 66 and 88 inches below ground surface or directly above the bedrock surface. Based on an assumed depth to bedrock of 5 feet below ground surface, it is estimated that one surface soil and two subsurface soil samples will be collected from each location for chemical characterization. Headspace screening and lithologic descriptions will be completed on all samples. Additional subsurface soil samples may be collected if headspace screening indicates the presence of contamination. Specific details regarding sample intervals, depths, and collection methods are provided in the FSP.

The sanding, painting, and general cleaning activities performed in this area may have generated wastes with associated inorganic, volatile organic and explosive compound contamination. Analyses for these types of contaminants will be performed. Potential SVOCs and pesticide/PCBs contamination resulting from the activities performed in these areas is not expected. In order to completely characterize the site, however, samples from 10 percent of the locations will be analyzed for SVOCs and pesticides/PCBs. These locations will be evenly distributed across the investigation area. SVOC and pesticides/PCB analyses will also be performed at all biased locations where surface anomalies are identified.

Inorganics, explosive related compounds, SVOCs and pesticides/PCBs are generally less mobile and adsorb to soil. Consequently, all would be expected to be found in both the surface and subsurface soils. VOCs, in comparison, could be removed from the surface over time due to a combination of downward migration and surficial volatilization.

Soil chemical analyses will be performed in accordance with the contaminant mobility and persistence characteristics. All subsurface soil samples collected from areas A-1 and A-2 for chemical characterization will be analyzed for VOCs. Surface samples will not be analyzed for VOCs due to the extended time since the site has operated and assumed volatilization during that period. All surface and upper subsurface (6 to 28 inches) samples will be analyzed for inorganics and explosive-related compounds. 10 percent of the surface and upper subsurface samples will also be analyzed for SVOCs and pesticide/PCBs. Separate aliquots from all deeper samples submitted for VOC analyses will be archived. In the event that inorganic, explosive-related compounds, SVOC or pesticides/PCB-contamination is detected in the surface or upper subsurface sample, the archived material at that location will be analyzed for the contaminants of concern.

All biased located samples will be analyzed for inorganics, VOCs, SVOCs, pesticides/PCBs, and explosive-related compounds.

Since the extent of activity in these areas is inferred from historical descriptions of site activities and aerial photographs, preliminary laboratory results for inorganic, VOC, and explosive compound results will be reviewed if available before demobilizing from the field. These analytes are considered to be the most indicative of activities performed in at the WSA. This preliminary review will allow for possible expansion of localized study areas in the event that contamination is found beyond the initial sample collection zone. Preliminary data will consist of raw laboratory results which have not undergone independent validation. Use of the data will, therefore, be restricted to decisions regarding the need for additional sample locations, analysis of archived sample material and evaluation of the need for monitoring wells. These data and all other analytical data will be independently validated prior to use for all other investigative needs.

During this investigative task, background conditions in surface and subsurface soil samples will be established. Five surface and subsurface soil background locations will be sampled. A surface and subsurface sample will be collected at each location. Background locations will be west of the site beyond the property boundary. These locations will be identified during the field effort and are not shown on Figure 3-3. Samples collected from these locations will provide for comparative analysis of sample results generated from soil samples collected as part of this task and those from areas A-3, A-4, A-5, the EOD range and the bunker floor drains (see sections below). The comparative analysis will be conducted with respect Title 30 TAC 335.554, *Attainment of Risk Reduction Standard Number (RRSN) 1: Closure/Remediation to Background.* All background samples will be analyzed for inorganics, and explosive compounds. All background subsurface samples will also be analyzed for VOCs. In addition, a surface and a subsurface sample from one background location will also be analyzed for pesticides/PCBs and SVOCs.

3.3.2 Waste Accumulation Area and Building 8503 (A-3)

Investigation Area

The Waste Accumulation Area (SWMU 59) and Building 8503 operations are likely to pose the greatest potential impact to the environment by nature of their function. Building 8503 was the primary maintenance and inspection facility. The buildings contains two open maintenance bays located on the north and south ends of the buildings. Each bay has two doors on their east and west sides. The southern bay contains two paint

booths. Each bay contains an overhead crane system which would allow for work on heavy equipment. The entire building is surrounded by a concrete surface. The Waste Accumulation Area (SWMU 59) is located directly west of the southern end of Building 8503, along the edge of the concrete surface. During the site reconnaissance, cracks in the pad were noted adjacent to the Waste Accumulation Area (see Figure 3-1).

The entire surface surrounding the Waste Accumulation Area and Building 8503 is impervious and stormwater sheet flows away from the buildings to the north, south, and west onto the adjacent grass soil. Sloping terrain in the area generally directs runoff from the north to the south. A ditch approximately 10 feet off the west side of the concrete pad collects runoff and directs it south toward Building 8500, where it runs overland or infiltrates into the ground (see Figure 3-2).

Task Objective

The task objective is to determine if contamination had been released from the Waste Accumulation Area and/or Building 8503 to the surrounding surface and subsurface soils and to the subsurface soils directly below the Waste Accumulation Area concrete pad. Sample results from this task will be evaluated in conjunction with those from the drainage way and seep investigation to determine if contamination has migrated away from the immediate area via the ditch located to the west of the concrete pad.

Task Scope and Rational

The Waste Accumulation Area containment features will be evaluated. Particular attention will be given to potential cracks and staining on the concrete. One crack was noted previously by TEC during the post award site visit. Soils beneath such cracks will be investigated by drilling through the concrete and collecting samples for lithologic and chemical characterization. Two holes will be drilled through the concrete at intervals of 10 feet along all concrete cracks identified. This WP assumes there will be one crack in addition to the one previously identified.

Subsurface soil samples below the concrete pad will be collected for chemical characterization at intervals of 5 feet or directly above bedrock if encountered first. The first subsurface soil sample for chemical characterization will be collected from a 22-inch interval directly below the pad. Depth to bedrock at this location is reported to be at less than 5 feet below ground surface. Therefore, the second sample for chemical characterization will likely be directly above the bedrock surface. The subsurface soil samples beneath the pad will be analyzed for inorganics and organic compounds including, VOCs, SVOCs, pesticides/PCBs and explosive compounds

Three series of surface and subsurface soil samples will be collected in the unpaved areas adjacent to the concrete pad (Figure 3-3). The first series will be located along the entire perimeter, within 5 feet of the edge of the pad. The sample locations will be spaced approximately 50 feet apart except for those locations adjacent to the Waste Accumulation Area; these locations will be spaced approximately 10 feet apart. Surface and subsurface soil samples collected from these locations will target potential contaminants transported across the pad with surface water runoff. The second series will be located within the ditch itself, approximately 10 feet from the edge of the pavement. These samples will be spaced approximately 50 feet apart. Results from these samples will be used to determine if the TCE identified in the Radian RI/FS (1989)

is still present and to identify other potential contaminants. The third series of boreholes will be approximately 30 feet beyond the edge of the pavement towards the southwest corner of the area. These samples will be positioned to identify the extent of any contamination related to the Waste Accumulation Area and Building 8503. Provisions for two additional biased sample surface and subsurface sample locations are included in this plan for characterization of anomalous areas. These locations will be determined in the field and are not shown on Figure 3-3.

Surface and subsurface soil samples will be collected at each location as shown on Figure 3-3. Surface samples will be collected between 0 and 6 inches below ground surface. Subsurface soil samples for chemical characterization will typically be collected at intervals of 5 feet or directly above bedrock if encountered first. The first subsurface soil sample for chemical characterization will be collected between 6 and 28 inches below ground surface. A second sample for chemical characterization will be collected between 66 and 88 inches below ground surface or directly above bedrock. Based on an assumed depth to bedrock of 5 feet below ground surface, it is estimated that one surface soil and two subsurface soil samples will be collected from each location for chemical characterization. Headspace screening and lithologic descriptions will be completed on all samples. Additional subsurface soil samples may be collected if headspace screening indicates the presence of contamination. Specific details regarding sample intervals, depths, and collection methods are provided in the FSP.

Previous investigations in the area indicate that VOC contamination was present in the soils (Radian 1989). All subsurface soil samples collected for chemical characterization will be analyzed for VOCs. Surface samples will not be analyzed for VOCs due to the extended time since the site has operated and assumed volatilization during that period. Inorganic analytes were also detected in the study. The investigation did not include explosive compounds (Radian 1989). All surface and upper subsurface (6 to 28 inches) samples will, therefore, be analyzed for inorganics and explosive related compounds. In order to provide complete characterization at those locations where previous contamination was reported, the surface and upper subsurface samples from the three locations directly adjacent to the Waste Accumulation Area building and the two adjacent locations in the ditch will also be analyzed for SVOCs and pesticide/PCBs (see Figure 3-3). Separate aliquots from all deeper samples submitted for VOC analyses will be archived. In the event that inorganic, explosive compound, SVOC or pesticide/PCB contamination is detected in the surface or upper subsurface sample, the archived material at that location will be analyzed for the contaminants of concern.

All biased located samples will be analyzed for inorganices, VOCs, SVOCs, pesticide/PCBs, and explosive-related compounds.

3.3.3 Vehicle Fueling Area (A-4)

Investigation Area

A vehicle fueling area was located approximately 300 feet southwest of Building 8514 on an unpaved circular drive. Remnants of the fuel pump(s) are present on site in the form of a 2 by 4 foot concrete pad. The pad is located at the southern most extent of the circular drive. The pump station was served by a 1,000 gallon UST located approximately 12.5 feet south of the drive. Potential contamination related to this former UST will be investigated in conjunction with others as described below in Section

3.3.7. A diagram of the fuel pump supply line and UST was developed as part of a report on the tank removal. The diagram is provided in Appendix C of this WP.

Task Objective

Since the fueling area is unpaved, spills may have resulted in soil contamination. The objective of this task is to determine if spills in the area contaminated the surface and subsurface soils.

Task Scope and Rational

Four sample locations will be established directly north of the abandoned fuel pump. The locations will be positioned in the area were vehicle fueling would take place. Locations will be spaced 5 to 10 feet apart based on observations made in the field. Approximate locations are indicated on Figure 3-3.

Surface and subsurface soil samples will be collected at each location. Surface samples will be collected from 0 to 6 inches below ground surface. Subsurface soil samples for chemical characterization will be collected at intervals of 5 feet or directly above bedrock if encountered first. The first subsurface soil sample for chemical characterization will be collected between 6 and 28 inches below ground surface. Based on an assumed depth to bedrock of 5 feet below ground surface, it is estimated that one surface soil and two subsurface soil samples will be collected from each location for chemical characterization. Headspace screening and lithologic descriptions will be completed on all samples. Additional subsurface soil samples may be collected if headspace screening indicates the presence of contamination. Specific details regarding sample intervals, depths, and collection methods are provided in the FSP.

Samples collected from the vehicle fueling area will be analyzed for those compounds indicative of contamination from gasoline, diesel, and fuel oils. Surface and subsurface soil sample analyses will include BTEX, TPHs and PAHs, in accordance with TNRCC PST guidance.

3.3.4 Disturbed Surface Area (A-5)

Investigation Area

During TEC's October 1996 site reconnaissance, a disturbed surface area was noted at the southwest corner of the property, outside of the inner security fence. It appeared that earth moving equipment had been used to excavate fill material. The area consists of gravely soil with no vegetative cover and encompasses approximately 20,000 square feet.

Task Objective

The objective of this task is to determine if activities at this disturbed surface area were associated with waste products and if these activities resulted in contamination of surface and subsurface soils.

Task Scope and Rational

Since there are no discrete anomalies, samples locations will be established over a grid pattern as indicated in Figure 3-3. Samples will be collected at intervals of 100 feet along two grid lines transecting the area.

Surface and subsurface soil samples will be collected at location as shown on Figure 3-3. Surface samples will be collected from 0 to 6 inches below ground surface. Subsurface soil samples for chemical characterization will be collected at intervals of 5 feet or directly above bedrock if encountered first. The first subsurface soil sample for chemical characterization will be collected between 6 and 28 inches below ground surface. A second sample for chemical characterization will be collected between 66 and 88 inches below ground surface or directly above bedrock. Based on an assumed depth to bedrock of 5 feet below ground surface, it is estimated that one surface soil and two subsurface soil samples will be collected from each location for chemical characterization. Headspace screening and lithologic descriptions will be completed on all samples. Additional subsurface soil samples may be collected if headspace screening indicates the presence of contamination. Specific details regarding sample intervals, depths, and collection methods are provided in the FSP.

It is unknown what materials may have been associated with this area. All locations, therefore, will be characterized for potential contaminants associated with waste generating activities which could include VOCs, inorganics, and explosive compounds. All subsurface soil samples collected for chemical characterization will be analyzed for VOCs. Surface samples will not be analyzed for VOCs due to the extended time since the site has operated and assumed volatilization during that period. All surface and upper subsurface (6 to 28 inches) samples will be analyzed for inorganics and explosive compounds. In order to provide complete characterization, a surface and upper subsurface sample from one location will also be analyzed for SVOCs and pesticide/PCBs. Separate aliquots from all deeper samples submitted for VOC analyses will be archived. In the event that inorganic, explosive-related compound, SVOC or pesticide/PCB contamination is detected in the surface or upper subsurface sample, the archived material at that location will be analyzed for the contaminants of concern.

3.3.5 EOD Range

Investigation Area

The EOD range was located to directly west of the site on a flat area of approximately 40,000 square feet (see Figure 3-3). Warning signs mark the perimeter of the former range.

Task Objective

The objective of the task is to determine if residual explosive related materials are present in the surface and subsurface soils.

Task Scope and Rational

Nine sample locations will be positioned on a grid established across the area with 100 foot spacing as shown on Figure 3-3. The grid location and spacing may be modified

based on visual observations. It is estimated that two additional biased locations will be established at any surface anomalies identified in the field.

Surface and subsurface soil samples will be collected at each location. Surface samples will be collected between 0 and 6 inches below ground surface. Subsurface soil samples for chemical characterization will typically be collected at intervals of 5 feet or directly above bedrock if encountered first. The first subsurface soil sample for chemical characterization will be collected between 6 and 28 inches below ground surface. A second sample for chemical characterization will be collected between 66 and 88 inches below ground surface or directly above bedrock. Based on an assumed depth to bedrock of 5 feet below ground surface, it is estimated that one surface soil and two subsurface soil samples will be collected from each location for chemical characterization. Headspace screening and lithologic descriptions will be completed on all samples. Additional subsurface soil samples may be collected if headspace screening indicates the presence of contamination.

The surface and upper subsurface soil samples will be analyzed for inorganics and explosive compounds. The deeper subsurface soil sample will be archived and analyzed for inorganics and explosive compounds if contamination is detected in the upper samples from that location.

3.3.6 Bunker Floor Drain Outlets

Investigation Area

The WSA contains 11 abandoned munitions storage bunkers. The interior floor of each of these bunkers is sloped to drainage troughs located along the side walls. Each drainage trough discharges to the exterior ground surface through drains located at the base of the front wall as indicated on Figure 3-3. No signs of flow or stressed vegetation at the drains were noted during the TEC site reconnaissance.

Task Objective

The objective of this task is to determine if spills inside the bunkers may have occurred and migrated outside through the drains and contaminated the surface and subsurface soils.

Task Scope and Rational

Each of the 11 bunkers contain two wall drains. Since there were no signs of flow or stressed vegetation around the drains, any potential spills would most likely have infiltrated within the immediate vicinity of the drain. Therefore one surface and subsurface sample location will be established immediately outside of each wall drain (see Figure 3-3).

Surface samples will be collected between 0 and 6 inches below ground surface. Subsurface soil samples for chemical characterization will be collected at five foot intervals or directly above bedrock if encountered first. The first subsurface soil sample for chemical characterization will be collected between 6 and 28 inches below ground surface. A second sample for chemical characterization will be collected between 66 and 88 inches below ground surface or directly above bedrock. Based on an assumed depth to bedrock of 5 feet below ground surface, it is estimated that one surface soil and

two subsurface soil samples will be collected from each location for chemical characterization. Head space screening and lithologic descriptions will be completed on all samples. Additional subsurface soil samples may be collected if headspace screening indicates the presence of contamination. Specific details regarding sample intervals, depths, and collection methods are provided in the FSP.

The bunkers provided storage for munitions. Munitions related materials are the only potential source of contamination in the bunkers. The surface and upper subsurface soil sample will therefore be analyzed for inorganics and explosive compounds. The deeper subsurface soil sample will be archived and analyzed for inorganics and explosive compounds if contamination is detected in the upper samples from that location.

3.3.7 Removed UST Locations

Investigation Area

The WSA contained five USTs. These tanks provided fuel in support of emergency power generation, heating and vehicle fueling (see Figure 3-1). Each tank was associated with a building. A description of each tank, including building number, contents, size, dimensions and function, is summarized in Table 3-3. These features are based on facility use descriptions and on diagrams developed as part of the tank removal effort. Diagrams for each UST are provided in Appendix C.

Task Objective

The objective for this task is to determine if potential tank and piping leaks have contaminated subsurface soils and to indicate whether groundwater contamination has resulted.

Task Scope and Rational

Borehole subsurface samples will be collected from each UST in order to identify leaks associated with both the tanks and piping. Soil borings at each UST will be installed on the basis of the tank location and the presence of pipe joints. A summary of the number of boreholes to be installed at each UST location is provided in Table 3-3.

Subsurface samples will be collected from each borehole. Samples for volatile organic headspace screening and lithologic descriptions will be collected continuously through the entire borehole. A maximum of three subsurface samples will also be collected from each borehole for analytical characterization. Sampled will be collected to define the vertical extent of contamination. Samples for chemical characterization will be collected as follows:

- the interval with the highest headspace screening reading;
- the contaminated interval directly above potential saturation; and
- the contaminated interval directly below saturation.

In those boreholes where headspace screening indicates contamination is not present, a maximum of two samples will be collected from each borehole.

Samples will be analyzed for compounds indicative of contamination from gasoline, diesel and fuel oils. Analyses will include BTEX, TPH and PAHs, in accordance with TNRCC PST guidance.

3.3.8 Drainageways and Seeps

Investigation Area

Surface water runoff provides one of the two contaminant transport pathways identified in the conceptual site model (see Section 2.3). A number of drainageways transport surface water off site (see Figure 3-2). Seven of these (D-1 through D-7) drain buildings and surrounding areas are located within the inner fence. Drainageways D-8 and D-9 are located to the west of the site and drain the EOD area. In addition to these direct surface water routes, shallow groundwater from the site discharges as seeps in the ravines which surround the site to the south, east, and north (see Figure 3-2).

Task Objective

The objective of this task is to determine if potential contaminants have and/or are being transported off site via the surface water pathway.

Task Scope and Rational

In order to determine if contaminants have been or are being mobilized off-site, both samples will be collected from the seven drainage ways and seven seeps located on and around the WSA. The two drainage ways leading from the EOD from one area will also be investigated.

Surface water samples will provide an indication of immediate contaminant transport. Surface water samples will be collected at all locations where available. It is assumed that surface water samples will be collected from all seep locations and from one location downgradient of the site in drainage area D-5 (see Figure 3-4). Surface water samples from all seep locations and from the location on D-5 will be analyzed for inorganics, VOCs, SVOCs, pesticide/PCBs, and explosive-related compounds.

Sediment provides a similar indication of immediate contamination as well as an indication of past surface water contamination. Sediment samples will be collected from each drainageway and seep location. Sediment samples drainage way locations will be established in order to

- identify contamination immediately downgradient from potential sources such as buildings and outdoor material storage and maintenance areas; and
- differentiate between multiple source areas.

Drainage pathways D-1 through D-7 and all seeps may have been impacted by multiple sources. Sediment samples from all seep locations will be analyzed for inorganics, VOCs, explosive-related compounds, SVOC and pesticides/PCBs. Sediment samples from drainageways D-1 through D-7 will be analyzed for target contaminants which include inorganics, VOCs, and explosive-related compounds. SVOC and pesticide/PCB analyses will also be performed on one centrally located sample from each of the seven drainageways associated with the fenced WSA (D1 through D-7). EOD drainageways (D-8 and D-9) will be analyzed for inorganics and explosive compounds.

Three sediment and surface water background locations will also be established for comparison to those WSA-associated samples collected during this task. One surface water and one sediment sample will be collected from each location. Each sample will be analyzed for inorganic analytes and VOC, pesticides/PCB, SVOC and explosive compounds.

3.3.9 Groundwater Monitoring

Investigation Area

Groundwater represents the second potential contaminant pathway identified in the conceptual site model (see section 2.6). As indicated, groundwater sources include the overburden on top of the impervious Walnut Formation and the Paluxy Formation.

Groundwater associated with the overburden is likely to be sporadic across the site and affected by seasonal precipitation. Groundwater flow in this uppermost zone is expected to follow topography toward the east, southeast, and in the northern portion of the site to the northeast (see Figure 3-5).

The upper portion of the Paluxy Aquifer is below the 45-foot thick Walnut Aquitard at a depth of at least 50 feet below ground surface. This aquifer is a domestic and agricultural source of water for local residences. Groundwater in the Paluxy Aquifer flows to the east (see Figure 3-5).

Task Objective

The objective of the task investigation is to determine if contamination resulting from multiple sources at the WSA has migrated to the shallow overburden groundwater or to the deeper Paluxy Aquifer.

Task Scope and Rational

As part of an ongoing WSA background conditions study, three shallow wells are to be installed before the RFI field work begins (Jacobs, 1996). In addition to these three shallow overburden wells, four shallow overburden wells will be installed during the RFI field investigation (see Figure 3-5). Although locations are identified for the proposed RFI wells, actual locations will be determined based on the results of the ongoing background study. Construction and development details for these wells are provided in the FSP.

Two wells currently exist on site. These wells were the primary and backup water supply for the WSA and are reportedly screened at a depth of 220 feet below ground surface within the deeper Paluxy Aquifer (Jacobs, 1996). As part of the ongoing background study, these wells will be prepared for environmental sampling by removing existing hardware. The primary well is located east of and downgradient from Building 8503, the Waste Accumulation Area, and the EOD area. The backup well is located southeast of these same potential contaminant sources. The backup well is likely to be downgradient from these sources. Hydrogeologic evaluations from the backup study will verify its actual position relative to these sources. In addition to the existing wells, the background study efforts will include installation of two Paluxy Aquifer monitoring wells. Both wells will be located upgradient from the site. Only one of these upgradient Paluxy wells will be sampled during this RFI.

Seven shallow wells and three deeper wells will be used to characterize the shallow groundwater associated with the overburden and the Paluxy Aquifer. Prior to sampling, an electronic interface probe will be used to determine the static groundwater level (i.e., depth to groundwater) and the presence or absence of potential floating product. Should floating product be observed, the depth to the product and the product layer thickness will be determined.

One groundwater sample will be collected from each well using methods described in the FSP. Temperature, pH, electrical conductivity (EC), and turbidity from all wells will be measured in the field. Since the overburden groundwater and the Paluxy Aquifer could potentially have been impacted by multiple contamination sources, all groundwater samples will be analyzed for inorganics and organic compounds including, VOCs, SVOCs, pesticides/PCBs and explosive compounds.

The need for additional Paluxy wells downgradient of the site will be evaluated based on the results of the above investigations. If significant soil and shallow groundwater contamination is identified, the potential for contaminant migration through the Walnut Aquifer will be analyzed. If such analysis indicates the Paluxy Aquifer may be threatened in a manner not represented by the existing wells, additional wells downgradient of the site will be installed and sampled during a subsequent phase of the field investigation.

3.3.10 Asbestos Survey

Investigation Area

As part of the RFI, asbestos surveys will be conducted at 24 buildings located within the WSA. Galson Corporation (GC) completed an asbestos survey in November 1992. Although complete documentation of the study is unavailable, a synopsis provided in the Basewide EBS (1993) indicates that six WSA buildings were surveyed, five of which were shown to contain asbestos (see Table 3-4). A complete survey with adequate documentation is necessary for development of potential corrective measures during the latter stages of this RFI.

Task Objective

The objective of this task is to complete an asbestos survey of all buildings. The survey results will be used to evaluate potential health hazards, to determine the property's suitability for transfer, and to develop necessary information supporting the development of potential asbestos-related corrective measures.

Task Scope and Rational

The asbestos survey of all 24 buildings will be completed in accordance the Asbestos Hazard Emergency Response Act (AHERA) standard (40 CFR 763 Subpart E) for locating, collecting, quantifying, and assessing ACBMs. The AHERA sets the industry standard for conducting asbestos surveys and will subsequently yield the most reliable and complete information regarding the present state of asbestos in the building.

Using product knowledge and past sampling results, some products may be identified as ACBM or non-ACBM based on visual inspection alone and not on sampling. Such products are identified below:

- fiberglass, foam, or rubber will not be sampled and will be considered a non-suspect material;
- transite-like materials such as roofing, siding, walls, ducts, and flues will not be sampled but will be assumed to contain asbestos. Transite-like materials are known to contain 35 to 75 percent chrysotile. Sampling is therefore unwarranted in relation to the increased exposure risk created during sampling by creating friable material during the sampling process;
- flexible Air Handing Unit (AHU) connections will be sampled as a part of this asbestos survey as long as samples can be collected without compromising the integrity of the AHU system; and
- fire rated doors will not be sampled but assumed to be ACBM.

During the RFI site reconnaissance, representative buildings were walked through. A preliminary assessment of number of rooms, types of materials present and square footage was made for each building. Based on this assessment, an estimate of the number of samples to be collected was made and is summarized in Table 3-5. It should be noted that all buildings will be surveyed even though sampling at each building may not be required.

3.3.11 LBP Survey

Investigation Area

As part of the overall building investigation, a survey for LBP will be conducted at all 24 buildings located at the WSA. Facilities constructed prior to the implementation of the DoD ban on LBPs in 1978 are likely to contain such paint. The WSA facility was constructed in 1956. The Carswell Basewide EBS indicates that only family housing has been sampled to date. There is no documentation of sampling having been conducted at the WSA.

Task Objective

The task objective is to evaluate potential LBP hazards, determine the property's suitability for transfer, and develop necessary information supporting the development of potential LBP related corrective measures.

Task Scope and Rational

Paint chip bulk sampling involves physically removing a 2- to 4-square-inch piece of paint from the painted surfaces. Prior to the field sampling event, attempts will be made to obtain additional information regarding painting history. This history will be used to develop a sampling scheme unique to the individual buildings. Samples will be collected from each representative interior and exterior component with a distinct painting history. All sampling will be in accordance with Texas Environmental Lead Reduction Rules, Section 295.212, and USEPA/Housing and Urban Development Guidelines (1996).

During the RFI site reconnaissance, a preliminary survey of surface types was noted. Based on these preliminary findings an estimate of the number of samples to be collected from each building was developed (Table 3-5). The preliminary sample number

estimate takes into account the concrete block construction typically used at the site. Also there are some unfinished interiors that contain little or no painted surfaces. During the actual field investigation, painted building materials such as walls, trims, and moldings will be further evaluated to determine actual sample locations and quantities.

3.3.12 Facility Contamination Survey

Investigation Area

Since the buildings at the WSA have been used for industrial purposes, residual waste materials in the form of dust or other surficial coatings may be present on the interior surfaces. 16 of the buildings were used to stored various munitions which potentially contained explosive compounds. Buildings 8503 and 8514 were involved in maintenance and/or inspection activities potentially involving other wastes, as well as explosive compounds. The Waste Accumulation Area (Bldg. 8512) provided for storage of waste. The five remaining buildings were associated with public works type functions such as security, water supply and storage, and power generation. Such activities would not lead to the contamination of interior surfaces.

Task Objective

The presence of such contamination would present a health hazard to future site users. In addition to this general concern, TNRCC (30 TAC 335.6) and USEPA (40 CFR 265.11 and 40 CFR 265.114) regulations require that applicable units including foundation structures be decontaminated. The objective of this task is to identify those interior building surfaces which may be contaminated. This information will be used to develop a decontamination plan as part of overall corrective measures for the WSA.

Task Scope And Rational

As indicated in Table 3-5, 19 buildings will be evaluated for possible interior surface contamination. As indicated above, contaminants of concern at the site include inorganics, VOCs and explosives. VOCs would no longer be present on open surfaces due to volatilization and therefore will not be sampled. Wipe samples for metals and explosive compounds will be collected from each interior surface representative of a distinct area or activity. WSA buildings are cement block constructed on concrete slabs with few finished interiors. A number of buildings have multiple rooms or work areas. One wall and one floor wipe sample will be collected from each room or work area.

Wipe sampling involves wiping a surface of known dimensions with a cotton swab, gauze, or filter paper moistened with an appropriate solvent. Each floor or wall sample will be composited by wiping four representative subsample areas. Individual subsamples are combined to form the sample.

The number of anticipated samples to be collected from each building is identified in Table 3-5. Each sample will be analyzed in accordance with the types of activities performed and the potential wastes produced. All samples collected will be analyzed for inorganics and explosive compounds.

Three residential buildings located outside of the WSA property will also be sampled for surface contamination. One floor and one wall sample will be collected from each

building and analyzed for inorganics and explosive compounds. Background results will be directly compared to those obtained from WSA structures to determine if the levels identified are significantly greater than those from residential structures.

3.3.13 Other RFI Field Investigation Activities

Utilities Location

A utilities location survey using NAS Fort Worth personnel, existing site plans, and public utility-locator services, will be conducted to identify the location and orientation of all underground utilities in the area. In the event that public utility-locator services can not identify utilities on the Federal property, a professional geophysical service provider will be used to identify the location and orientation of all underground utilities in areas involving subsurface investigations.

Investigation Derived Waste (IDW) Disposal

The field investigations described above are not expected to generate significant quantities of IDW due to the usage of direct push methods from subsurface soil sampling. It is estimated that one drum of soil and four drums of purge water will be generated. One sample of each media will be collected for waste type characterization. Waste types will be determined upon receipt of this data. TEC will then retain a qualified waste transporter to remove IDW from the site for disposal at a licensed facility. TEC has identified several local area transporters with the capability of handling non-hazardous and hazardous wastes. All IDW will be properly containerized and stored during field activities.

Site Restoration

Should site conditions following RFI activities necessitate significant site restoration, TEC will retain a qualified subcontractor to restore site conditions to pre-investigation conditions. Activities which may necessitate site restoration include heavy equipment usage and/or drilling operations. Any necessary site restoration activities will be coordinated with NAS Fort Worth representatives.

3.4 LITERATURE SEARCH

A literature search will be conducted prior to RFI activities to identify existing records, data, and other information associated with the area of study. All relevant documents will be reviewed by TEC project team personnel.

The objective of this literature search is to obtain available information on previous investigations conducted on the WSA. Information will be collected on prior soil and groundwater sampling as well as on radiation swipe testing performed in the buildings found on WSA property. Remedial actions that have been implemented at the WSA will also be reviewed for their applicability to the RFI.

3.5 RECORDKEEPING

TEC field personnel will maintain field data log books. In addition to the log books, TEC field personnel will complete and maintain standard field data forms for all field

activities. Examples of field data forms are collectively presented in the FSP. These field data forms include:

- Field Sampling Reports;
- Chain-of-Custody Form;
- Boring Logs;
- Monitoring Well Construction Details and Abandonment Forms;
- Monitoring Well Development Records;
- Monitoring Well Purging Forms;
- Monitoring Well Static Water Level Forms;
- Instrument Calibration Log Sheets;
- Instrument Maintenance Records;
- Waste Inventory Tracking Forms;
- Health and Safety Monitoring Sheets; and
- Instrument Decontamination Log Sheets.

3.6 DATA QUALITY ASSESSMENT

A data quality assessment will be conducted following the completion of all RFI activities. The assessment will include a review and evaluation of all data generated.

A review of field records will be conducted to determine completeness, validity of samples collected, and the correlation of field data. Any anomalies in data will be identified and evaluated. A discussion regarding field data quality and sample validity will be provided in the RFI report (see Section 4.7).

An independent review of laboratory data will be conducted to determine the validity of all analyses provided. This review will focus on

- chain-of-custody documentation;
- holding times;
- method calibration limits;
- method blanks;
- laboratory verification of quantitation limits;
- preparatory batch control records;
- corrective actions;
- formulas used for analyte quantitation;
- examples of analyte quantitation; and
- completeness of data.

This review of laboratory data will also ensure that all samples and analyses required by the SAP have been processed, that complete records exist for each analysis and any associated QC measures, and that procedures specified in this WP and the SAP have been implemented. A complete discussion regarding analytical data validity will be provided in the RFI report.

An evaluation of valid environmental data will be conducted. Based on the data reviews, data generated through poor field or laboratory practices will not be considered in the evaluation. Historical data that is not supported by proper documentation will also not be considered in the evaluation. Field duplicate, field blank, and laboratory blank analytical results as well as sample matrix effects will be reviewed and a complete discussion regarding data evaluation and findings will be provided in the RFI report.

3.7 CHARACTERIZATION OF BACKGROUND CONDITIONS

There have been prior investigative activities in the study area, however, there are no studies of background conditions which have been completed to date. Jacobs Engineering is currently installing two deep monitoring wells upgradient within the WSA buffer zone (see Section 1.2.2 for more information). The wells will establish background concentrations of radium-226 and -228. These wells will be sampled four times each over a 2- to 3-month period. The intervals between the samples will be determined based on the average linear velocity of the groundwater.

Additional efforts to establish background conditions will be completed as part of the RFI field investigations as indicated above. Five surface and subsurface soil background locations will be sampled. A surface and subsurface sample will be collected at each location. These background locations will be west of the site beyond the property boundary. These locations will be identified during the field effort and are not shown on Figure 3-3. Samples collected from these locations will provide for comparative analysis of sample results generated from soil samples collected from areas A-1, A-2, A-3, A-4, A-5, bunker floor drains, and the EOD range. All soil samples will be analyzed for inorganics, VOCs, and explosive compounds. One surface and one subsurface sample will also be analyzed for pesticides/PCBs and SVOCs. Three sediment and surface water background locations will also be established for comparison to those WSA samples collected during the drainageway and seep investigation. One surface water and one sediment sample will be collected from each location and analyzed for inorganic analytes and VOCs, pesticides/PCBs, SVOCs and explosive compounds. The comparative analyses will be conducted with respect to Title 30 TAC 335.554, *Attainment of Risk Reduction Standard Number 1: Closure/Remediation to Background.*

Three groundwater locations will also be sampled to establish background conditions in the overburden-related groundwater and in the Paluxy Aquifer. Two wells will be screened in the overburden and one will be screened in the Paluxy Aquifer. One groundwater sample will be collected from each well. Each sample will be analyzed for inorganic analytes and VOCs, pesticides/PCBs, SVOCs and explosive compounds. The comparative analyses will be conducted with respect to Title 30 TAC 335.554.

Three residential buildings located outside of the WSA property will also be sampled for surface contamination. One floor and one wall sample will be collected from each building and analyzed for inorganics and explosive compounds. Background results will

be directly compared to those obtained from WSA structures to determine if the levels identified are significantly above those from residential structures.

Background samples will not be collected for comparison to petroleum contamination related to the vehicle fueling USTs. Data collected from these potential source areas will be directly compared to TNRCC PST action levels.

3.8 RISK ASSESSMENT

A focused risk assessment, consistent with TAC 30 Chapter 335, Subchapter S, will be conducted as part of the RFI if analytical results indicate that chemical contamination is present above background levels in environmental media at the WSA. The risk assessment will comply with the provisions set forth in Subchapter S Risk Reduction Standard Number 2, in which closure/remediation is based on health-based standards and criteria. The primary goal of RRSN2 is to develop health-based cleanup levels for directly contaminated environmental media, as well as media contaminated via chemical migration, and to support closure of hazardous waste sites. The risk assessment will be conducted to identify the COCs, the exposure pathways and potential receptors, and the toxicity levels of COCs needed to develop appropriate health-based cleanup levels and to identify human health and ecological ARARs. EPA RCRA guidance (*Interim Final RCRA Facility Investigation Guidance*, EPA 1989) will be consulted if necessary. Compliance with the requirements of Subchapter S will assure adequate protection of human health and the environment from potential exposure to contaminants released from the WSA.

In addition, if petroleum products associated with the former UST areas at the WSA are detected in samples collected during environmental investigations, a risk assessment will be conducted for these constituents in accordance with TAC Chapter 334 and TWC Chapter 26, Subchapter I. The assessment will be consistent with protocol and requirements set forth in the LPST guidance documents prepared by TNRCC: *Risk-Based Corrective Action for LPST* Sites (TNRCC 1994) and *Guidance for Risk-Based Assessments at LPST Sites in Texas* (TNRCC 1995). Cleanup levels for individual indicator TPH compounds will be developed based on the approach outlined for Plan A Target Concentration developed in TNRCC (1994, 1995).

The risk assessment will focus on SWMU 59, but will also be used to evaluate the entire WSA, including the outdoor maintenance and materiel storage areas and former UST areas. The level of effort and detail provided by the risk assessment will be commensurate with the amount and types of contamination identified during the site characterization.

The following sections describe the tools and methods to be used to develop cleanup levels in accordance with TAC 30 Chapters 334 and 335.

3.8.1 Identification of COCs

Previous environmental investigations of the WSA will be used to the extent possible to develop the cleanup levels. Data currently being collected for the RFI will also be used. Previous investigations indicate that low concentrations of TCE and low level radiation may be present in soil at SWMU 59. In addition, five USTs were previously removed without collection and analysis of surrounding soil. This soil will be sampled for this RFI.

without collection and analysis of surrounding soil. This soil will be sampled for this RFI.

Data on environmental media collected during previous investigations and during the current RFI will be compiled and evaluated to identify the chemicals potentially posing a risk to human health and the environment. The frequency of detection of compounds will provide the basis for identifying COCs. Compounds that are not detected in more than 1 percent of the samples of any one medium, or are detected below natural or anthropogenic background, will be eliminated from further evaluation in the risk assessment. If the list of COCs after this screening is still unclear, an additional step to identify and streamline the number of COCs carried through the assessment will be conducted. This step will constitute a comparison between maximum detected site concentrations and conservative risk-based screening levels for each medium (e.g., using residential exposure assumptions with target risk levels of $1x10^{-7}$ for carcinogens and 0.1 for noncarcinogens). Data summaries of the identified COCs will be prepared showing the data used in the risk assessment and statistical summaries (e.g., range of detected values, frequency of detect, range of detection limits).

Due to the lack of toxicity criteria for TPH as a whole, TPH will be represented by individual indicator compounds for which toxicity criteria are available. These indicator compounds will be screened for COC status through the same process as other detected compounds.

3.8.2 Identification of Exposure Scenarios

Exposure scenarios used to develop cleanup levels will be selected based on potential current and future exposure pathways and receptors identified at or near the site. Land use, zoning restrictions, property transfer, and potential deed restriction agreements of the site will be evaluated in selecting exposure scenarios. Current and future beneficial use of site groundwater will be evaluated for purposes of developing cleanup levels for TPH compounds. Figure 2-1 illustrates the preliminary conceptual site model, which will be refined during the risk assessment when more data is available. Preliminary information on land use indicates that receptors potentially exposed to contaminants released from the WSA include current Offsite area residents, future on-site residents and workers, including construction workers, and recreational users of local surface water. Potential environmental receptors include local terrestrial wildlife and aquatic biota of adjacent surface water.

No people are currently living or working on site, other than workers associated with environmental site investigations. Potential exposure to site-related contaminants for these individuals are addressed in HSPs prepared specifically for environmental investigation and remediation activities. These workers, therefore, will not be considered in the risk assessment. The site is fenced around the perimeter, preventing direct contact with potentially contaminated media by trespassers. The only potential current receptors are residents living within one-quarter mile off site and recreational users of local surface waters. The residents could potentially be exposed to site-related contaminants via surface waters used for recreational purposes. Due to the limited hydraulic conductivity in the vicinity of the site, current residents are not expected to be exposed to contaminants in the Paluxy Formation where domestic and agricultural wells are assumed to exist. This pathway will be reconsidered if site investigations

indicate that it may be of concern due to contaminant migration. The most likely future land use of the site is residential and commercial. Both future residents and workers could potentially be exposed to contaminants via direct contact with shallow groundwater, soil, surface water, and sediments. Although not a potable source, seasonal shallow groundwater flowing on top of the Walnut Formation is expected. Thus, future populations may contact the groundwater when it is discharges through seeps around the site or during construction activities associated with future development of the site.

A survey to identify potential ecological receptors has not yet been performed. Due to the undeveloped nature of the WSA and the presence of Live Oak Creek, however, the site is expected to support terrestrial and aquatic species.

Exposure assumptions that most appropriately reflect the identified exposure scenarios and that are consistent with RRSN2 in Subchapter S and Plan A in TAC Chapter 334 will be used to develop cleanup levels. All potentially complete pathways, including those resulting from cross-media contamination will be illustrated in a conceptual site model, refined from the preliminary model presented in this WP. As with the preliminary model, it will illustrate the source of contamination, mechanism of release, contaminated media, media interactions, exposure routes, and receptors. Exposure assumptions used to calculate cleanup levels will be presented in tabular format and sources of the assumptions will be documented. Exposure assumptions will include media contact rates, frequency and duration of contact, and contaminant absorption.

To accurately assess risk to human health and the environment and to demonstrate attainment of cleanup levels, exposure point concentrations will be calculated in accordance with TAC 30 Section 335.553. If a data set contains at least 10 data points and meets all of the quality criteria necessary to conduct a risk assessment (based on EPA's *Guidance for Data Usability in Risk Assessment* [EPA, 1992]), the exposure concentrations will be calculated based on the 95 percent upper confidence limit of the arithmetic mean of the site data for each contaminant in each medium; unless an alternative statistical method is more appropriate for the distribution of a particular data set. If exposures are expected to occur almost exclusively in a discrete area of the site, concentrations will be averaged over the data subset that best represents the exposure points (as opposed to averaging concentrations over the entire site). All data qualified as estimated during the data validation process will be included in calculations at reported values. Nondetect values of detected COCs will be included in calculation at one half of the reported detection limit.

For data sets containing less than 10 data points, each analytical result of a discrete sample will be conservatively assumed to be an exposure concentration and a direct comparison of each data point with the cleanup levels will be made.

3.8.3 Toxicity Assessment

A toxicity assessment will be conducted for each COC by compiling toxicity factors, adverse health effects, and other criteria. This information, combined with the exposure parameters developed in the Identification of Exposure Scenarios section, will be used to derive cleanup levels. Toxicity factors for both carcinogens (cancer slope factors) and noncarcinogens (reference doses) will be obtained from the EPA's on-line Integrated Risk Information System (IRIS), considered the primary source of these values, and

Agency for Toxic Substances and Disease Registry (ATSDR) toxicological profiles will be consulted for alternative values.

3.8.4 Development of Cleanup Levels

The results from the exposure and toxicity assessments will be combined to develop cleanup levels for each COC in each medium of concern. RRSN2 and Plan A rely on a hierarchical approach to identifying appropriate values for cleanup levels. Specifically, Texan or Federally promulgated health-based standards or criteria represent the primary basis for site cleanup levels. When these values are not available for a COC or do not provide adequate protection (i.e., do not correspond to acceptable risk levels), medium-specific concentrations (MSCs) will be derived. MSCs are health-based concentrations and will be derived from the exposure and toxicity information identified in the risk assessment and from the acceptable risk levels required in Subchapter S and Plan A (discussed below).

When addressing site cleanups, Texas relies on both state and Federal standards and criteria. Promulgated standards available for use as surface water cleanup levels include the Texas surface water quality standards (TAC 30 Chapter 307) and the federal maximum contaminant levels (MCLs), promulgated under the Safe Drinking Water Act. The surface water quality standards are the primary source of surface water cleanup levels. If these are not available for a COC, MCLs will be used. For groundwater affected by non-TPH compounds, MCLs will be the primary standards used as cleanup levels, unless the background total dissolved solids (TDS) concentration in the groundwater is greater than 10,000 milligrams per liter (mg/L). If this parameter is elevated to these levels, then the MCL, or MSC if no MCL is available, will be adjusted according to the exposure population of concern. No promulgated standards are available for direct contact exposure pathways associated with soil and sediment; therefore, MSCs will be calculated for soil and sediment cleanup levels where direct contact with surface soil and sediment is the only pathway of concern. If, however, the site investigation indicates that contaminants are migrating from soil to groundwater, the lower of the MCLs or MSCs, multiplied by an appropriate dilution and attenuation factor, will be considered the cleanup levels for surface and/or subsurface soil.

If promulgated standards or criteria are not available for COCs in groundwater and surface water, then MSCs will be calculated pursuant to the requirements and equations set forth in Subchapter S and Plan A. The exposure pathways for which equations and exposure factors are provided in Subchapter S and Plan A, include water and soil ingestion and inhalation of volatiles and particulates. Equations for exposure pathways not addressed in Subchapter S (e.g., dermal contact, fish consumption) but considered complete in the risk assessment, will be developed using relevant risk assessment guidance (e.g., EPA 1989a,b,c, EPA 1991, EPA 1992a,b) and assuming reasonable maximum exposures. MSCs will be derived assuming the target risk levels outlined in Subchapter S and Plan A. For chemicals categorized as Class A or B carcinogens, based on the EPA's Weight of Evidence classification scheme, the target risk level will be an excess upper bound lifetime cancer risk of $1x10^{-6}$. For chemicals classified as Class C carcinogens, the target risk level will be $1x10^{-5}$. Cancer risk levels reflect the incremental increase in the probability of developing cancer over a lifetime of continuous exposure to a carcinogenic agent. The target risk level for noncarcinogens

will be a hazard quotient of one, reflecting unity in the ratio of the exposure intake to the reference dose.

Groundwater cleanup levels for TPH compounds are determined using a different approach, per the TNRCC risk-based corrective action guidance. These cleanup levels are based upon the actual or reasonable potential beneficial use of the affected groundwater. Thus, results of the beneficial use evaluation conducted during the site investigation and exposure assessment will used to develop these cleanup levels. Whether cleanup levels will be MCLs or MSCs depends upon the beneficial use category identified for the groundwater. As part of the Plan A approach, target risk levels for groundwater cleanup levels may be modified based on the potential beneficial use category determined for groundwater. For example, when the TDS content of the potentially contaminated groundwater is less than 3,000 ppm and no beneficial use is documented within 0.5 miles of the site, the cumulative target risk for carcinogens may be $1x10^{-5}$ for Class A and B carcinogens and $1x10^{-4}$ for Class C carcinogens.

Cleanup levels will be adjusted where necessary to account for cross-media contamination, non-standard exposure pathways (e.g., fish consumption), and sensitive populations and receptors. Additionally, cumulative health effects posed by noncarcinogenic COCs with the same target organ effects will be considered when developing cleanup levels. Cleanup levels that are lower than practical quantitation limits (PQLs) or natural background concentrations will be adjusted upwards to the greater of the PQL or background level.

A table will be prepared to summarize all the cleanup levels determined for the COCs identified at the WSA.

3.8.5 Risk Reduction Evaluation

An evaluation will be provided to determine whether site concentrations meet the cleanup levels developed under the provisions of RRSN2 or Plan A. This determination will be presented in both tabular and discussion formats. Exposure concentrations derived in the exposure assessment step of the risk assessment will be compared to the identified cleanup levels. This comparison will be the basis for evaluating the magnitude and extent of potential risks posed by the COCs. Conclusions and recommendations regarding attainment of cleanup levels will be discussed.

3.9 CORRECTIVE MEASURES WORK PLAN

As part of the RFI, TEC will complete a corrective measures study based on information obtained during the investigation. The study will focus on those approved recommendations included in the RFI report and the results of risk assessment. Alternatives for removal, containment, treatment and/or other remediation of the contamination identified in the RFI will be identified, screened, and selected. The study will evaluate those technologies demonstrated fully implementable and effective under similar field conditions. Research and/or pilot scale technologies will not be evaluated. The study will be completed in accordance with guidance identified in the *RCRA Corrective Action Plan* (EPA 1986), *Guidance on Feasibility Studies Under CERCLA* (EPA 1985) and *Closure Guidance Documents (Draft)* (TNRCC, 1993). The CERCLA guidance referenced above will only be used to provide a framework and techniques for

guidance referenced above will only be used to provide a framework and techniques for developing remedial actions. Policy matters identified in this guidance are not applicable.

For each corrective measure selected, TEC will provide a description as it relates to remedial objectives and remedial requirements. Design details of the measure (including plans and specifications) will not be provided. The corrective description will focus on identifying the performance requirements needed to achieve each contamination-specific remedial objective. The results of the study will be provided in a Corrective Measures WP.

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Table 3-1. Data Quality Objectives

RFI Objective	Associated Data Gaps	Data Types	Data Category	Sample Types	Analyses	Principal Data Uses
Determine nature and extent of contamination associated with SWMU 59	Soil/sediment characteristics	Physical characteristics	Screening	Split-spoon samples/ surface grab	Parameters per ASTM D-2488-90	Physical attributes affecting potential contaminant migration
	Soil/sediment contamination	Organic vapor presence	Screening	Soil headspace	Organic vapors using PID	Identify areas of potential VOC contamination in shallow subsurface; health and safety
		Chemical characteristics	Definitive	Split-spoon samples/ surface grab	Inorganics; VOCs; SVOCs; Pesticides/ PCBs; explosives	Confirm contaminant presence; risk assessment; CMS support
	Integrity of cement pad	Visual observation	Screening	N/A	N/A	Selection of potential on-pad drill locations
Determine nature and extent of contamination related to activities other than SWMU 59	Soil/sediment characteristics	Physical characteristics	Screening	As above for SWMU 59	As above for SWMU 59	As above for SWMU 59
	Soil/sediment contamination	Organic vapor presence	Screening	As above for SWMU 59	As above for SWMU 59	As above for SWMU 59
		Chemical characteristics	Definitive	As above for SWMU 59	As above for SWMU 59	As above for SWMU 59

Table 3-1. continued

RFI Objective	Associated Data Gaps	Data Types	Data Category	Sample Types	Analyses	Principal Data Uses
	Surface water condition	Physical and chemical characteristics	Screening	Grab	pH, temperature, conductivity	Identify potential contaminant migration pathway
	Surface water contamination	Chemical characteristics	Definitive	Grab	As above for SWMU 59	Identify potential contaminant migration pathway; risk assessment; CMS support
	Groundwater contamination	Physical and chemical characteristics	Screening	Grab	pH, temperature, conductivity, water level	Identify potential contaminant migration pathway
	Groundwater contamination	Chemical characteristics	Definitive	Grab	As above for SWMU 59	Identify potential contaminant migration pathway; risk assessment; CMS support
Determine nature and extent of contamination related to previously removed USTs	Soil characteristics	Physical characteristics	Screening	As above for SWMU 59	As above for SWMU 59	As above for SWMU 59
	Soil contamination	Organic vapor presence	Screening	As above for SWMU 59	As above for SWMU 59	As above for SWMU 59
		Chemical characteristics	Definitive	As above for SWMU 59	As above for SWMU 59	As above for SWMU 59

Table 3-1. continued

RFI Objective	Associated Data Gaps	Data Types	Data Category	Sample Types	Analyses	Principal Data Uses
Determine nature and extent of contamination associated with buildings and structures	Presence/extent of asbestos	Asbestos	Screening/ Definitive	Asbestos survey; Analysis of select samples	Visual observation with laboratory confirmation	Contaminant presence and extent; health and safety; risk and CMS support
	Presence/extent of lead paint	Paint sample characteristics	Definitive	Chip samples	Laboratory methods	Contaminant presence and extent; health and safety; risk and CMS support
	Nature and extent of contamination on structures	Chemical characteristics	Definitive	Wipe samples	SVOCs, pesticides, PCBs, expl.	Contaminant presence and extent; health and safety; risk and CMS support

Table 3-2 Summary Of Sample Locations And Numbers

	No. of Locations			No. of Samples									
Investigation Tasks	WSA	Back-ground	Total	Surface	Sub-surface	Ground-water	Surface Water	Sedi-ment	Asbes-tos	Paint	Wipe	Quality Control[4]	Total
Outdoor Materiel Storage and Maintenance (A-1 and A-2)	44	5	49	49	93	-	-	-	-	-	-	22	164
Waste Accumulation Area/Building 8503 (A-3)	31	-[1]	31	27	62	-	-	-	-	-	-	12	101
Vehicle Fueling Area (A-4)	4	-[1]	4	4	8	-	-	-	-	-	-	5	17
Disturbed Surface Area (A-5)	4	-[1]	4	4	8	-	-	-	-	-	-	5	17
EOD Range	11	-[1]	11	11	11	-	-	-	-	-	-	5	27
Bunker Floor Drains	22	-[1]	22	22	22	-	-	-	-	-	-	9	53
Removed UST Locations	9	-[1]	9	-	27[2]	-	-	-	-	-	-	8	35
Drainageways and Seeps	28	3	31	-	-	-	11	31	-	-	-	13	55

Table 3-2. continued

Investigation Tasks	No. of Locations			No. of Samples									
	WSA	Back-ground	Total	Surface	Sub-surface	Ground-water	Surface Water	Sedi-ment	Asbes-tos	Paint	Wipe	Quality Control[4]	Total
Groundwater Monitoring	7	3	10	-	-	10	-	-	-	-	-	4	14
[illegible]	[illegible]	-	[illegible]		-	-	-	-	[illegible]	-	-	4	[illegible]
Lead Based Paint	159	-	159	-	-	-	-		-	159	-	16	175
[illegible]	[illegible]	[illegible]	[illegible]	-			-	-	-	-	[illegible]	7	[illegible]

[1] Background conditions to be derived from samples collected during Outdoor Materiel Storage and Maintenance Area Task

[2] Maximum number of samples assuming contamination found in all boreholes.

[3] Maximum number of samples assuming all seep locations are discharging during the sampling event.

[4] Quality control samples include field duplicated, trip blanks, equipment blanks, and ambient blanks.

Table 3-3. Summary Of Underground Storage Tanks

Building Number	Tank Contents	Tank Size	Tank Dimensions	Function	Number of Boreholes		
					Tank	Piping	Total
Building 8514	Diesel	1,000 gallons	10 feet by 6 feet	Vehicle Fueling	1	-	1
Building 8507	Fuel Oil	1,000 gallons	10.6 feet by 4 feet	Heating	1	-	1
Building 8505	Diesel	5,000 gallons	18 feet by 8 feet	Power	1	2	3
Building 8500	Fuel Oil	750 gallons	8 feet by 4 feet	Heating	1	2	3
Building 8503	Fuel Oil	2,000 gallons	12 feet by 6 feet	Heating	1	-	1

Table 3-4. Previous Asbestos Survey Results

Facility No.	Facility Name	ACM Present
8500	Safety Control and Identification	Sheetrock, piping, fittings, floor tiles, asphalt and gravel
8502	Water Supply Facility	Pipe insulation
8503	Surveillance Inspection Shipping	Unknown
8505	Electric Power Station	Pipe insulation
8506	Ammunition Storage	Roof
8514	Munitions Shop	Piping, asphalt and gravel

Table 3-5. Building Characteristics And Estimated Number Of Samples

Facility No.	Name/Use	Square Footage	Number of Estimated Samples		
			Asbestos	Lead Paint	Surface Contaminants
8500	Safety, Control and Identification	932	12	9	NA
8501	Water Tank Storage	1219[1]	0	0	NA
8502	Water Supply Facility	78	6	6	NA
8503	Surveillance Inspection Shipping	6,959	18	18	8
8504	Water Supply Facility	78	3	3	NA
8505	Electric Power Station	1,488	1	6	NA
8506	Small Arms Ammunition Storage	5,000	3	18	2
8507	Spares Storage	2,500	0	9	2
8508	Pyrotechnic Storage	351	3	9	2
8509	Segmented Magazine Storage	540	0	6	8

Table 3-5. continued

Facility No.	Name/Use	Square Footage	Number of Estimated Samples		
			Asbestos	Lead Paint	Surface Contaminants
8511	Detonator Storage	126	3	9	1
8512	Waste Accumulation Area SWMU 59	86	0	6	3
8514	Conventional Munitions Shop	2,600	3	12	5
8531	Munitions Storage	1,576	3	9[2]	2[2]
8533	Munitions Storage	1,266	3	0[2]	0[2]
8535	Munitions Storage	2,147	3	9[2]	2[2]
8537	Munitions Storage	2,147	3	0[2]	0[2]
8539	Munitions Storage	2,147	3	0[2]	0[2]

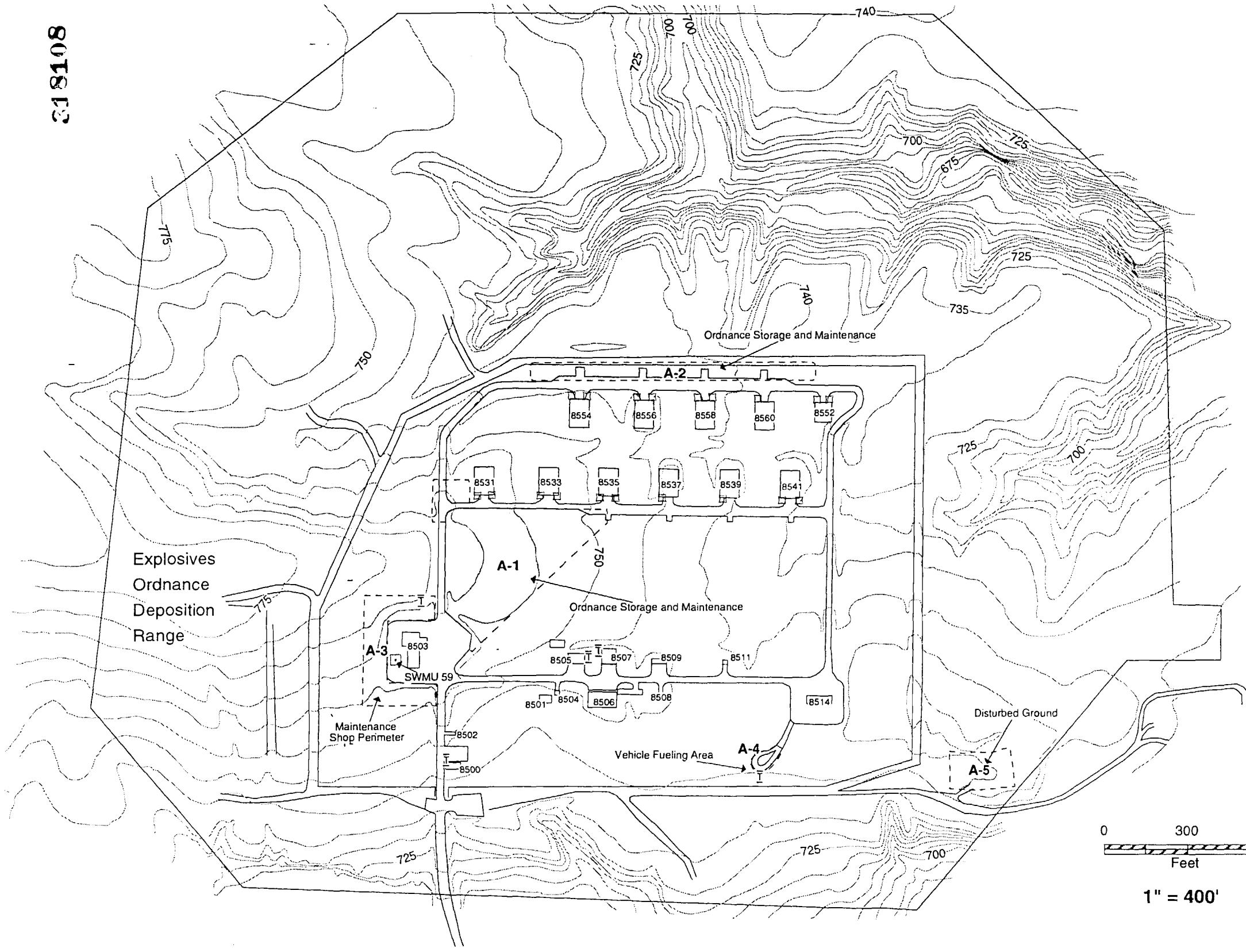
Table 3-5. continued

Facility No.	Name/Use	Square Footage	Number of Estimated Samples		
			Asbestos	Lead Paint	Surface Contaminants
8541	Munitions Storage	2,147	3	9[2]	2[2]
8552	Munitions Storage	1,060	3	9[2]	2[2]
8554	Munitions Storage	2,146	3	9[2]	2[2]
8556	Munitions Storage	2,146	3	0[2]	0[2]
8558	Munitions Storage	2,146	3	0[2]	0[2]
8560	Munitions Storage	2,146	3	0[2]	0[2]

[1] Approximate square footage extrapolated from Jacobs (1996).

[2] Only representative munitions storage building with identical construction will be sampled for lead paint and surficial contaminants

NAS Fort Worth
Offsite
Weapons Storage Area



LEGEND

A-1	Soil Investigation Area
	Area of Concern
	Bunker Drain
T	Underground Storage Tank

0 300 600
Feet

1" = 400'

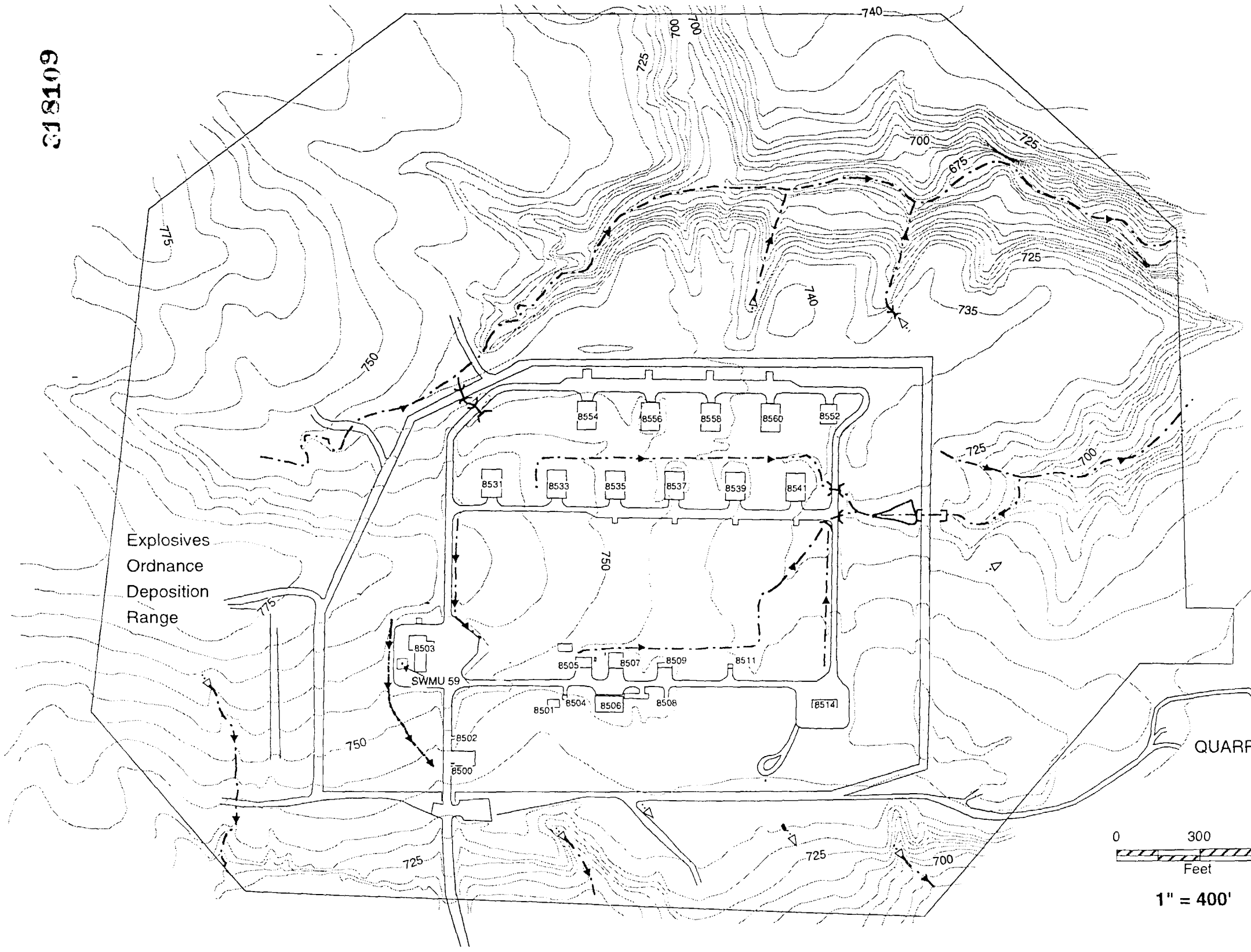
N

The Environmental Company, Inc.

Date: December 1996
Project Manager: B. Duffner
Prepared By: WSM
Project No: P-3109

Figure 3-1 -- RFI Surface and Subsurface Soil Investigation Areas

NAS Fort Worth
Offsite
Weapons Storage Area



LEGEND

- Seep
- Drainageway/Ditch
- Culvert
- Drain Pipe

0 300 600
Feet

1" = 400'

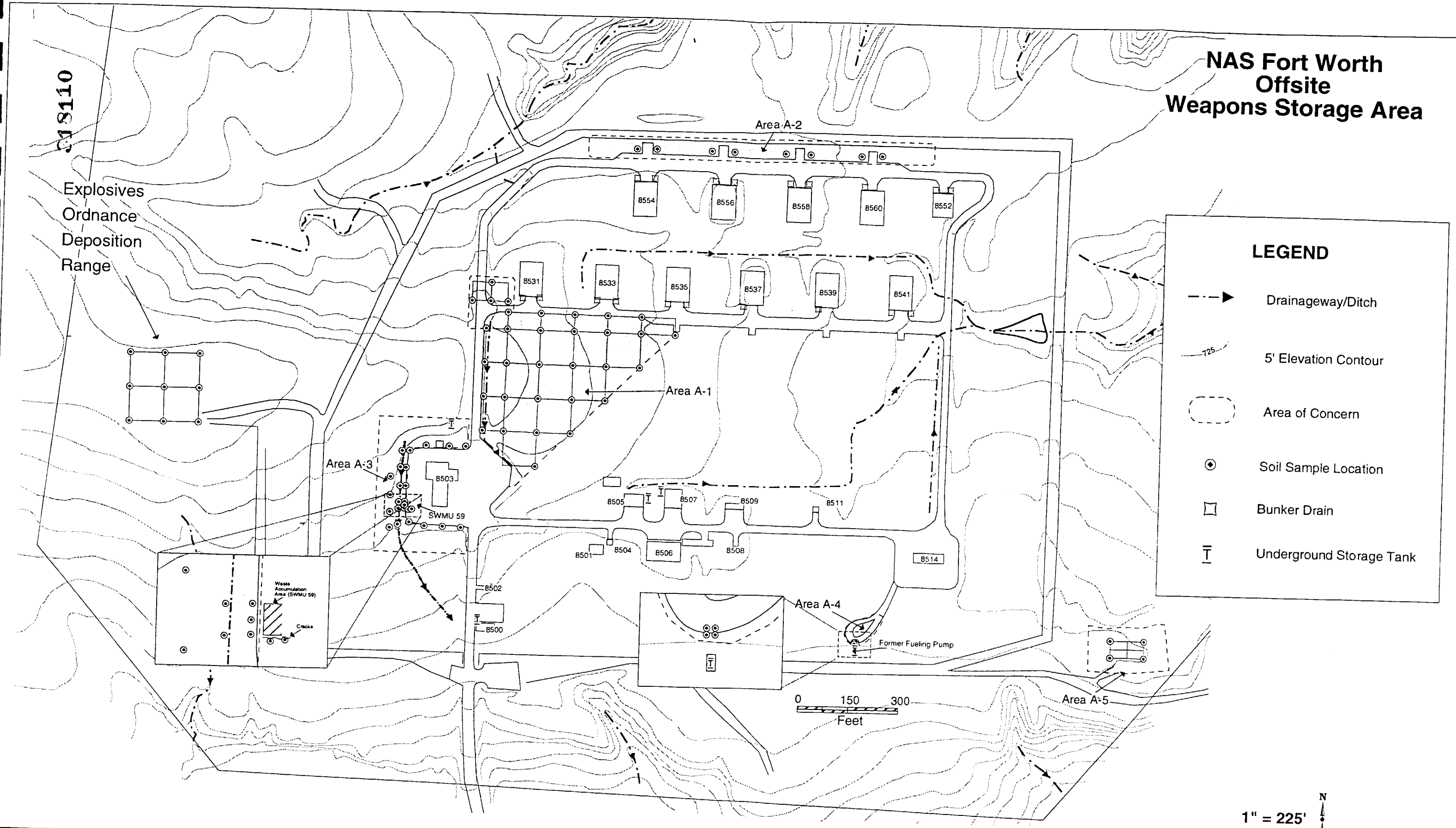
N

The Environmental Company, Inc.

Date: December 1996
Project Manager: B. Duffner
Prepared By: WSM
Project No: P-3109

Figure 3-2 -- RFI Surface Sediment and Surface Water Investigation Areas

NAS Fort Worth Offsite Weapons Storage Area

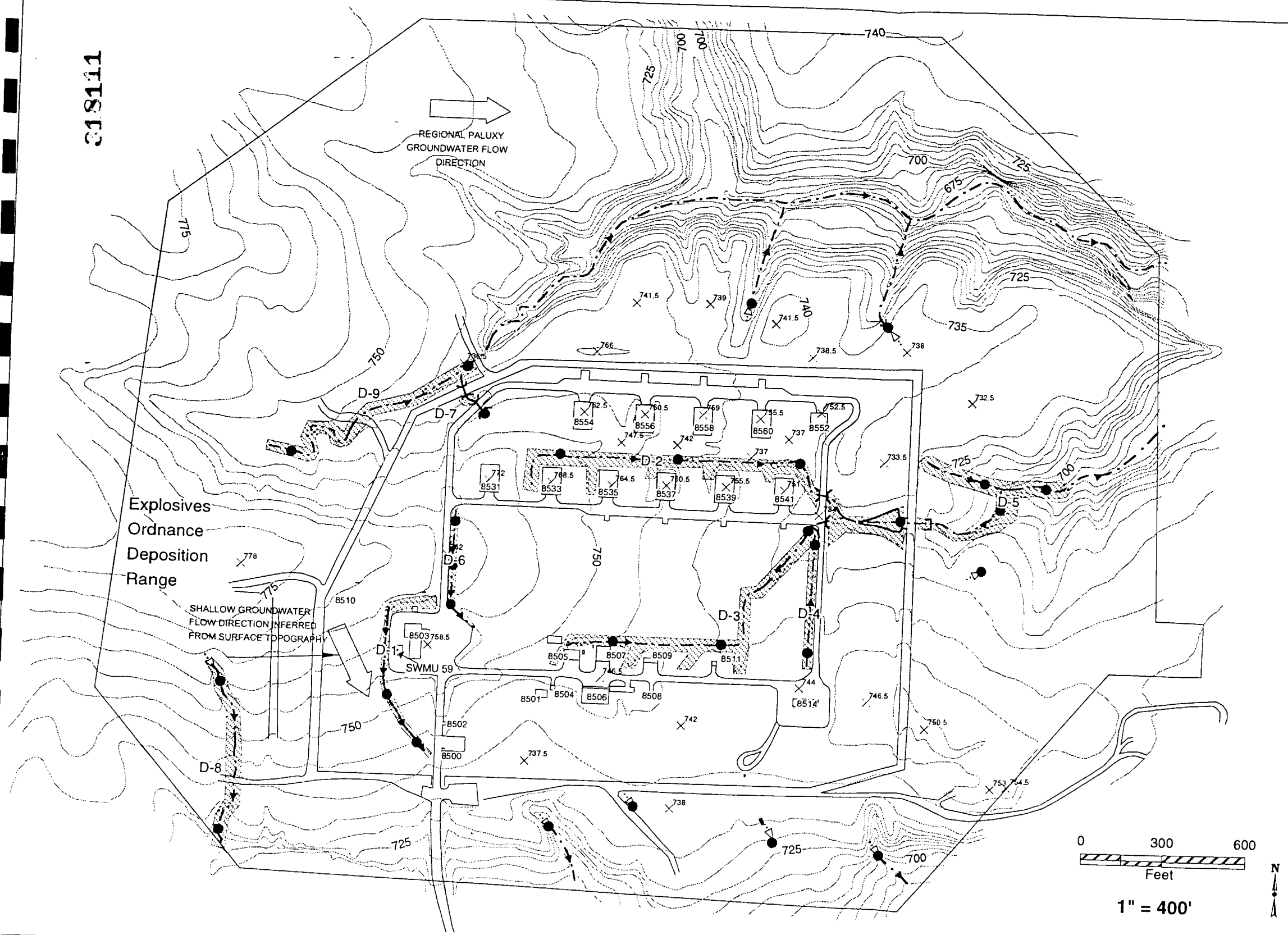


The Environmental Company, Inc.

Date: December 1996
Project Manager: B. Duffner
Prepared By: WSM
Project No: P-3109

Figure 3-3 -- Surface and Subsurface Soil Sample Locations

NAS Fort Worth
Offsite
Weapons Storage Area



LEGEND

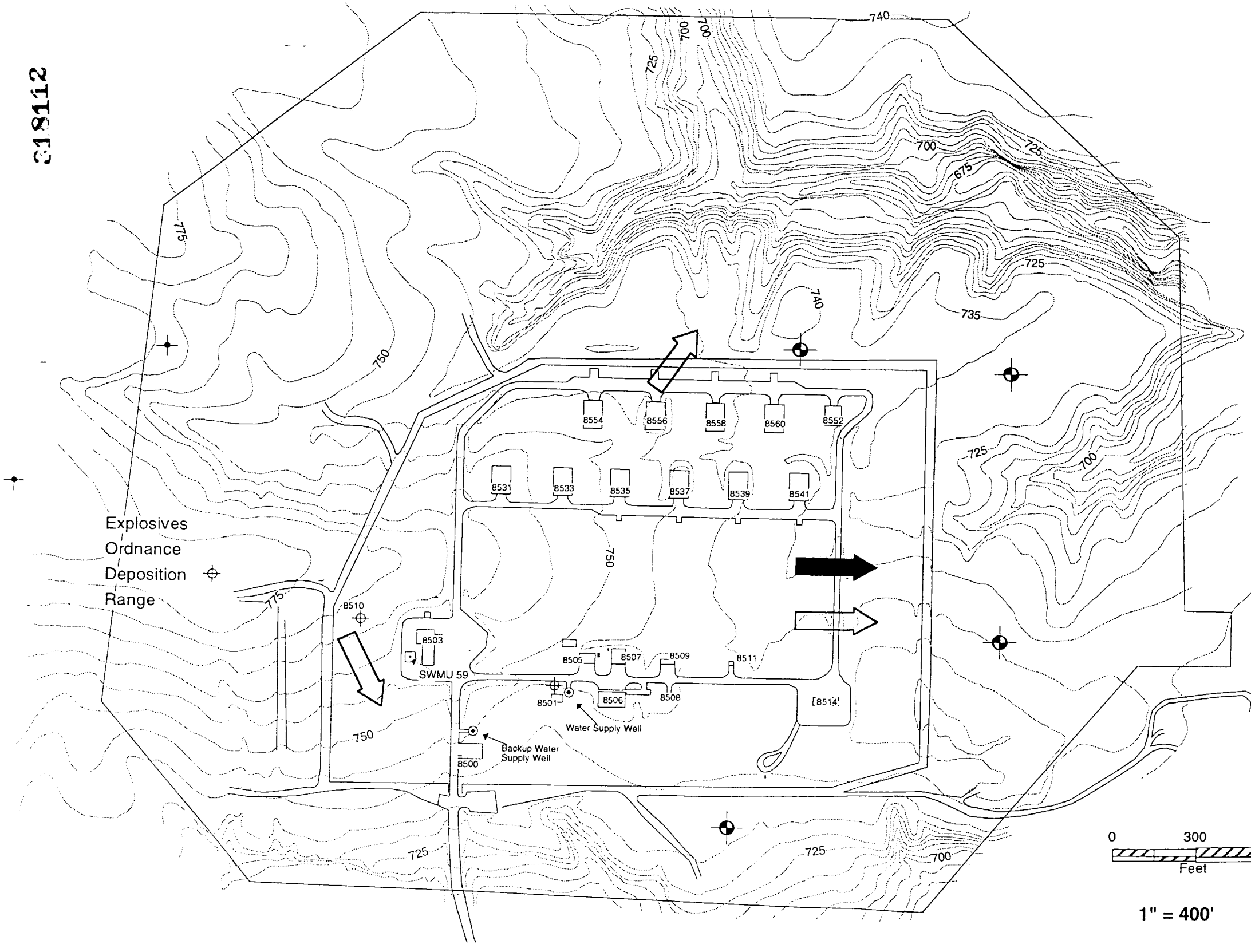
- Seep
- Drainageway/Ditch
- 5' Elevation Contour
- D-1 Drainage Areas of Concern
- Sample Locations

The Environmental Company, Inc.

Date: December 1996
Project Manager: B. Duffner
Prepared By: WSM
Project No: P-3109

Figure 3-4 -- Drainageway and Seep Sample Locations

NAS Fort Worth Offsite Weapons Storage Area



LEGEND

- Existing Paluxy Aquifer Wells
- Paluxy Aquifer Background Study Wells
- Overburden Background Study Wells
- Proposed RFI Overburden Wells
- 725 5' Elevation Contour
- Paluxy Aquifer Groundwater Flow Direction
- Inferred Overburden Groundwater Flow Direction

0 300 600
Feet

1" = 400'

N

The Environmental Company, Inc.

Date: December 1996
Project Manager: B. Duffner
Prepared By: DEB
Project No: P-3109

Figure 3-5 -- NAS Fort Worth Offsite Weapons Storage Area Monitoring Well Locations

4.0 REPORTING REQUIREMENTS

This section details project reporting requirements. All deliverable products/reports will be prepared and submitted in accordance with the SOW and the applicable Contracts Data Requirements Lists (CDRLs) (see Appendix A). CDRL Data Item Numbers are indicated in brackets following each subsection to facilitate reference with Appendix A.

4.1 PROJECT SCOPING DOCUMENTS

This WP constitutes one of the project scoping documents required by the SOW for this contract and delivery order. Other scoping documents required by the SOW include a HSP and a SAP, with the latter consisting of an FSP and a QAPP. [A004]

4.2 MONTHLY STATUS REPORTS

TEC will complete and submit monthly financial and management reports. These Monthly Status Reports will be organized according to the standardized Work Breakdown Structure (WBS) to describe the status of expenditure of funds correlated with the progress of the work completed. [A001AB, B006]

4.3 CHANGE OF CONTRACTOR PERSONNEL

TEC has provided an organizational chart displaying key personnel involved in this project and their respective labor categories with the first Monthly Status Report. TEC will notify the Contracting Officers Representative (COR) of any significant changes in project personnel and provide an updated organizational chart as necessary and appropriate. [A001AA]

4.4 PROJECT SCHEDULES

TEC has prepared a computer-generated network analysis that is a detailed task plan for all WBS tasks (see Section 5.0). The network analysis will be in the form of a Gantt chart to appropriately indicate the percentage of work scheduled for completion by any given date during the period of the delivery order. The Gantt chart will show both serial and parallel subtasks leading to a deliverable. [B001]

4.5 PHOTO DOCUMENTATION

TEC will provide color photo documentation as deemed necessary and appropriate, including documentation of site features, sample locations, and RFI field activities. Color photographs will be included with technical reports. Photographic negatives will also be provided with final submittals. [A031]

4.6 PRELIMINARY LABORATORY REVIEW PACKAGES

In the event that an analytical laboratory is used that has not been previously endorsed by AFCEE, TEC will submit a preliminary laboratory review package to AFCEE/ERC. The preliminary laboratory review package will contain those items identified in the SOW. A preliminary laboratory review package will not be submitted for analytical laboratories used which have been audited by AFCEE within the past 6 months. [A035]

4.7 REPORTING REQUIREMENTS

Reporting requirements of this project include completion of a RCRA Facility Investigation Report and an Ecological/Baseline Risk Assessment. These individual reports are described below.

4.7.1 RFI Report

A draft and final RFI report will be submitted in accordance with the approved project schedule. The RFI report will describe all activities completed during the project including laboratory analyses, evaluation of the analytical results and field measurements with respect to quality control data, and interpretation and analysis of the valid data. The RFI report will address the TNRCC investigation requirements outlined in the Texas Industrial Waste Management Regulation (30 TAC 335) as they relate to the Waste Accumulation Area (SWMU 59). The RFI report will also incorporate Phase II Site Assessment information for the entire WSA to satisfy CERFA requirement. The report will be prepared in accordance with relevant USEPA and TNRCC's TAC guidance documents. The report will include color photographic prints, data, and drawings as required by the SOW. The final report will include responses from all AF and regulatory agencies. [A030AA, A030AB]

4.7.2 Ecological/Baseline Risk Assessment

TEC personnel will conduct an Ecological/Baseline Risk Assessment using validated data generated during the RFI. The ecological/baseline risk assessment will be conducted in accordance with the *Handbook.* TEC will document the Ecological/Baseline Risk Assessment and will include the assessment results as a component of the RFI Report. [A030AA]

4.8 INTERIM CORRECTIVE MEASURES WP

As part of the RFI, TEC will complete a corrective measures study based on the recommendations of the investigation and risk assessment. The study results will be documented in a Corrective Measures WP. The Corrective Measures WP will delineate all required corrective measures at the site. Due to the time constraints identified in the SOW, the study will only evaluate those technologies demonstrated completely implementable and effective under similar field conditions. Research and/or pilot scale technologies will not be evaluated. For each corrective measure, TEC will provide a description of the measure, specific remedial objectives, and remedial requirements. This WP will be completed in accordance with applicable TNRCC and EPA guidance. Draft and final versions of the Corrective Measures WP will be provided. The final report will include responses FROM all AF and the regulatory agency. [A030AB]

4.9 IRPIMS DATA

Preparation of data for submission to the IRPIMS database is a multiphase process, requiring data validation for both field and laboratory data. Records for field samples will be checked for accuracy and completeness in the TEC office before data entry. After entry into IRPIMS-compatible computer files, all data will again be checked to ensure accuracy and agreement between the electronic data files and the original field records.

Information received from the laboratories, both hard copy materials and electronic data files, will be subjected to compliance screening before incorporation into the overall project data files. TEC personnel will check that the data are complete, that the proper analyses were performed for each sample, and that all hard copy materials, particularly chain of custody forms, have been delivered and are legible. The hard copy of the laboratory analyses will also be scanned. The resulting files will be checked against the laboratory's electronic data files to ensure that there are no discrepancies between the legal record (the hard copy) and the electronic equivalents.

In addition, laboratory data will be reviewed to assess data qualifiers and usability. All QC information will be analyzed, including results of laboratory calibrations and check standards, gas chromatography/mass spectroscopy tuning criteria, and results of analyses of matrix spike/matrix spike duplicates, field duplicates, and laboratory control samples. During this process, qualifiers may be attached to some data, and the database will be updated accordingly. Any data determined to be "out of control" through poor field or laboratory practices will be flagged and will not be included with the rest of the data during project analysis.

5.0 PROJECT SCHEDULE

A project schedule to complete the RFI activities is provided in Appendix D. The project schedule is presented in the form of a color Gantt Chart.

Project milestones and document submittal dates are indicated on the project schedule. Serial and parallel subtasks leading to a deliverable are also indicated on the project schedule.

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APPENDIX A

STATEMENT OF WORK

RCRA FACILITY INVESTIGATION (RFI) OF THE OFFSITE WEAPONS STORAGE AREA (WSA) SWMU 59

NAVAL AIR STATION (NAS) FORT WORTH JOINT RESERVE BASE CARSWELL FIELD, TEXAS

PROJECT NO. 96-8117

STATEMENT OF WORK

RCRA FACILITY INVESTIGATION (RFI) OF THE

OFFSITE WEAPONS STORAGE AREA (WSA)

SWMU 59

AT

CARSWELL AFB, TX

Project No. 96-8117

Contract Number: F41624-94-D-8002

Delivery Order 0009

August 9, 1996

This document consists of 13 pages including this cover sheet, but not including any annexes.

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RESOURCE CONSERVATION AND RECOVERY ACT (RCRA) FACILITY INVESTIGATION (RFI) OF THE OFFSITE WEAPONS STORAGE AREA (WSA) AT CARSWELL AFB, TX

1.0 INTRODUCTION

The purpose of this statement of work (SOW) is to provide services, technical man-hours, and materials to perform a Resource Conservation and Recovery Act (RCRA) Facility Investigation (RFI) for the Offsite Weapons Storage Area (WSA) at Carswell Air Force Base (AFB), Texas (TX).

1.1 SCOPE

1.1.1 In carrying out any work assignment issued, the Contractor shall furnish the necessary personnel, services, equipment, materials, and facilities and otherwise do everything necessary for or incidental to the performance of work set forth herein.

1.1.2 Primary services shall include services to perform a RFI for the Offsite WSA. The Contractor's place of performance shall be at the Carswell AFB, Texas.

1.1.3 Secondary services incidental to these services include a topographical and geophysical survey; sampling of soil and groundwater; and preparation of a work plan for an interim corrective measure at the site.

1.2 BACKGROUND

1.2.1 Base Background. Carswell AFB was first activated in 1918 as a combat pilot training school. The base officially closed on 30 September 1993. The Carswell Air Force Base Disposal and Reuse Final Environmental Impact Statement was filed with the U.S. Environmental Protection Agency (EPA) on 29 April 1992. A National Environmental Policy Act (NEPA) Record of Decision was issued on 31 March 1993. The Air Force Base Conversion Agency (AFBCA) is identifying the priority of the disposal and reuse of each parcel, based on market demand and the reuse goals of the local community.

Carswell AFB is on the National Priorities List, and their Installation Restoration Program (IRP) is managed by the Air Force and subject to the provisions of a Federal Facility Agreement (FFA) between the Air Force, EPA Region VI, and state regulatory agencies.

Due to a realignment, Carswell AFB has been renamed the NASFW. It is located in north central Texas in Tarrant County, 8 miles west of downtown Fort Worth. The base property, totaling 2,555 acres, consists of the main base and two noncontiguous parcels. The main base comprises 2,264 acres and is bordered by Lake Worth to the north, the West Fork of the Trinity River and

Westworth Village to the east, Fort Worth to the northeast and southeast, White Settlement to the west and southwest, and AF Plant 4 to the west. The area surrounding NAS Fort Worth is mostly suburban, including the residential areas of the cities of Fort Worth, Westworth Village, and White Settlement. The land uses west of the base are predominantly industrial. These include supporting commercial centers, AF Plant 4, and an industrial complex in White Settlement.

In 1984, the IRP was initiated at the former Carswell AFB and began with a program records search conducted by CH_2M Hill, Inc. Since 1984, Air Force IRP studies have been conducted by several contractors, and have focused on the identification and characterization of waste disposal areas and solid waste management units (SWMUs) identified in the installation's Hazardous Waste Storage permit (HW50289) issued in 1991. A total of sixty-eight (68) SWMUs were identified and investigated by A.T. Kearney, Inc., in a RCRA Facility Assessment (RFA) conducted in 1989. A former hazardous waste accumulation area (SWMU 59) was located on the Offsite WSA.

In April 1995, LAW Environmental, Inc., was retained by AFCEE to begin a basewide groundwater monitoring program. The purpose of the program was to accurately delineate the contamination of the groundwater at NAS Fort Worth. The first semiannual report was published in October 1995, and the second report was published in June 1996.

Pursuant to the Defense Base Closure and Realignment Act (DBCRA) of 1990, the former Carswell AFB was selected for closure and associated property disposal during Round II Base Closure Commission deliberations. However, it has recently been realigned, and most of the property will eventually be transferred to the U.S. Department of the Navy. Hence Carswell AFB has been redesignated as the NASFW.

2.0 APPLICABLE DOCUMENTS

2.1 AFCEE QUALITY ASSURANCE PROJECT PLAN AND FIELD SAMPLING PLAN

The AFCEE Quality Assurance Project Plan (QAPP) and Field Sampling Plan (FSP) provides guidelines for laboratory and field activities and applicable formats for project documents.

2.2 COMPLIANCE DOCUMENTS

The Contractor shall comply with all federal, state, and local regulatory agency requirements and applicable statutes, policies, and regulations, including the most current version of the applicable portions of the documents listed in paragraph 2.2 of the basic contract SOW.

2.3 GUIDANCE DOCUMENTS

The documents listed in paragraph 2.3 of the basic contract SOW are incorporated by reference herein as guidance. Specifically, the Contractor shall use the EPA Interim Final RCRA Facility Investigation (RFI) Guidance and the Texas Administrative Code (TAC) 30, Chapter 335, Subchapters A, R, and S.

3.0 GENERAL REQUIREMENTS

3.1 MEETINGS, CONFERENCES, AND SITE VISITS

3.1.1 Postaward Meeting. After the issuance of this Delivery Order (DO), the Contractor shall attend a postaward meeting at the base or other location specified by the Contracting Officer's Representative (COR). The purpose of the meeting shall be to familiarize the Contractor with the work and hazardous waste site addressed under this DO.

3.1.2 Progress Meetings. Not Applicable.

3.1.3 Design Integration Meetings. Not Applicable.

3.1.4 Public Meetings. Not Applicable.

3.2 SPECIAL NOTIFICATION

3.2.1 Health Risks. The Contractor shall immediately report to the COR, via telephone, any data or results generated during investigations pursuant to this DO that might indicate any potential imminent health risk to contracted or federal personnel, or the public at large. Following this telephone notification, a written notice with supporting documentation shall be prepared and delivered within three (3) working days. Upon request of the Air Force, the Contractor shall provide pertinent raw laboratory data (e.g., chromatograms) within three (3) weeks of the telephone notification.

3.2.2 Change of Contractor Personnel. An organizational chart displaying key personnel involved in the effort and their respective labor categories shall be submitted with the first monthly Status Report. The Contractor shall notify the COR of all professional personnel to work on specific tasks under this DO. The Contractor shall notify the COR of any significant changes in project personnel, along with the steps that the Contractor is taking to ensure there are no impacts to the schedule or costs associated with individual tasks. The Contractor shall also identify to the COR all subcontractors to be used under this DO prior to work being initiated. The Contractor shall provide information about the qualifications of the subcontractors to the COR prior to utilization. (A001AA)

3.3 LABORATORIES

3.3.1 General. Laboratories used by the Contractor may be subject to on-site audits by AFCEE. All laboratories shall be capable of meeting Data Quality Objectives (DQOs) specified in the approved project-specific Sampling and Analysis Plans (SAPs). The laboratories shall screen for analytes and perform Quality Assurance/Quality Control (QA/QC) requirements as specified in the SAPs. All analyses shall be reported on a dry weight basis to facilitate comparison with the off-site laboratory data. The analytical capabilities of the laboratory shall be sufficient for the methods specified in the SAP, and the laboratory shall have sufficient throughput capacity to handle the necessary analytical load during all field activities.

3.3.2 **On-Site Laboratories.** The Contractor may use on-site laboratories for screening purposes. An on-site laboratory may be utilized for the analytical methods required by the approved project/site specific SAP. The laboratory shall meet all applicable certification requirements for the necessary analysis methods prior to its implementation. Laboratory Standard Operating Procedures and QC requirements shall be included in the SAP. All proposed deviations from the above requirements shall be submitted in writing to the Contracting Officer (CO) for concurrence prior to proceeding with the affected work.

3.3.3 **Preliminary Laboratory Review Packages.** For laboratories that have not been previously endorsed by AFCEE, the Contractor shall submit a preliminary laboratory review package to AFCEE/ERC describing the information listed below for each laboratory to be used. This information will facilitate future laboratory review by the government. Prior approval of the laboratory is not a prerequisite to its use. (A035)

a. Laboratory-derived method detection limits, including data used for the calculations. One data set shall be sent for each applicable method (not each instrument, if more than one instrument is being used per method).

b. A full set of acceptance criteria for recovery of surrogate standards and spikes, including the data used to make the calculations. One data set shall be sent for each applicable method (not each instrument, if more than one instrument is being used for a particular type of analysis).

c. Instrument calibration curves for each applicable analytical method.

d. A copy of the laboratory's Quality Assurance Manual.

e. Performance evaluation results for the past two years.

3.4 WORKSITE REQUIREMENTS

3.4.1 **Safety Requirements.** The Contractor shall provide for protecting the lives and health of employees and other persons; preventing damage to property, materials, supplies, and equipment; and avoiding work interruptions. For these purposes, the Contractor shall comply with Occupational Safety and Health Administration (OSHA) safety and health regulations.

3.4.2 Worksite Maintenance. The worksite shall be maintained as recommended in the Handbook so as to 1) prevent the spread of contamination, 2) provide for the integrity of the samples obtained, and 3) provide for the safety of federal workers, contracted personnel, and/or other individuals in the vicinity of the project areas.

The worksite shall be well marked to prevent inadvertent entry into all work areas. Access to work areas shall be monitored and thoroughly controlled. Standard work zones and access points for hazardous waste operations shall be established and maintained as the site conditions warrant. The Contractor shall, at all times, keep the work area free from accumulation of waste materials.

The Contractor shall remove nonessential equipment from the worksite when not in use. The worksite shall be maintained to present an orderly appearance and to maximize work efficiency.

Before completing the work at each sampling site, the Contractor shall remove from the work premises any rubbish, tools, equipment, and materials that are not property of the government. Upon completing the work, the Contractor shall leave the area clean, neat, and orderly and return worksites to the original condition. The Contractor shall also ensure compliance with any federal and state regulations for decontaminating tools, equipment, or other materials as required.

The Contractor shall be responsible for the handling, temporary storage, characterization, permitting, manifesting, transportation, and disposal of all investigation-derived wastes, including drilling fluids and cuttings, excavation material, storage containers, well development and purge water, personal protective equipment and decontamination-related solids and liquids.

3.4.3 **Operations Impact Minimization.** The Contractor shall mark the field locations of all points of ground penetration during the planning/mobilization phase of the field investigation. The base Point of Contact (POC) shall be consulted to properly position sampling locations (wells, borings, soil gas probes, etc.) with respect to site locations, to minimize the disruption of base activities, and to avoid penetrating underground utilities. Additionally, the Contractor may be required to coordinate with other base personnel to attain these objectives. The Contractor shall provide for the detection of underground utilities independent of base Civil Engineering services utilizing geophysical or other techniques. All necessary permits shall be obtained, and necessary coordination shall be completed, prior to commencement of individual sampling operations. Frequent communication and coordination with base personnel shall be necessary to accomplish these goals.

3.4.4 Storage. The Contractor shall be responsible for the security of his equipment. Equipment or materials that require storage on base shall be placed at sites as designated by the base POC. The Contractor shall be responsible for security and weatherproofing of any stored material and equipment. Missing or damaged material shall be replaced at no additional cost to the government. At the completion of the work, all temporary fences and structures that the Contractor used to protect materials and equipment shall be removed from the base. The Contractor shall clean the storage area of all debris and material and perform all repairs as required to return the site to its original condition.

3.4.5 Security. The Contractor is responsible for obtaining and monitoring Contractor security badges for all areas for the duration of this contract. All security badges or passes shall be returned to the base POC upon expiration of the badge, upon completion of the project, or when possession of the badge is no longer necessary (e.g., upon removal of contracted personnel from specific projects). Photography of any kind must be coordinated through the base POC or Base Conversion Agency representative.

3.5 WORK BREAKDOWN STRUCTURE

The Contractor shall prepare a proposal, project schedule, and monthly financial reports organized according to a preapproved work breakdown structure (WBS). The Contractor shall utilize the WBS specified in the basic contract as a guide and propose the specific WBS for this DO to the CO and COR for approval.

4.0 WORK TASKS

4.1 DELIVERY ORDER SCOPING AND PLAN DEVELOPMENT

4.1.1 Presurvey. The Contractor shall conduct presurveys to enable preliminary scoping of environmental issues. The Contractor shall visit the Offsite WSA and make all preliminary studies of monitoring or sampling locations and accessibility, number of sampling locations, number and type of personnel required, number and type of tests or samples desired, special or modified sampling equipment and procedures required, personal protective equipment required, and type of analytical protocol or procedures to ensure that the survey activities shall comply with applicable regulations, laws, or standards.

4.1.2 Premobilization Survey. The Contractor shall determine, by registered land surveyor, any locations of off-base drilling easements. Prior to performing any off-base fieldwork or drilling any off-base wells, the Contractor shall conduct a survey to determine the closest property line. After wells have been installed, the Contractor shall locate easements from the closest property line and establish permanent easement boundaries. The Contractor shall provide a metes and bounds description and plot plan for each easement site.

4.1.3 Plan Development. The Contractor shall prepare a RFI WP. The RFI WP shall include a Health and Safety Plan (HSP) and a Sampling and Analysis Plan (SAP). The SAP shall consist of a Field Sampling Plan (FSP) and a QAPP. In the development of the WPs, the Contractor shall utilize the AFCEE boilerplate QAPP and FSP. The CO, AFCEE COR, and base POC shall be notified in writing of any proposed modification to, or deviation from, any activity described in these documents.

4.1.3.1 Quality Program Plans. The QPP shall consist entirely of a single RFI WP that encompasses all proposed activities under this DO including both a HSP and a SAP. Separate documents and separate submittals of a HSP and SAP are not required.

4.1.3.1.1 Health and Safety Plan. The Contractor shall prepare and deliver a HSP as part of the RFI WP to comply with Air Force, OSHA, EPA, state, and local health and safety regulations regarding the proposed work effort. The Contractor shall utilize to the fullest extent possible existing corporate HSPs, tailoring them to the current effort. The Contractor shall use EPA guidelines for designating the appropriate levels of protection needed at the study site. The Contractor shall coordinate the HSP directly with applicable regulatory agencies prior to submittal to AFCEE and provide the COR with evidence of HSP coordination prior to the start of fieldwork. The Contractor shall certify to AFCEE that it has reviewed the approved HSP with

each employee and subcontractor's employees prior to the time each employee engages in field activities. The HSP shall be submitted as part of the RFI WP.

4.1.3.1.2 **Sampling and Analysis Plan.** The Contractor shall include a SAP as part of the RFI WP. The SAP shall consist of FSP and QAPP provisions.

4.1.3.2 **Work Plans.** The Contractor shall deliver a RFI WP for all phases of work specified in this DO. The RFI WP shall address all phases of work specified in this DO including appropriate references to previously approved WPs and SAPs. The WP shall incorporate into a single document all proposed activities including necessary HSP, FSP and QAPP. (A004)

4.1.3.3 **Management Action Plan.** Not Applicable.

4.1.3.4 **Community Relations Plan.** Not Applicable.

4.1.3.5 **Environmental and Land Use Plan.** Not Applicable.

4.2 PRELIMINARY ASSESSMENT/SITE INSPECTION. Not Applicable.

4.3 REMEDIAL INVESTIGATION/FEASIBILITY STUDY. Not Applicable.

4.4 REMEDIAL DESIGN. Not Applicable.

4.5 TREATABILITY STUDIES, PILOT TESTS, AND BENCH-SCALE TESTS. Not Applicable.

4.6 SUBTASKS. Not Applicable.

4.7 OTHER ENVIRONMENTAL ACTIVITIES

In accordance with the approved RFI WP, the Contractor shall conduct a RFI and Risk Assessment of the Offsite WSA site groundwater and subsurface soil to characterize environmental conditions and define the nature and extent of contamination. This RFI shall be done through a field investigation for the collection of geologic, geophysical, hydrogeological, ecological, chemical, physical, and hydrologic data, and environmental samples using an established coordinate system. The RFI shall also include the laboratory analysis of those samples for potential contaminants, the evaluation of the analytical results and field measurements with respect to quality control data, and the interpretation and analysis of validated data. The purpose of data collection, sample collection, and laboratory analysis is to determine whether any contaminants generated from the Offsite WSA have entered the environment and pose a risk to human health or the environment. The RFI will include a Phase II Site Assessment of the entire Offsite Weapons Storage Area to satisfy CERFA requirements. The Contractor shall deliver reports, photographs, data, drawings, designs, and other documentation as required by this DO, documenting the results of the RFI. The Contractor shall prepare an RFI report in accordance with the EPA's and TNRCC's TAC guidance documents. The contractor shall do a corrective

measures study as part of the RFI and prepare and submit a Corrective Measures Implementation WP for any corrective measure recommendations identified as a result of the RFI. The Corrective Measures WP shall be started by the contractor at the direction of the COR following government review of the RFI results. The Corrective Measures WP shall delineate all required corrective measures at the site. It shall be designed for execution by a third party remedial action contractor.. Both the RFI report and interim corrective measures WP shall be prepared in draft and subsequently revised to reflect both Air Force and regulatory agency comments. (A030AA, A030AB, A031)

4.7.1 Environmental and Occupational Noise/Vibration Surveys and/or Industrial Hygiene Equipment Evaluations. Not Applicable.

4.7.2 Miscellaneous Analyses. Not Applicable.

4.7.3 Environmental Monitoring. Not Applicable.

4.7.4 Sampling for Remedial Action. Not Applicable.

4.8 MISCELLANEOUS DELIVERABLES

4.8.1 Monthly Financial and Management Reports. The Contractor shall submit financial and management reports to describe the status of expenditure of funds correlated by task with the progress of the work completed. Reports shall provide current status and projected requirements of funds, man-hours, and work completion; indicate the progress of work and the status of the program and assigned tasks; and inform of existing or potential problem areas. (B006, A001AB)

4.8.2 Project Schedules. The Contractor shall deliver a detailed task plan for all tasks for approval by the COR. The schedule shall be in the form of a progress chart of suitable scale to indicate appropriately the percentage of work scheduled for completion by any given date during the period of the DO. (B001)

4.8.3 Installation Restoration Program Information Management System (IRPIMS) Data Management. The Contractor shall meet the data deliverable requirements of the IRPIMS. The Contractor shall be responsible for recording field and laboratory data into a computerized format as required by the most current version of the IRPIMS Data Loading Handbook (mailed under separate cover). To perform this task, the Contractor shall use the latest version of the IRPIMS QC Tool, a PC software utility (mailed under separate cover with software manual), to quality check ASCII data files and to check all data files for compliance with requirements in the IRPIMS Data Loading Handbook. The IRPIMS Contractor Data Loading Tool (CDLT) is available on request. This PC software is designed to assist the Contractor in preparing the various ASCII data files.

Individual IRPIMS data files (analytical results, groundwater level data, etc.), including resubmissions, shall be delivered with a transmittal letter by the Contractor to AFCEE in sequence according to a controlled time schedule as identified in the current version of the IRPIMS Data

Loading Handbook. All Location IDs will include Northings, Eastings, and Elevations in the State Plane Coordinate system. The Contractor shall include a copy of the QC Tool error report (i.e., output from the QC Tool) for each IRPIMS file submission. The error report shall be submitted as hard copy with the transmittal letter. (B003)

All Contractor data deliverables shall be sent to:
AFCEE/MSC BLDG 532
Environmental Systems Support Team
ATTN: IRPIMS Data Management
3207 North Road
Brooks AFB, TX 78235-5363

In addition, the Contractor shall provide a copy of the transmittal letter to the Air Force contracting office responsible for the contract, HSC/PKV (3207 North Road, Brooks AFB, TX 78235-5363) for AFCEE contracts. This letter shall identify the files included or otherwise omitted (with an appropriate explanation), the government contract and DO number, and the Air Force POC that is responsible for monitoring the government contract.

The Contractor shall be responsible for the accuracy and completeness of all data submitted. All data entered into the IRPIMS data files and submitted by the Contractor shall correspond exactly with the data contained in the original laboratory reports and other documents associated with sampling and laboratory contractual tasks.

Each file delivered by the Contractor will be electronically evaluated by AFCEE/MSC for format compliance and data integrity in order to verify acceptance. All files delivered by the Contractor are required to be error-free and in compliance with the IRPIMS Data Loading Handbook. Any errors identified by AFCEE/MSC in the submission shall be corrected by the Contractor.

4.8.4 Presentation Materials. Not Applicable.

4.8.5 Photo Documentation. The Contractor shall deliver photo documentation as necessary to support other deliverables. All photos will be submitted as integral to the deliverable it supports. Separate deliverables are not required.

4.8.6 Meeting Minutes. Not Applicable.

5.0 DATA MANAGEMENT

The Contractor shall collect, prepare, publish, and distribute the data in the quantities and types designated on the Contract Data Requirements List (CDRL). The Contractor shall designate a focal point who shall integrate the total data management effort and manage changes, additions, or deletions of data items. In addition, the Contractor shall identify items to be added, recommend revisions or deletion of items already listed on the CDRL as appropriate, and maintain the status of all data deliverables. Deliverables shall be in accordance with the applicable CDRLs in Exhibits A, B, and C.

6.0 GOVERNMENT-FURNISHED PROPERTY

Provided under separate cover.

7.0 GOVERNMENT POINTS OF CONTACT

AFCEE/ERB
Team Chief (TC)
Mr. Charles Rice
AFCEE/ERB
3207 North Road
Brooks AFB, TX 78235-5363
Office Phone # (210) 536-6452
Fax Phone # (210) 536-3609

Base POC
AFBCA Site Manager
Mr. Olen Long, P.E.
AFBCA/OL-H
6550 White Settlement Road
Fort Worth, Texas 76114-3520
Office Phone # (817) 731-8284
Fax Phone # (817) 731-8137

DEPARTMENT OF THE AIR FORCE
AIR FORCE BASE CONVERSION AGENCY

30 Nov 95

MEMORANDUM FOR AIR FORCE CENTER FOR ENVIRONMENTAL EXCELLENCE (AFCEE)
ATTN: Mr. Charlie Rice

SUBJECT: Base Support Agreement for 1996 Projects

The Air Force Base Conversion Agency (AFBCA) will provide the following support to existing 1996 projects as well as well as any future modifications:

a. Provide contractor(s) with existing engineering plans, drawings, diagrams, aerial photographs, etc., to facilitate evaluation of the IRP site under investigation.

b. Arrange for personnel identification badges, vehicle passes, and/or entry permits.

c. Provide areas for staging, decontamination, and temporary waste storage. Contractor(s) will make every effort to remove waste from the base in an expedient, yet cost-effective manner.

d. Supply sources of electrical power and water. Contractor(s) will be responsible for any utility connections required.

e. Provide empty office space for contractor(s) use during the field activities.

2. Please direct any questions to Alan Flolo, (817)731-8973, ext 18.

OLEN R. LONG, GM-13
Installation Management Officer

218134

F41624-95-D-8002-0009
Attachment 3

30 AUG 1996

MEMORANDUM FOR AFCEE/ERB.
ATTN: Mr. Charles A Rice.

FROM HSC/PKVCC
3207 North Road
Bldg 532
Brooks AFB, TX 78235-5353

SUBJECT: Appointment of the Contracting Officer's Representative (COR) for Contract F41624-95-D-8002 Delivery Order 0009 for NAS JRB Carswell Field, TX

1. You are hereby notified that Mr. Charles A. Rice, AFCEE/ERB, has been appointed as the Contracting Officer's Representative (COR) for subject contract Delivery Order. The authority vested in this position is limited by the terms and conditions of the basic contract, the Delivery Order and this letter.

2. As the appointed COR, Mr. Rice shall:

a. Be responsible for the technical monitoring of Contractor performance, and will act as the technical point of contact for this effort.

b. Expedite the technical reviews of the Contractor's proposal for any changes to the delivery order.

c. Authorize release of materials or actions requiring Government concurrence, as specified in the delivery order. A Copy of all written correspondence between the COR and the contractor shall be furnished to the Contracting Office at the above address.

d. Coordinate activities with Contractor personnel and other individuals involved in this effort at NAS JRB Carswell Field, TX.

e. Expedite the review of invoices/payment vouchers.

f. Be responsible for the inspection and acceptance of the completed effort specified in subject delivery order.

g. Maintain written records, for PCO review, of all actions taken by technical personnel and the contractor to ensure that costs, schedule and technical performance is documented.

h. Attend meetings, i.e., site visits, pre-performance conferences, as the official Government technical representative, as needed.

i. Expedite the evaluation of technical reports submitted by the contractor.

3. The COR is not a Contracting Officer and does not have authority to take any action, either directly or indirectly, that would change the price, quantity, quality, place of performance, schedule ,or any other terms or conditions of the delivery order. Additionally, the COR does not have authority to direct the accomplishment of the effort which goes beyond the scope of the Statement of Work (SOW) attached to the subject delivery order. The COR may be held personally liable for unauthorized acts in accordance with DFARS 201.602-2.

4. In the event Mr. Rice is unable to discharge the duties enumerated above, all functions shall revert to the Contracting Officer (CO) of record. The authority delegated hereby cannot be transferred in any manner without the express written direction of the CO.

JERRY W. OUTLEY
Contracting Officer

30 AUG 1996

cc:
AFCEE/ERB (Mr. Charles A. Rice)
DCMAO Baltimore (ACO)
AFBCA/OL-H (Ms Randi Audello)
(Mr. Olen Long)

==========

1st Endorsement

I acknowledge receipt of the above letter and have received or will receive in the near future COR training conducted by HSC/PKV. I fully understand the scope and limits of my COR duties and responsibilities, and will comply with them as delegated.

Mr. Charles A. Rice
Contracting Officer's Representative

Date: 29 Aug 96

APPENDIX B

ARARs FOR GROUNDWATER, SURFACE WATER, AND SOIL

APPENDIX B: ARARS OR TBCS FOR GROUNDWATER, SURFACE WATER AND SOIL

Constituent	Ground Water[1-4]	Soil[1-5]	Surface Water	
			Fresh Acute Criteria (µg/L)	Fresh Chronic Criteria (µg/L)
Acenaphthene	2.19e+00	2.19e+02		
Acetone	3.65e+00	3.65e+02		
Acetonitrile	2.19e-01	2.19e+01		
Acetophenone	3.65e+00	3.65e+02		
Acrolein	7.30e-01 (12)	7.30e+01		
Acrylamide	1.89e-05	1.89e-03		
Acrylonitrile	1.58e-04	1.58e-02		
Alachlor	2.00e-03 (9)	2.00e-01		
Aldicarb	3.00e-03 (9)	3.00e-01		
Aldicarb Sulfone	2.00e-03 (9)	2.00e-01		
Aldicarb Sulfoxide	4.00e-03 (9)	4.00e-01		
Aldrin	5.01e-06	5.01e-04	3	
Aluminum Phosphide	1.46e-02	1.46e+00		
Aniline	1.49e-02	1.49e+00		

APPENDIX B: ARARS OR TBCS FOR GROUNDWATER, SURFACE WATER AND SOIL

Constituent	Ground Water[1-4]	Soil[1-5]	Surface Water	
			Fresh Acute Criteria (µg/L)	Fresh Chronic Criteria (µg/L)
Anthracene	1.10e+01	1.10e+03		
Antimony	6.00e-03 (9)	6.00e-01		
Arsenic	5.00e-02 (9)	5.00e+00	360	190
Atrazine	3.00e-03 (9)	3.00e-01		
Barium (ionic)	2.00e+00 (9)	2.00e+02		
Benzene	5.00e-03 (9)	5.00e-01		
Benzidine	3.70e-07	3.70e-05		
Beryllium	4.00e-03 (9)	4.00e-01		
Biphenyl	1.83e+00	1.83e+02		
Bis (2-chloro-ethyl) ether	7.74e-05	7.74e-03		
Bis (2-chloroisopropyl) ether	1.22e-02	1.22e+00		
Bis (2-ethyl-hexyl) phthalate	6.08e-03	6.08e-01		
Bromodichloromethane	1.00e-01 (9)	1.00e+01		
Bromoform	1.00e-01 (9)	1.00e+01		

APPENDIX B: ARARS OR TBCS FOR GROUNDWATER, SURFACE WATER AND SOIL

Constituent	Ground Water[1-4]	Soil[1-5]	Surface Water	
			Fresh Acute Criteria (µg/L)	Fresh Chronic Criteria (µg/L)
Bromomethane	5.11e-02	5.11e+00		
Butyl-4,6-dinitrophenol, 2-sec-	3.65e-02	3.65e+00		
Cadmium	5.00e-03 (9)	5.00e-01		
Carbofuran	4.00e-02 (9)	4.00e+00		
Carbon Disulfide	3.65e+00	3.65e+02		
CarbonTetrachloride	5.00e-03 (9)	5.00e-01		
Chlordane	2.00e-03 (9)	2.00e-01	2.4	0.0043
Chloroanaline, p-	1.46e-01	1.46e+01		
Chlorobenzene	1.00e-01 (9)	1.00e+01		
Chlorobenzilate	7.30e-01	7.30e+01		
Chloroethane (Ethylchloride)	7.30e-01	7.30e+01		
Chloroform	1.00e-01 (9)	1.00e+01		
Chloronaphthalene, 2-	2.92e+00	2.92e+02		
2-chlorophenol	1.83e-01	1.83e+01		

APPENDIX B: ARARS OR TBCS FOR GROUNDWATER, SURFACE WATER AND SOIL

Constituent	Ground Water[1-4]	Soil[1-5]	Surface Water	
			Fresh Acute Criteria (µg/L)	Fresh Chronic Criteria (µg/L)
Chromium (total)	1.00e-01 (9)	1.00e+01	16	11
Chromium (VI)	1.00e-01 (9)	1.00e+01		
Copper	1.0 (17)			
Cresol, m-	1.83e+00 (12)	1.83e+02		
Cresol, o-	1.83e+00 (12)	1.83e+02		
Cresol, p-	1.83e+00 (12)	1.83e+02		
Cyanide	2.00e-01 (9)	2.00e+01	45.78	10.69
DDD	3.55e-04	3.55e-02		
DDE	2.50e-04	2.50e-02		
DDT	2.50e-04	2.50e-02		
Di-n-butyl phthalate	3.65e+00	3.65e+02		
Di-n-octyl phthalate	7.30e-01	7.30e+01		
Dibromo-3-chloropropane, 1,2-	2.00e-04 (9)	2.00e-02		
Dibromochloromethane	1.00e-01 (9)	1.00e+01		

APPENDIX B: ARARS OR TBCS FOR GROUNDWATER, SURFACE WATER AND SOIL

Constituent	Ground Water[1-4]	Soil[1-5]	Surface Water	
			Fresh Acute Criteria (µg/L)	Fresh Chronic Criteria (µg/L)
Dichlorobenzene (1,2)	6.00e-01 (9)	6.00e+01		
Dichlorobenzene (1,3)	6.00e-01 (9)	6.00e+01		
Dichlorobenzene (1,4)	7.50e-02 (9)	7.50e+00		
Dichlorodifluoromethane	7.30e+00	7.30e+02		
Dichloroethane (1,1)	3.65e+00	3.65e+02		
Dichloroethane (1,2)	5.00e-03 (9)	5.00e-01		
Dichloroethylene (1,1)	7.00e-03 (9)	7.00e-01		
Dichloroethylene, cis-(1,2)	7.00e-02 (9)	7.00e+00		
Dichloroethylene, trans-(1,2)	1.00e-01 (9)	1.00e+01		
Dichlorophenol, 2,4-	1.10e-01	1.10e+01		
Dichlorophenoxyacetic acid, 2,4-	7.00e-02 (9)	7.00e+00		
Dichloropropane (1,2)	5.00e-03 (9)	5.00e-01		
Dieldrin	5.32e-06	5.32e-04		
Diethyl phthalate	2.92e+01	2.92e+03		

APPENDIX B: ARARS OR TBCS FOR GROUNDWATER, SURFACE WATER AND SOIL

Constituent	Ground Water[1-4]	Soil[1-5]	Surface Water	
			Fresh Acute Criteria (µg/L)	Fresh Chronic Criteria (µg/L)
Diethylhexyl adipate	5.00e-01 (9)	5.00e+01		
Dimethoate	7.30e-03	7.30e-01		
Dimethyl phenol, 2,4-	7.30e-01	7.30e+01		
Dinitrobenzene, 1,3-	3.65e-03	3.65e-01		
Dinitrophenol, 2,4-	7.30e-02	7.30e+00		
Dioxane (1,4)	7.74e-03	7.74e-01		
Diphenylamine	9.13e-01	9.13e+01		
Diphenylhydrizine, 1,2-	1.06e-04	1.06e-02		
Disulfoton	1.46e-03	1.46e-01		
Endosulfan	1.83e-03	1.83e-01		
Endothall	1.00e-01 (9)	1.00e+01		
Endrin	2.00e-03 (9)	2.00e-01	0.18	0.0023
Ethoxy ethanol, 2-	1.46e+01	1.46e+03		
Ethoxyethanol acetate, 2-	1.10e+01	1.10e+03		

APPENDIX B: ARARS OR TBCS FOR GROUNDWATER, SURFACE WATER AND SOIL

Constituent	Ground Water[1-4]	Soil[1-5]	Surface Water	
			Fresh Acute Criteria (µg/L)	Fresh Chronic Criteria (µg/L)
Ethyl benzene	7.00e-01 (9)	7.00e+01		
Ethylene dibromide	5.00e-05 (9)	5.00e-03		
Ethylene glycol	7.30e+01	7.30e+03		
Ethylene oxide	8.35e-05	8.35e-03		
Fluoranthene	1.46e+00	1.46e+02		
Fluorene	1.46e+00	1.46e+02		
Fluorides	4.00e+00 (9)	4.00e+02		
Formaldehyde	7.30e+00 (12)	7.30e+02		
Gross alpha emitters	15 pCi/L (9)			
Gross beta particles and photon emitters	4 mrem (9)			
Heptachlor	4.00e-04 (9)	4.00e-02	0.52	0.0038
Heptachlor epoxide	2.00e-04 (9)	2.00e-02		
Hexachlorobenzene	1.00e-03 (9)	1.00e-01		
Hexachlorobutadiene	1.09e-02	1.09e+00		

APPENDIX B: ARARS OR TBCS FOR GROUNDWATER, SURFACE WATER AND SOIL

Constituent	Ground Water[1-4]	Soil[1-5]	Surface Water	
			Fresh Acute Criteria (µg/L)	Fresh Chronic Criteria (µg/L)
Hexachlorocyclohexane, alpha	1.35e-05	1.35e-03		
Hexachlorocyclohexane, beta	4.73e-04	4.73e-02		
Hexachlorocyclohexane, gama	2.00e-04 (9)	2.00e-02		
Hexachloroethane	6.08e-02	6.08e+00		
Iron	0.3 (17)			
Isobutyl alcohol	1.10e+01	1.10e+03		
Lead (inorganic)	1.50e-02 (9)	1.50e+00	81.4 (18)	3.2 (18)
Manganese	0.05 (17)			
Mercury	2.00e-03 (9)	2.00e-01	2.4	1.3
Methomyl	9.13e-01	9.13e+01		
Methoxy ethanol	1.46e-01	1.46e+01		
Methoxychlor	4.00e-02 (9)	4.00e+00	-	0.03
Methoxyethanol acetate	7.30e-02	7.30e+00		
Methyl Ethyl Ketone	1.83e+00	1.83e+02		

APPENDIX B: ARARS OR TBCS FOR GROUNDWATER, SURFACE WATER AND SOIL

Constituent	Ground Water[1-4]	Soil[1-5]	Surface Water	
			Fresh Acute Criteria (µg/L)	Fresh Chronic Criteria (µg/L)
Methyl isobutyl ketone	1.83e+00	1.83e+02		
Methyl methacrylate	2.92e+00	2.92e+02		
Methylene Chloride	5.00e-03 (9)	5.00e-01		
Naphthalene	1.46e+00	1.46e+02		
Nickel	1.00e-01 (9)	1.00e+01		
Nitrate	1.00e+01 (9)	1.00e+03		
Nitrite	1.00e+00 (9)	1.00e+02		
Nitrobenzene	1.83e-02	1.83e+00		
Nitroso-methyl-ethyl-amine, n-	3.87e-06	3.87e-04		
Nitrosodi-n-propylamine, n-	1.22e-05	1.22e-03		
Nitrosodiethylamine, n-	5.68e-07	5.68e-05		
Nitrosodimethylamine, n-	1.67e-06	1.67e-04		
Nitrosopryyolidine, n-	4.06e-05	4.06e-03		
Pentachloronitrobenzene	3.28e-03	3.28e-01		

APPENDIX B: ARARS OR TBCS FOR GROUNDWATER, SURFACE WATER AND SOIL

Constituent	Ground Water[1-4]	Soil[1-5]	Surface Water	
			Fresh Acute Criteria (µg/L)	Fresh Chronic Criteria (µg/L)
Pentachlorophenol	1.00e-03 (9)	1.00e-01		
Phenol	2.19e+01	2.19e+03		
Phthalic anhydride	7.30e+01	7.30e+03		
Polychlorinated biphenyls	5.00e-04 (9)	5.00e-02	2	0.014
Pronamide	2.74e+00	2.74e+02		
Pyrene	1.10e+00	1.10e+02		
Pyridine	3.65e-02	3.65e+00		
Radium 226 + 228	5 pCi/L (9)			
Radium 226	20 pCi/L (9)			
Radium 228	20 pCi/L (9)			
Radon 222	300 pCi/L (9)			
Selenium	5.00e-02 (9)	5.00e+00	20	5
Silver	1.83e-01	1.83e+01		
Strychnine	1.10e-02	1.10e+00		

APPENDIX B: ARARS OR TBCS FOR GROUNDWATER, SURFACE WATER AND SOIL

Constituent	Ground Water[1-4]	Soil[1-5]	Surface Water	
			Fresh Acute Criteria (µg/L)	Fresh Chronic Criteria (µg/L)
Pentachlorophenol	1.00e-03 (9)	1.00e-01		
Styrene	1.00e-01 (9)	1.00e+01		
Sulfate	3.00e+02 (17)			
Tetrachlorobenzene, 1,2,4,5-	1.10e-02	1.10e+00		
Tetrachloroethane (1,1,1,2)	3.28e-02	3.28e+00		
Tetrachloroethane (1,1,2,2)	4.26e-03	4.26e-01		
Tetrachloroethylene	5.00e-03 (9)	5.00e-01		
Tetrachlorophenol, 2,3,4,6-	1.10e+00	1.10e+02		
Tetraethyl dithiopyrophosphate	1.83e-02	1.83e+00		
Toluene	1.00e+00 (9)	1.00e+02		
Toxaphene	3.00e-03 (9)	3.00e-01	0.78	0.0002
TP Silvex, 2,4,5-	5.00e-02 (9)	5.00e+00		
Trichlorobenzene (1,2,4)	7.00e-02 (9)	7.00e+00		
Trichloroethane (1,1,1)	2.00e-01 (9)	2.00e+01		

APPENDIX B: ARARS OR TBCS FOR GROUNDWATER, SURFACE WATER AND SOIL

Constituent	Ground Water[1-4]	Soil[1-5]	Surface Water	
			Fresh Acute Criteria (µg/L)	Fresh Chronic Criteria (µg/L)
Trichloroethane (1,1,2)	5.00e-03 (9)	5.00e-01		
Trichloroethylene	5.00e-03 (9)	5.00e-01		
Trichlorofluoromethane	1.10e+01	1.10e+03		
Trichlorophenol (2,4,5)	3.65e+00	3.65e+02		
Trichlorophenol, 2,4,6-	7.74e-03	7.74e-01		
Trichlorophenoxyacetic acid, 2,4,5-	3.65e-01	3.65e+01		
Trichloropropane, 1,1,2-	1.83e-01	1.83e+01		
Trichloropropane, 1,2,3-	2.19e-01	2.19e+01		
Trinitrobenzene, 1,3,5-	1.83e-03	1.83e-01		
Uranium	0.02 (9)			
Vinyl acetate	3.65e+01	3.65e+03		
Vinyl Chloride	2.00e-03 (9)	2.00e-01		
Xylene	1.00e+01 (9)	1.00e+03		
Zinc	5 (17)			

(1) Concentrations for constituents are expressed in scientific notation. Examples 2.20E-00 = 2.2; 2.20E+02 = 220; and 2.20E 01 = 0.22.

(2) The development of final cleanup levels may involve other factors as described in this subchapter, such as cumulative health effects, that are not considered in this chapter.

(3) Ground-water concentrations are based on Maximum Contaminant Levels (MCLs) or the formula and parameters for residential use of ground water which are contained in 31 TAC §335.567 (relating to Appendix I). For non-residential exposure conditions, the ground water concentrations are calculated using the procedures of §335.559(d)(2) or (3).

(4) For some constituents, the Practical Quantitation Limit (PQL) may be the appropriate Ground Water MSC as described in 31 TAC 335.555(d)(1) of this rule. See 40 Code of Federal Regulations Part 264 (Appendix IX) for a list of ground-water PQLs.

(5) Residential soil ground-water protection concentrations are based on a multiplication factor of 100 times the ground-water MSC.

(6) Industrial soil ground-water protection concentrations are based on a multiplication factor of 100 times the MCL or, when an MCL is not available, a factor of 100 times the ground-water concentration calculated using the formula and parameters which are contained in 31 TAC §335.559(d)(2) or (3) of this title.

(7) Residential soil concentrations (maximum) are calculated using the formula and parameters for residential land use which are contained in §335.567 of this title (relating to Appendix I). The person must also demonstrate that ground water is protected and that no nuisance conditions exist (31 TAC §335.559(a)-(h) of this title).

(8) Industrial soil concentrations (maximum) are calculated using the formula and parameters for industrial land use which are contained in 31 TAC §335.567 of this title (relating to Appendix I). The person must also demonstrate that ground water is protected and that no nuisance conditions exist (31 TAC §335.559(a)-(h) of this title).

(9) The final, proposed or listed Maximum Contaminant Level (MCL), from Section 141 of the Federal Safe Drinking Water Act. For lead, the Action Level for lead in drinking water is used as the MSC.

(10) All concentrations were calculated using data from the Integrated Risk Information System (IRIS) Chemical Files, or data from the Health Effects Assessment Summary Tables (HEAST), developed by the United States Environmental Protection Agency, Office of Research and Development and Office of Health and Environmental Assessment, Washington, D.C. 20460. The toxicity information, and the MSCs, will be updated as new information becomes available.

(11) In some cases, an oral Reference Dose (RFD) or an oral Slope Factor (SF) was substituted for the inhalation RFD or inhalation SF in calculating MSC. This MSC will be updated when this information becomes available.

(12) The MSCs calculated for this compound are based on noncarcinogenic effects. The following formula was used for calculating the soil MSCs: MSC = [(oral RFD)(Body Weight)(ED)(365

days/yr)]/[(EF)(ED)(IR)(CF)]. For residential soils, the following exposure factors were used: BW = 15 Kg; ED = 5 years; EF = 350 days/year; IR = 200 mg/day. For industrial soils, the following exposure factors were used: BW = 70 Kg; ED = 25 years; EF = 250 days/year; IR = 100 mg/day. In both cases, the CF is 0.000001 kg/mg. When oral slope factors become available, these MSCs will be revised.

(13) As described in 31 TAC §335.559(e) of this title, the sum of concentrations of the volatile organic compounds in vapor phase in soil shall not exceed 1,000 ppm by weight or volume.

(14) The MSC for lead in soil is based on values calculated by the United States EPA using the Lead Uptake/Biokinetic Model, Version 0.4, which has been developed by the United States EPA Office of Health & Environmental Assessment.

(15) Soil MSCs for polychlorinated biphenyls are based upon the 4/2/87 TSCA regulations, 40 Code of Federal Regulation 761.125 (see 52 FR 10688).

(16) NHHB = Not Human Health Based. The SAI-Ind MSC for this compound exceeds 10e+6 ppm, which means it is not toxic to humans when exposed to soils under these assumptions. Persons must consider other criteria of 31 TAC §335.559 of this title (relating to Medium Specific Requirements and Admustments for Risk Reduction Standards Number 2.) to develop numeric cleanup values.

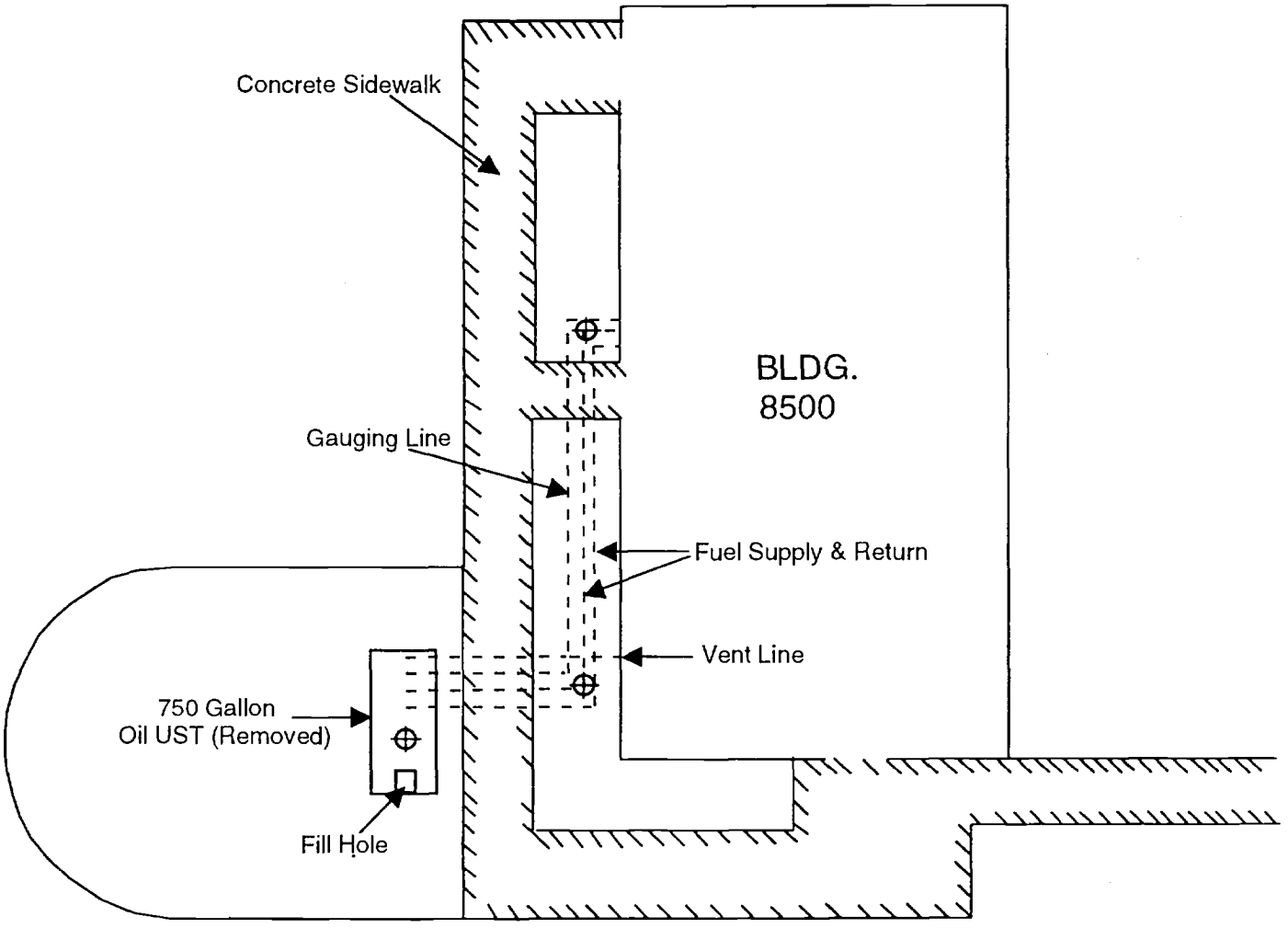
(17) Texas drinking water secondary constituent level (30 TAC 290.113).

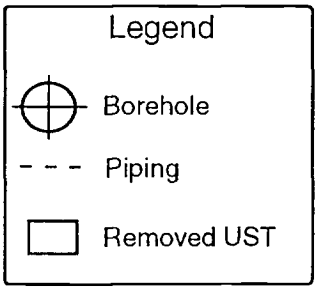
(18) Assume 100 mg/L as $CaCO_3$ is hardness.

APPENDIX C

REMOVED UNDERGROUND STORAGE TANK DIAGRAMS

318152





Date
10 December 1996

Project No.
3109-025

Project Manager
B. Duffner

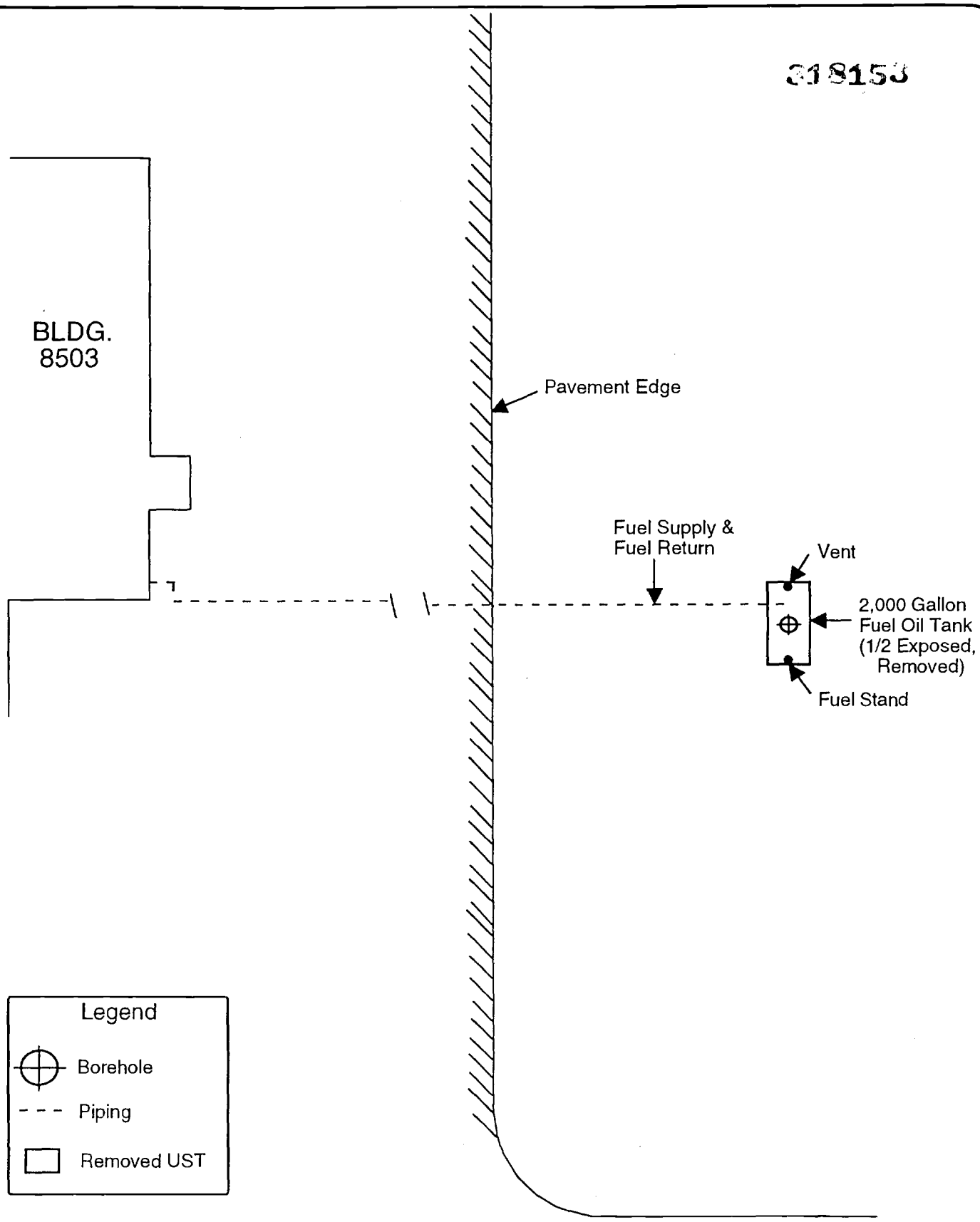
Prepared by
AMM

The Environmental Company, Inc.

N

1 inch = 10 feet

Building 8500
UST Borehole Locations



Date
20 December 1996
Project Manager
B. Duffner
Prepared by
AMM

Project No.
3109-025

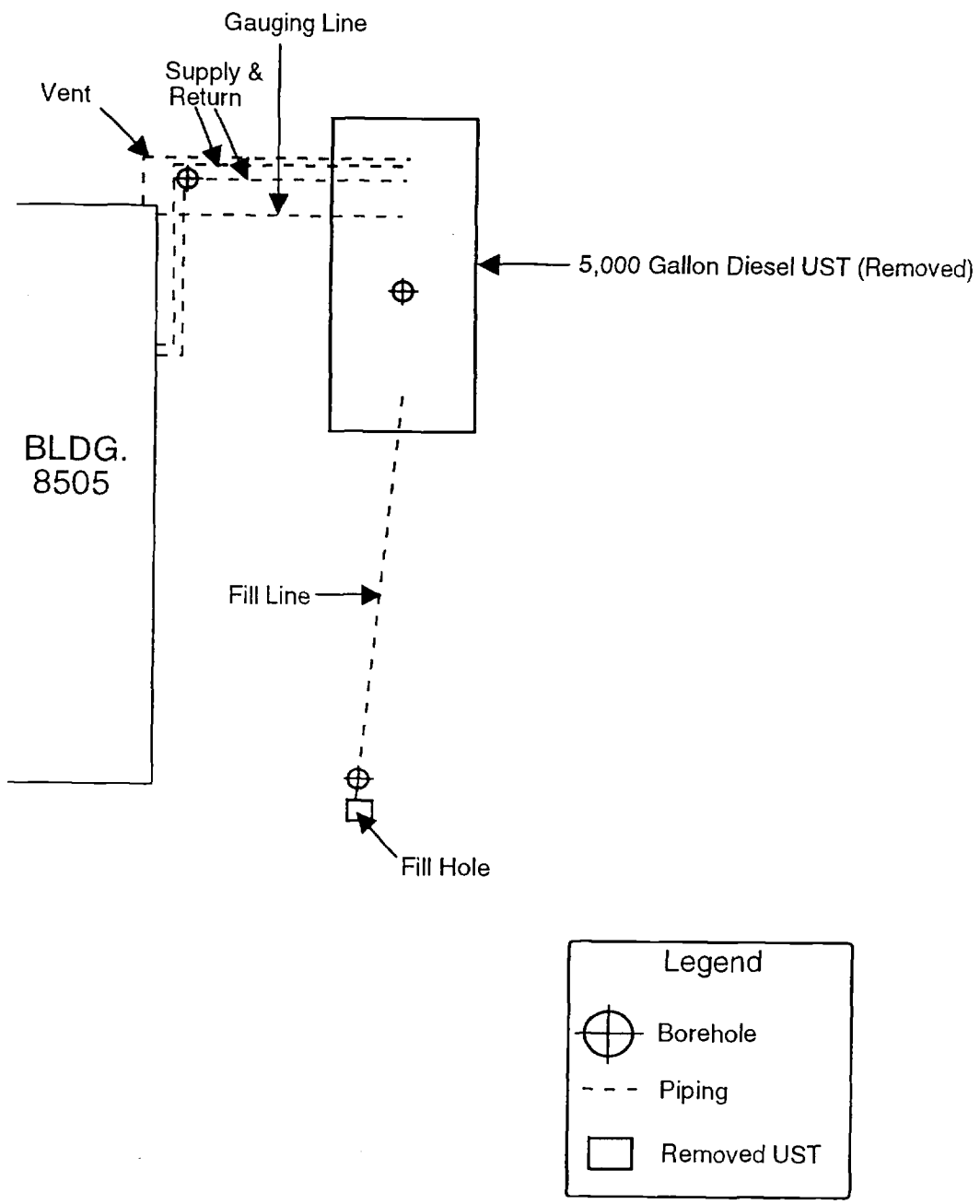
The Environmental Company, Inc.

N

1 inch = 20 feet

Building 8503
UST Borehole Locations

318154



Date
10 December 1996

Project No.
3109-025

Project Manager
B. Duffner

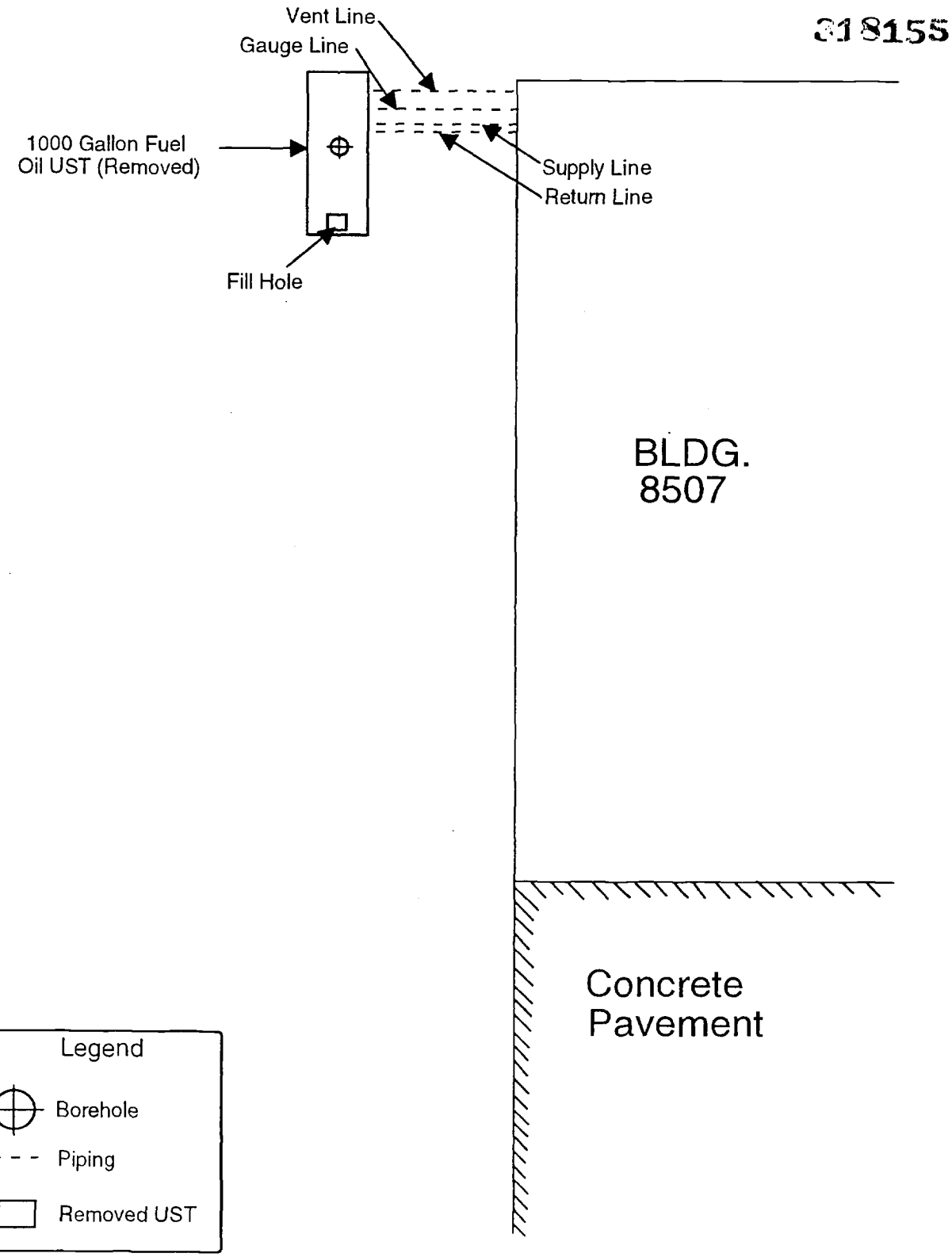
Prepared by
AMM

The Environmental Company, Inc.

N

1 inch = 10 feet

Building 8505
UST Borehole Locations



Date
10 December 1996

Project No.
3109-025

Project Manager
B. Duffner

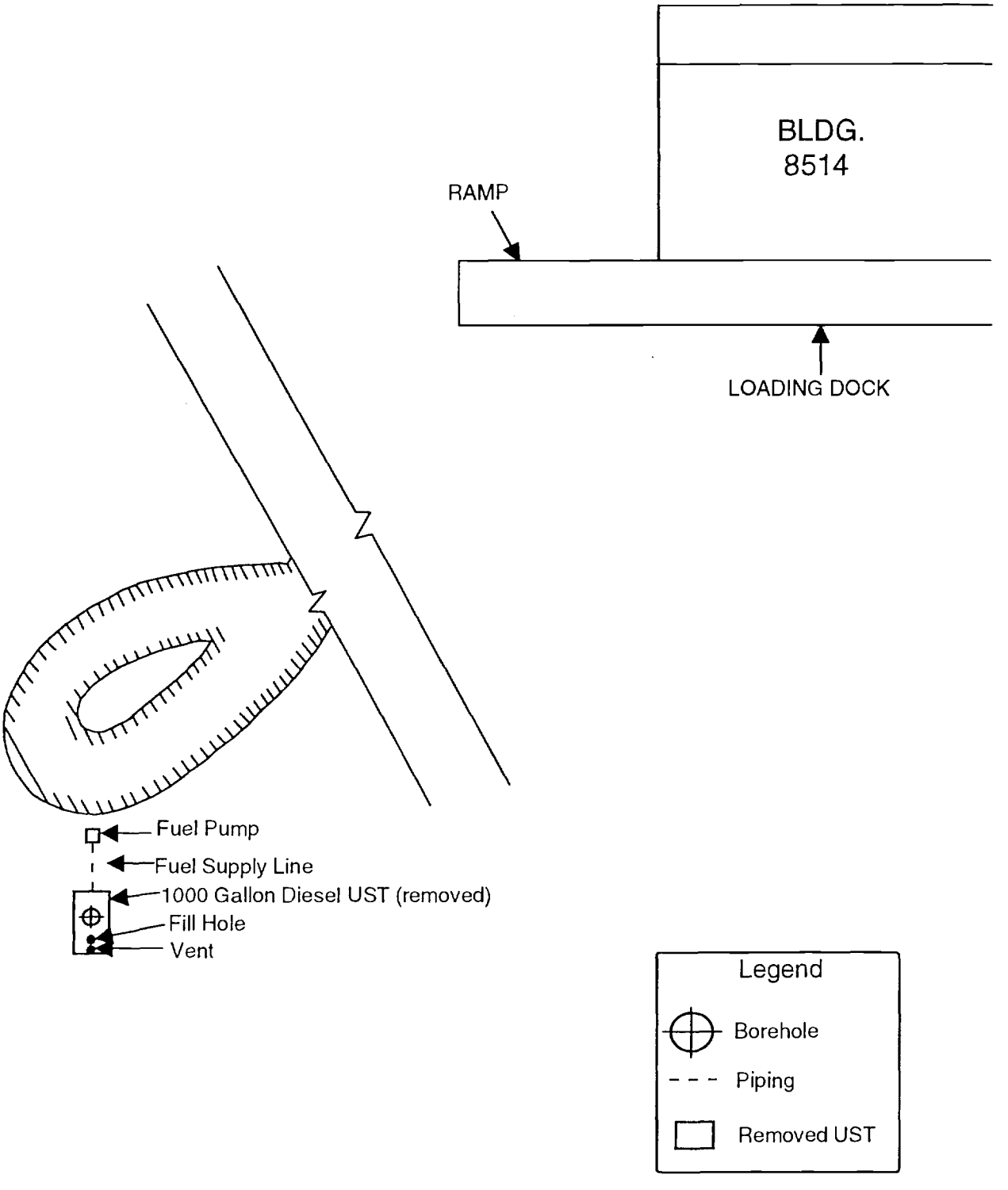
Prepared by
AMM

The Environmental Company, Inc.

1 inch = 10 feet

Building 8507
UST Borehole Locations

318156



Date
10 December 1996

Project No.
3109

Project Manager
B. Duffner

Prepared by
AMM

The Environmental Company, Inc.

N

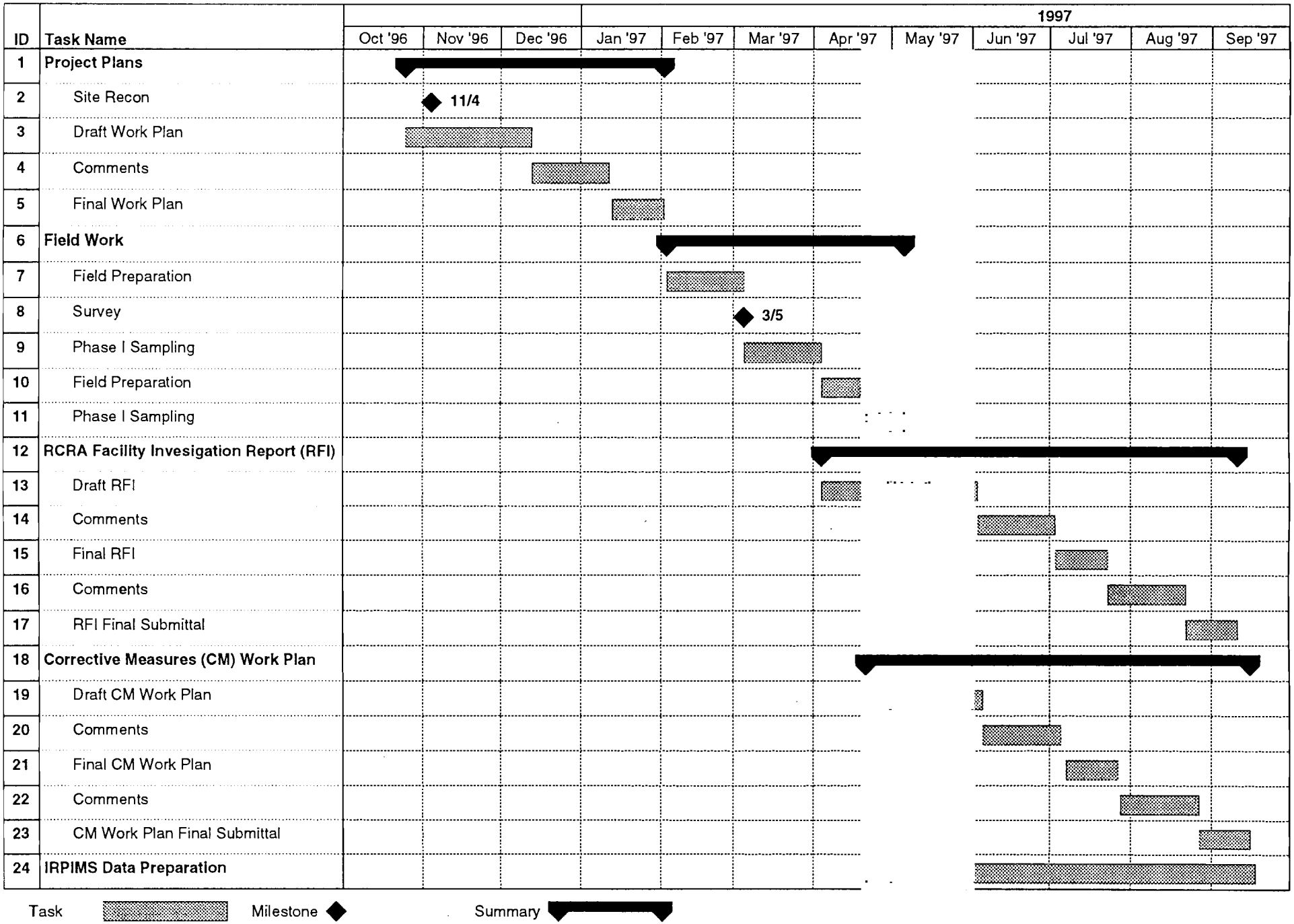
1 inch = 25 feet

Building 8514
UST Borehole Locations

APPENDIX D

PROJECT SCHEDULE

PROPOSED SCHEDULE FOR RCRA FACILITY INVESTIGATION AT CARSWELL FIELD WSA



FINAL PAGE

ADMINISTRATIVE RECORD

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