DEPARTMENT OF THE ARMY
HEADQUARTERS, U. S. ARMY GARRISON COMMAND
1733 PLEASONTON ROAD
FORT BLISS, TEXAS 79916-6816

7-1-1998

REPLY TO ATTENTION OF:

Directorate of Environment

Mr. Benito Garcia
New Mexico Environment Department
Hazardous and Radioactive Materials Bureau
2044 Galisteo
P.O. Box 26110
Santa Fe, NM 87502

Dear Mr. Garcia:

Please find enclosed copies of the following documents for regulatory review.

1. Work Plan Letter for Supplemental RCRA Facility Investigation of the McGregor Range Former Fire Training Area (SWMU-21) and The Inactive Waste Drum Storage Area (SWMU-22) dated September 1998.

2. Subsurface Investigation of the New Mexico Oxidation Lagoons (SWMU No's 19, 25B, 27B) Fort Bliss, Texas dated July 1998.

3. RCRA Facility Assessment Work Plan Hueco Range Camp, Fort Bliss, New Mexico dated May 1998.

4. RCRA Facility Investigation New Mexico SWMU's - Phase 2 SWMU 20, Fort Bliss Texas and New Mexico dated April 1998.

5. Relative Risk Site Evaluation Inactive Doña Ana Range / Detonation Area SWMU 26, Fort Bliss, Texas dated April 1998.

Submission of some of these documents was delayed after consultation with Mr. Steve Pullen because of the possibility that some of the documents might be more efficiently reviewed by NMED if they were combined and submitted under the proposed Fee Regulation. The length of time required for rule making, however, has surpassed original expectations. As a result, Fort Bliss wishes to submit these documents for review at this time in order to ensure program continuity. Furthermore, as a means to cross check our records for completeness, Fort Bliss respectfully requests an inventory of all Fort Bliss RCRA corrective action documents currently before the NMED HRMB.

If you have any questions or concerns please do not hesitate to contact Mr. Kelly Blough at (915) 568-7979 or by E-mail at bloughk@emh10.bliss.army.mil.

Sincerely,

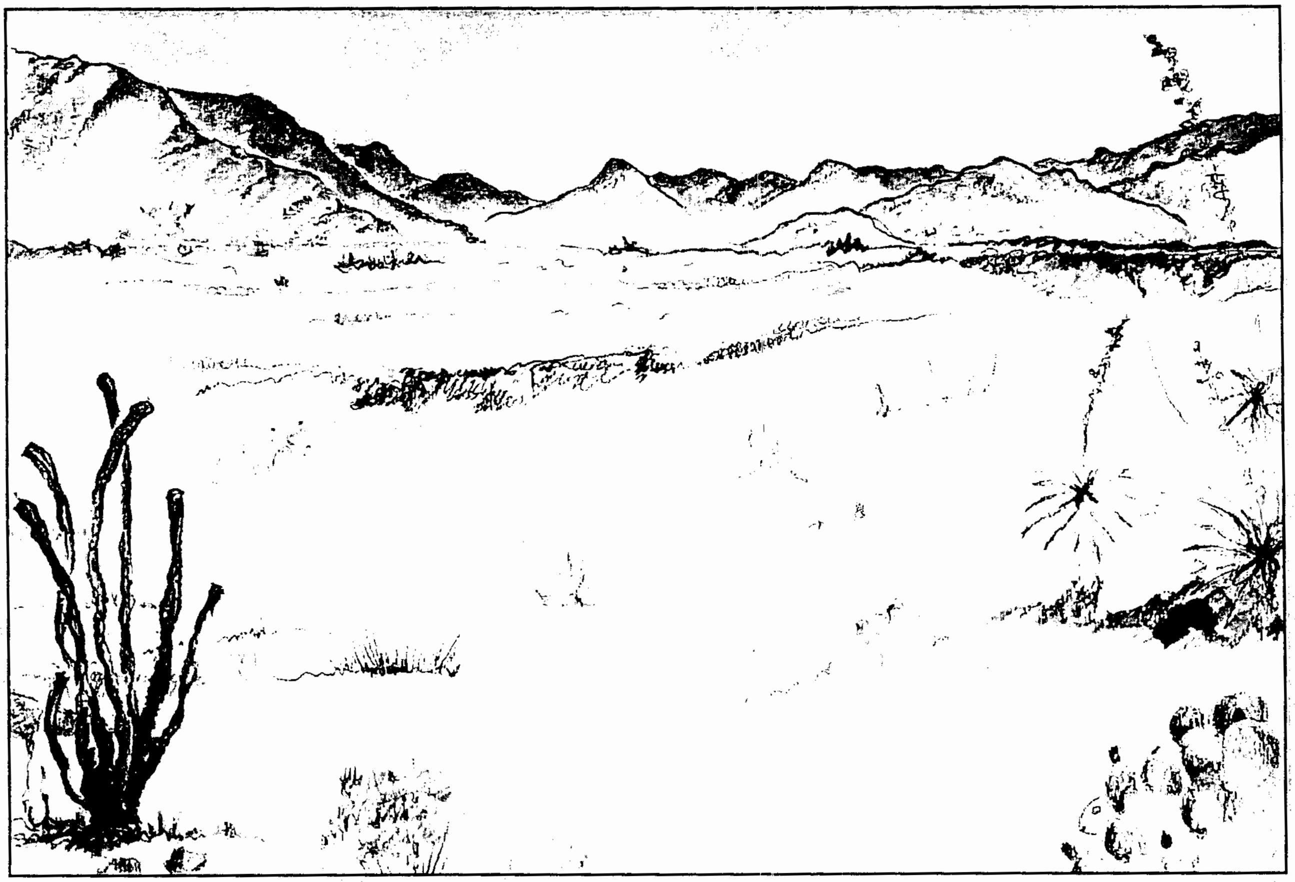
David Felix
Chief, Multimedia Compliance Div., DOE

Enc.

cc Ms. Julie Jacobs, NMED GWPB (w/ enclosure)
Mr. David Neleigh, EPA Region VI
File

Subsurface Investigation of the New Mexico Oxidation Lagoons

(SWMU No's. 19, 25B, and 27B)



Fort Bliss, Texas

July 1998

99-001

SUBSURFACE INVESTIGATION OF THE NEW MEXICO OXIDATION LAGOONS
(SWMU NOs. 19, 25B, AND 27B)
FORT BLISS, TEXAS

Prepared for
Fort Bliss Directorate of Environment,
U.S. Army Corps of Engineers, Fort Worth, and
COMPA Industries, Inc.

July 1998

CONTENTS

Section | **Page**

CONTENTS (Continued)

TABLES

Table | **Page**

FIGURES

Figure | **Page**

1.0 INTRODUCTION

Tetra Tech EM Inc. (Tetra Tech) was subcontracted to COMPA Industries, Inc. (COMPA), to conduct work under Task Order No. D.O. 0027 from the U.S. Army Corps of Engineers (COE) under Contract No. DACA63-93-D-0036. Under this subcontract, Tetra Tech conducted a subsurface investigation of the New Mexico oxidation lagoons at the Doña Ana Range Camp (Solid Waste Management Unit [SWMU] 27B), McGregor Range Camp (SWMU 19), and the Orogrande Range Camp (SWMU 25B) located at the Fort Bliss Military Reservation (Ft. Bliss) administered from El Paso, Texas. Activities conducted for this investigation followed the approach described in the field sampling and analysis plan (FSAP) (Tetra Tech 1997). The FSAP was designed to be consistent with the Resource Conservation and Recovery Act (RCRA) facility investigation (RFI) work plan prepared by the Thompson Professional Group, Inc. (Thompson) (1996).

RFI activities were conducted in response to the requirements of Fort Bliss' RCRA Part B Permit (Roy F. Weston [Weston] 1997). The investigation of the oxidation lagoons at Fort Bliss supplements the RFI activities. This report presents the results of the deep subsurface investigation at SWMUs 19, 25B, and 27B. The remainder of this section discusses project objectives and background. Section 2.0 presents the regional environmental setting. Section 3.0 describes the field investigation program, and Section 4.0 discusses the results of the field investigation. Section 5.0 presents the vadose zone modeling. Conclusions are presented in Section 6.0, followed by references in Section 7.0.

1.1 PROJECT OBJECTIVE

As described in the SA, this task order had two primary objectives: (1) to evaluate the presence and concentration of contaminants in subsurface soil and groundwater at the three oxidation lagoons (SWMUs 19, 25B, and 27B), and (2) to determine the moisture content of subsurface soils and the hydrogeologic profile of each site to evaluate the potential for water and solutes to migrate to the regional aquifer. These objectives were addressed by a program that included the following tasks:

- Task 1—Drilling and monitoring well installation
- Task 2—Chemical and geotechnical laboratory analyses
- Task 3—Vadose zone modeling

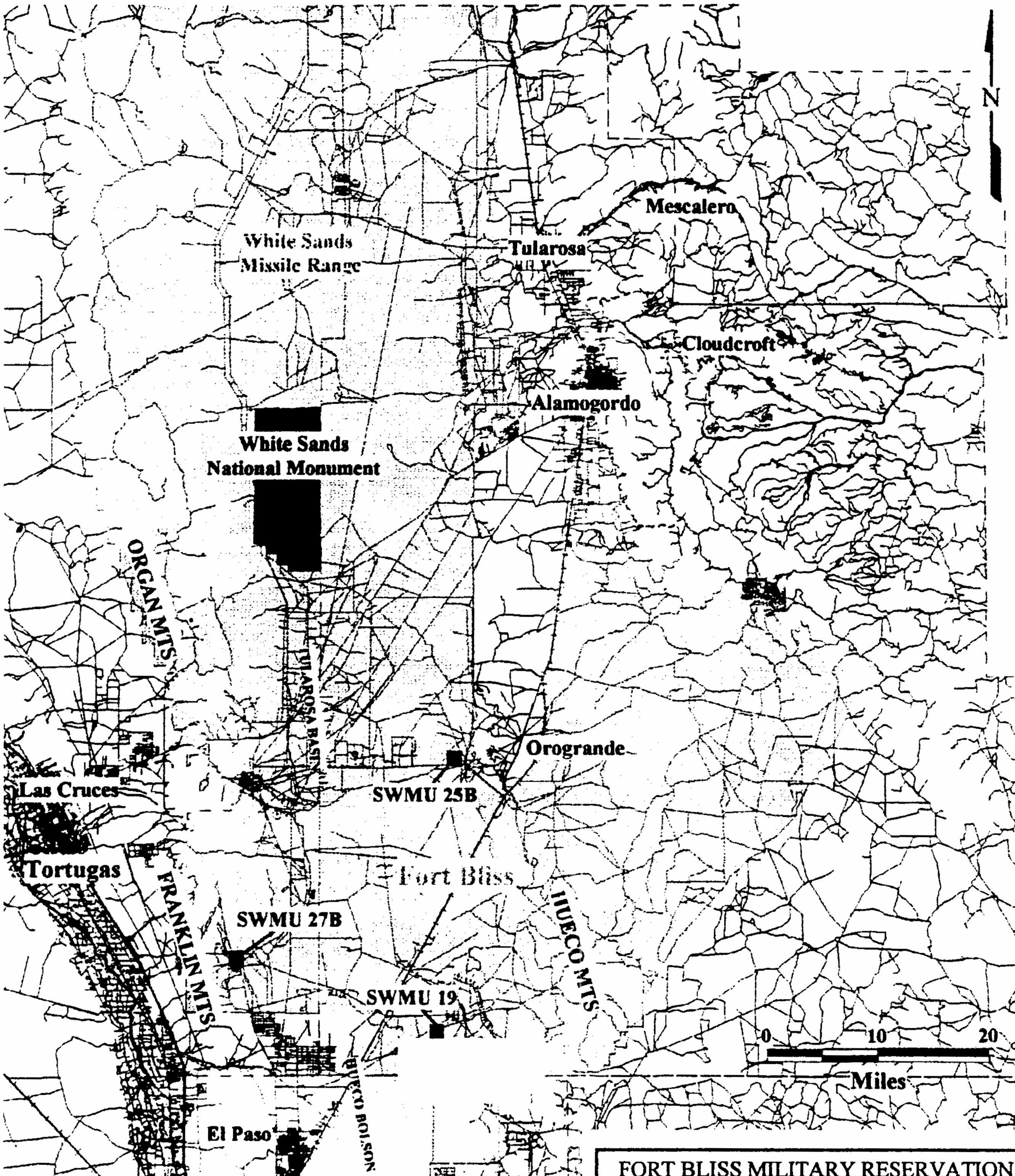
1.2 PROJECT BACKGROUND

Fort Bliss occupies about 1.2 million acres of land in Texas and New Mexico near El Paso, Texas. A site location map is presented in Figure 1. Several training camps located throughout the reservation function as training support centers for the U.S. Army. The training camps consist of logistical support and training structures, housing and maintenance facilities, and other support areas. SWMUs 19, 25B, and 27B were constructed as disposal units for sanitary and liquid wastes generated by Army personnel and training camp-related activities. The SWMUs consist of an oxidation lagoon at each training camp, as well as other associated units, such as Imhoff tanks and drying beds. The oxidation lagoons are active and currently receive wastewater from various sources.

Hazardous wastes are reportedly generated from sources at the training camps and may be discharged with waste into the oxidation lagoons (Thompson 1996). Potential hazardous wastes generated at the training camps include solvents, battery acid, supertropical bleach, methanol, formaldehyde, xylenes, paint and paint thinner, and chromic acid rinse water. Minor amounts of these wastes may end up in wastewater routed to the oxidation lagoons.

Several previous site investigations have been performed at various SWMUs at Fort Bliss. The following site investigation reports have been submitted to the New Mexico Environmental Department (NMED) and the U.S. Environmental Protection Agency (EPA):

- U.S. Army Environmental Hygiene Agency. 1987 and 1989. Aberdeen Proving Ground, Maryland. Final Report, Evaluation of Solid Waste Management Units. Fort Bliss, Texas. August 3 to 7, 1987, and September 26 to 29, 1989.
- A.T. Kearney. 1989. RCRA Facility Assessment Preliminary Review/Visual Site Inspection Report. March.
- Environmental Science & Engineering, Inc. (ESE). 1991. RCRA Facility Inspection Report. New Mexico Solid Waste Management Units, Fort Bliss. Volume 1. September.
- ESE. 1992. Draft Corrective Investigation Study Report for Solid Waste Management Unit 25B, Orogrande Oxidation Lagoon, Fort Bliss, El Paso, Texas.



FORT BLISS MILITARY RESERVATION
EL PASO, TEXAS

FIGURE 1
FORT BLISS RFI
SITE LOCATION MAP

Tetra Tech EM Inc.

SOURCE: MODIFIED FROM WESTON, 1997

- Earth Science Corporation. 1993. Environmental Compliance Assessment Report. April.

Weston (1997) conducted the most recent RFI at SWMUs 19, 25B, 27B, as well as the Meyer Range Camp oxidation lagoon (SWMU 76). The objective of the RFI was to determine if hazardous wastes or hazardous constituents were released into the environment from any of the SWMUs. Weston collected surface soil and sediment, subsurface soil, surface water, wastewater, and groundwater samples at the SWMUs. Groundwater samples were collected only from monitoring wells screened in a shallow, water-bearing zone encountered at SWMU 19. The remainder of this section summarizes Weston's (1997) conclusions regarding the occurrence of groundwater and environmental contamination at the oxidation lagoons.

Doña Ana Range Oxidation Lagoon (SWMU 25B)

- Groundwater was not encountered in any of the borings drilled at the Doña Ana Range oxidation lagoon.
- Cadmium and lead were detected above MCLs in the surface water sample collected from the Doña Ana Range oxidation lagoon.
- VOCs, pesticides, and metals were detected in several sediment samples collected from the Doña Ana Range oxidation lagoon at concentrations that exceeded background but were below EPA Region 3 Risk-Based Concentrations for Industrial Soil Ingestion and soil to air transfer scenarios.

McGregor Range Oxidation Lagoon (SWMU 19)

- The McGregor Range oxidation lagoon is the largest of the three SWMUs investigated and appears to be the most active, based on the amount of wastewater discharged into the oxidation lagoon.
- Perched groundwater at the McGregor Range oxidation lagoon was encountered between 50 and 60 feet below ground surface (bgs).
- Lead exceeded its maximum contaminant level (MCL) in one groundwater sample. Nitrates were detected in all three groundwater samples. No other compounds were reported in the groundwater samples.
- No hazardous constituents were detected above MCLs in surface water samples. Nitrates were detected in all three wastewater samples.

- Volatile organic compounds (VOC), semivolatile organic compounds (SVOC), pesticides, polychlorinated biphenyls (PCB), and heavy metals were detected in sediment samples collected from the McGregor Range oxidation lagoon at concentrations that exceeded background levels but were below EPA Region 3 Risk-Based Concentrations for Industrial Soil Ingestion and soil to air transfer scenarios.

- Hazardous constituents potentially attributable to the SWMU were detected in surface soil samples collected downgradient of the overflow structures at the McGregor Range oxidation lagoon. However, further surface soil sampling conducted by Weston at a location downgradient of the McGregor Range Oxidation Lagoon overflow structures indicated that a significant release of hazardous constituents from the SWMU had not occurred through the overflow.

Orogrande Range Oxidation Lagoon (SWMU 27B)

- Groundwater was not encountered in any of the borings drilled at the Orogrande Range oxidation lagoon.

- Lead, acetone, and total petroleum hydrocarbons were detected above MCLs or reporting limits in surface water samples collected from the Orogrande Range oxidation lagoon.

- Total Kjeldahl nitrogen and pesticides were detected in sediment samples collected from the Orogrande Range oxidation lagoon at concentrations that exceeded background but were below EPA Region 3 Risk-Based Concentrations for Industrial Soil Ingestion and soil to air transfer scenarios.

The report also concluded that a release of hazardous constituents to groundwater did not appear to have occurred at any of the SWMUs. With the exception of general repairs to piping, no interim measures or corrective actions have been conducted at any of the SWMUs.

2.0 REGIONAL ENVIRONMENTAL SETTING

This section discusses the regional environmental setting of Fort Bliss, including physiography, climate, geology, and hydrogeology.

2.1 PHYSIOGRAPHY

The New Mexico portion of Fort Bliss is situated within the New Mexico Highlands section of the Basin and Range Province (U.S. Department of Agriculture [USDA] 1981). All three SWMUs studied as part of this investigation are located in the Tularosa Basin and its southern extension, the Hueco Bolson; the basins are closed with no outlets. As a result, surface water collects in low spots and either evaporates, is transpired by vegetation, or recharges groundwater.

The surface topography of the basins is nearly level to gently rolling and consists of shallow, ephemeral lake beds (playas), alluvial plains, and low sand dunes (USDA 1981). No major streams or surface water bodies are present within the basins, except for some seasonal streams and arroyos that drain the mountains.

2.2 CLIMATE

The region surrounding Fort Bliss is classified as an arid to semiarid, continental climate, which is typical of the southwestern United States (USDA 1981). Most of the precipitation falls between July and October. The Sacramento and Hueco Mountains east of the Tularosa Basin and Hueco Bolson receive most of the precipitation which reduces the amount of rainfall reaching the basins. The annual average precipitation ranges from 8 to 11 inches in the basin area to 12 to 18 inches in the higher elevations. Average annual snowfall ranges from 3 to 5 inches in the basin to 12 to 25 inches at higher elevations. Average annual temperatures in the basin range from 61°F in the central part of the basin to 45°F in the higher elevations (USA 1981).

2.3 GEOLOGY

The Tularosa Basin and Hueco Bolson, and other basins in the region, formed about 10 million years ago in response to a regional, extensional tectonic event associated with the opening of the Rio Grande Rift (New Mexico Bureau of Mines and Mineral Resources [NMBMMR] 1978). The basins in the region are generally oriented in a north-south direction and are separated by tilted, fault-blocked uplifts. The Tularosa Basin and Hueco Bolson are bounded by the Sacramento and Hueco Mountains to the east and the Franklin-Organ-San Andres Mountains to the west.

The mountain ranges surrounding the Tularosa Basin and Hueco Bolson are Precambrian metasedimentary- and granite-cored uplifts capped with Paleozoic age strata. The Hueco Bolson portion of the basin is structurally asymmetrical, with the greatest amount of displacement along the base of the Franklin Mountains. Basin fill deposits range from near 9,000 feet thick along the Franklin Mountains to about 3,000 feet thick near the Hueco Mountains (NMBMMR 1978). A thick sequence of fluvial deposits is present along the eastern edge of the Franklin Mountains and is probably related to the ancestral Rio Grande (NMBMMR 1978).

Basin fill material consists of the Miocene to Pleistocene age upper Santa Fe Group, which includes unconsolidated sedimentary sequences of alternating clay, sand, and gravel units of lacustrine, alluvial, and fluvial origin (NMBMMR 1978). The upper Santa Fe Group has been subdivided into the older Fort Hancock/Rincon Valley Formation and the younger Camp Rice Formation; the formations are considered gradational. In general, the Fort Hancock/Rincon Formation consists of clays and fine-grained sediments of lacustrine origin, and the Camp Rice Formation consists of coarser-grained sediment of fluvial origin. A thin veneer of recent Quaternary age sediment, mostly fine-grained eolian sands, overlies the upper Santa Fe Group throughout most of the basin.

Tertiary age basalt flow deposits and igneous intrusive bodies are present locally throughout the basins. The most prominent igneous intrusives in the area are the Jarilla Mountains, located next to the Orogrande Range Camp at the northern edge of Fort Bliss.

2.4 HYDROGEOLOGY

Groundwater resources are most abundant on the west side of the Hueco Bolson, which probably reflects the presence of thick sequences of coarse-grained deposits along the eastern flank of the Franklin Mountains. The main source of groundwater recharge in the Hueco Bolson is infiltration of precipitation and surface water along the foothills of the mountains. The City of El Paso receives most of its water supply from the west side of the Hueco Bolson (Weston 1997). In contrast, groundwater supplies along the east side of the Hueco Bolson are generally sparse.

In general, the regional groundwater surface in the Hueco Bolson is encountered at about 350 feet bgs, although it varies depending on the presence of pumping wells and location within the Bolson. Regional groundwater flow in the northern Hueco Bolson is to the south toward the Rio Grande with a component flowing toward the center of the Hueco Bolson from the eastern and western flanks of the basin (U. S. Geological Survey [USGS] 1991). The hydrogeology of each SWMU is discussed below.

Drinking water for the Doña Ana Range Camp is supplied by two production wells located about 1.5 miles north of the camp (Weston 1997). The wells are reportedly completed in the basin fill deposits at depths as great as 800 feet bgs. In 1985, the static water level of the wells was reported at 359 feet bgs, and the combined withdrawal of the wells was 3.5 million gallons (Weston 1997). No other production wells are located within 15 miles of the Doña Ana Range Camp wells.

The Army has drilled more than 30 geothermal test wells in an area east and southeast of the McGregor Range Camp. Groundwater was encountered at 451 feet bgs in one test well drilled near SWMU 19 in 1995; groundwater encountered in other test wells ranged from 265 to 540 feet bgs (Witcher 1997). The test wells apparently produced warm or hot water and were not used for drinking water purposes. The water samples also had total dissolved solids concentrations as great as 8,100 milligrams per liter (mg/L). The McGregor Range Camp currently receives drinking water from the City of El Paso.

No wells or test holes are known to have been drilled near the Orogrande Range Camp, and no hydrogeologic information is available for the area. Drinking water for the Orogrande Range Camp is supplied by White Sands Missile Range.

3.0 FIELD INVESTIGATION PROGRAM

The following sections describes the field investigation program and the various field activities conducted at Fort Bliss.

3.1 DRILLING AND MONITORING WELL INSTALLATION

In accordance with the FSAP, one boring was drilled at each of the oxidation lagoons (SWMUs 19, 25B, and 27B). The borings were intended to be drilled 10 feet into the saturated zone of the regional aquifer, which was expected to be encountered at about 350 feet bgs. Drilling was performed by Beylik Drilling of Rio Rancho, New Mexico.

All borings were drilled using a Dresser T70W air rotary drill rig with pneumatic casing hammer. A drag bit was used to drill the borehole, and air was circulated through the drill pipe annulus to bring the soil cuttings to the surface. As the borehole was drilled an outer casing was driven with the pneumatic casing hammer. This drilling method continuously advanced the casing with the drill bit so that no annular space existed between the formation and the drill pipe, thus avoiding the creation of a vertical migration pathway and preventing any cross-contamination of water-bearing zones during drilling. The method also allowed for a rapid delivery of drill cuttings to the surface.

As stated in the FSAP, it was anticipated that a perched water-bearing zone might be encountered at about 60 feet bgs at each of the sites and would be cased off with surface casing; the surface casing was to extend about 3 to 5 feet below the base of the perched zone to minimize the potential for cross-contamination and a surface casing. At the McGregor site, a moist to wet soil zone was encountered at 56 to 58 feet bgs. The borehole was left open for 2 hours to allow any groundwater to enter the borehole, but no standing groundwater collected in the borehole. Because groundwater was not encountered, a surface casing was not installed during drilling but was installed during well installation to provide additional protection against the potential downward vertical migration of groundwater. No shallow or perched water-bearing zones were encountered at the Doña Ana or Orogrande sites, and drilling continued without the placement of surface casing.

3.1.1 Drilling

Monitoring well MW-27B01 at the Doña Ana Range (SWMU 27B) was drilled and installed between December 3 through 13, 1997 (see Figure 2 for monitoring well location). Groundwater was encountered during split-spoon soil sampling at 340 feet bgs. In accordance with the FSAP, a temporary, Hydropunch™-type well screen, which consisted of a retractable well point, was attached to the inner casing and lowered into the borehole. Tetra Tech collected a groundwater sample from the well point with a disposable Teflon® bailer. The borehole was then completed to 345 feet bgs, the monitoring well screen and riser were placed in the borehole, and the driller began removing the drive casing from the borehole. After about 270 feet of drive casing was removed, the driller noted that the bottom 90 feet of drive casing remained in the borehole. The drive casing apparently sheared off and parted during driving with the hammer. The depth of the casing could not be identified by the driller; however, it was later determined by geophysical methods to be situated at the bottom of the borehole between 250 and 340 feet bgs.

A second borehole, SB-27B10, was drilled between December 27, 1997, and January 2, 1998, in an attempt to install a properly constructed monitoring well and to provide a suitable borehole for conducting downhole geophysical logging. However, drilling was terminated when very hard soil conditions caused refusal at 300 feet bgs. Polyvinyl chloride (PVC) casing, with no well screen, was installed from the completion depth of 300 feet bgs to the ground surface.

Monitoring well MW-1904 at the McGregor Range (SWMU 19) was drilled and installed between December 14 and 22, 1997 (see Figure 3 for monitoring well location). Very hard and dry silty clays caused slow and difficult drilling conditions. To prevent the annulus from clogging, thus maintaining drill cutting returns, and to soften the soil and prevent drill refusal, the Fort Bliss Directorate of the Environment (DOE) authorized the driller to add water; water from the Fort Bliss water supply system was used.

When the drilling depth reached 350 feet bgs, Tetra Tech notified DOE that groundwater had not yet been encountered. DOE directed Tetra Tech to terminate drilling and install the monitoring well at 350 feet bgs.

Monitoring well MW-2501 at the Orogrande Range (SWMU 25B) was drilled and installed between January 3 and January 8, 1998 (see Figure 4 for monitoring well location). Because of the slow and difficult drilling conditions encountered, water was again added during drilling. Drilling was eventually terminated when bedrock was encountered at 320 feet bgs. Groundwater was not encountered in the borehole. Tetra Tech notified DOE and was directed to install the monitoring well at a depth of 320 feet bgs.

3.1.2 Monitoring Well Construction

All three monitoring wells were constructed of 2.5-inch outside diameter (OD), flush-threaded, Schedule 80 PVC pipe. The screen slot size was 0.10-inch. Screens were 10 feet long in all three monitoring wells, and the bottom of each well screen was fitted with a 2.5-foot PVC sump. Centralizers were placed directly below and above the well screen and at about 100-foot intervals along the riser. Construction diagrams for all monitoring wells are presented in Appendix A.

For monitoring well MW-27B01 at the Doña Ana Range (SWMU 27B), No. 10-20 filter pack sand was placed from the bottom of the borehole, at 340 feet bgs, to about five feet above the top of the well screen, at 325 feet bgs. Bentonite pellets were then placed directly above the filter pack. Because of the difficulty in determining the top of the bentonite layer, an additional 100 gallons of pure bentonite slurry